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A New Sample of Gamma-Ray Emitting Jetted Active Galactic Nuclei—Preliminary Results

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Abstract: We are compiling a new list of gamma-ray jetted active galactic nuclei (AGN), starting from the fourth catalog of point sources of the *Fermi* Large Area Telescope (LAT). Our aim is to prepare a list of jetted AGN with known redshifts and classifications to be used to calibrate jet power. We searched in the available literature for all the published optical spectra and multiwavelength studies useful to characterize the sources. We found new, missed, or even forgotten information leading to a substantial change in the redshift values and classification of many sources. We present here the preliminary results of this analysis and some statistics based on the gamma-ray sources with right ascension within the interval 0^h–12^h (J2000). Although flat-spectrum radio quasars and BL Lac objects are still the dominant populations, there is a significant increase in the number of other objects, such as misaligned AGN, narrow-line Seyfert 1 galaxies, and Seyfert galaxies. We also introduced two new classes of objects: changing-look AGN and ambiguous sources. About one third of the sources remain unclassified.

Keywords: BL Lac objects; quasars; Seyfert galaxies; relativistic jets

1. Introduction: Why This Work?

There are many ways to estimate the power emitted by a relativistic jet, but there are also serious problems of consistency among the various methods (e.g., [1]). In 2019, we started a program aimed at calibrating the main methods to estimate the jet power and presented some preliminary results [2]. The need to compile a suitable list of gamma-ray emitting jetted active galactic nuclei (AGN) soon became apparent as the gamma-ray luminosity is a reliable proxy of the radiative jet power [3,4]. The obvious starting point was the fourth catalog of point sources of the *Fermi* Large Area Telescope (LAT) (4FGL, [5]) and the derived catalog of AGN (4LAC, [6]).

However, the classification of the gamma-ray sources in the two catalogs is not exactly the same (see Section 4). Therefore, we decided to start a careful check. The classification is important in order to apply the most proper formula to calculate the jet power, which, in

turn, depends on the main radiative process driving the gamma-ray emission. External Compton is dominant in objects with strong optical emission lines, such as flat-spectrum radio quasars (FSRQs) and narrow-line Seyfert 1 galaxies (NLS1s), while BL Lac Objects—characterized by optical spectra with weak or no emission lines—are powered by the synchrotron self-Compton.

The classification is also important to understand when the jet emission is significantly contaminated by gamma rays from starburst activity as happens in nearby Seyfert galaxies. Another important problem is to divide between beamed (the jet viewed at small angles) and unbeamed (large viewing angles), to understand how much special relativity can boost the jet power.

To calculate the jet power, we also need to know a reliable redshift, where reliable means a spectroscopic redshift. Photometric redshifts are often found in the literature; however, in the case of jetted AGN, the strong variability of the jet emission can significantly affect the results. Therefore, we also need to carefully check the redshift values to keep only those based on optical spectroscopy. We also kept values estimated from the imaging of the host galaxy, although with a caveat.

To summarize, our philosophy was to select a sample of sources with redshift and classification that were as reliable as possible, given the best information available. It is better to have a relatively small, but reliable, sample, rather than a large one with significant uncertainties.

2. Sample Selection and Procedure

We started from the 4FGL Data Release 2 (DR2, Revision 5, 17 December 2020), which contains 5788 gamma-ray point sources[1]. We kept all the extragalactic sources (except for starburst and normal galaxies) plus the sources with counterparts of unknown nature (unk class), and the partially identified sources (bcu and blazar candidates of uncertain type). We did not consider any of the Galactic sources (pulsars, binaries, supernova remnants, star forming regions, etc.), the unassociated gamma-ray sources (i.e., without any counterpart), and the association with counterparts with a probability smaller than 80%, which is also the threshold set by the *Fermi* LAT Collaboration to define an association. We also applied a cut to remove the sources at low Galactic latitudes ($|b| < 10^{\circ}$), to take into account the issues related to the strong diffuse gamma-ray emission along the Galactic plane. The final sample consisted of 2982 gamma-ray point sources associated with a counterpart.

We carefully searched for the redshift of the counterparts both in the available literature and in public databases, such as the Sloan Digital Sky Survey (SDSS DR16[2]) and Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST DR6V2[3]). For the literature, we referred to the public databases Set of Identifications, Measurements and Bibliography for Astronomical Data (SIMBAD[4]), NASA/IPAC Extragalactic Database (NED[5]), and SAO/NASA Astrophysics Data System (ADS[6]).

We proceeded as follows: we took for granted the association proposed by the *Fermi* LAT Collaboration and searched for the counterpart in both SIMBAD and NED. For example, the first source in our sample is 4FGL J0001.2 + 4741, which is associated with B3 2358 + 474. Therefore, we inserted B3 2358 + 474 in both SIMBAD and NED to search for published papers dealing with its identification and classification based on the optical and radio spectra, radio morphology, and optical imaging of the host galaxy.

In this specific case, SIMBAD has only two publications, while NED has fourteen, but all of them are generic catalogs, and none of them contains the information we need. We searched also in SDSS and LAMOST, but there were no entries. The 4FGL classifies B3 2358 + 474 as bcu, and we were not able to find either data or information suitable to identify this object. However, we adopted a more generic unclassified (UNCL) class (see the next section for an explanation of our adopted classes).

Another example, the second source in our sample, which is 4FGL J0001.2 − 0747 = PMN J0001 − 0746. Simbad reports 38 references, while NED has 33. No optical spectra were found in either the SDSS or LAMOST databases. Searching in the literature, we found

only one useful reference [7], but the reported spectrum was featureless. Therefore, we confirmed the BL Lac Object classification of 4FGL, but without measured redshift.

In a further example, the third source: 4FGL J0001.5 + 2113 = TXS 2358 + 209, Simbad has 16 references, while NED has 29. Both databases reported $z = 1.106$ measured by [8]; however, searching in the available literature, we found that, some years later, this value was changed to $z = 0.439$ by the same authors on the basis of a better spectrum [9]. The publicly available spectrum on the SDSS[7] confirms the latter measurement. The spectrum also confirms the classification as flat-spectrum radio quasar set by 4FGL. This example also clearly shows why researchers should be wary of just downloading AGN redshifts from NED or SIMBAD without carefully vetting them, as many AGN have multiple measurements, and the NED/SIMBAD values may not reflect the most recent updates.

There are other cases where we found different redshift values for the same source. There are many reasons: wrong identifications based on weak features or artifacts, lower limits taken as measured values, and mere transcription errors from the paper to the online database. We would like to underline that the values of redshift and the revised classification were mostly taken from published works. We considered a redshift value from automatic pipelines of public databases (SDSS, LAMOST) only in the cases where it was evident. We did not perform any new observations or data analysis, because our aim is not to build a catalog but rather to extract a suitable list of gamma-ray emitting jetted AGN.

3. Classification

The 4FGL and 4LAC adopted the following classes (acronyms in all capital letters indicate a firm identification, i.e., confirmed by coordinated multiwavelength variability) [5,6]:

- BLL/bll (BL Lac Object);
- FSRQ/fsrq (flat-spectrum radio quasar);
- RDG/rdg (radio galaxy);
- AGN/agn (non-blazar active galaxy);
- SSRQ/ssrq (steep-spectrum radio quasar);
- CSS/css (compact steep spectrum radio source);
- BCU/bcu (blazar candidate of uncertain type);
- NLSY1/nlsy1 (narrow-line Seyfert 1 galaxy);
- SEY/sey (Seyfert galaxy); and
- UNK/unk (sources associated with counterparts of unknown nature).

We have adopted another classification scheme:

- BLLAC: BL Lac Object;
- FSRQ: flat-spectrum radio quasar;
- NLS1: Narrow-Line Seyfert 1 Galaxy;
- SEY: Seyfert galaxies (type 1, 2, or intermediate);
- MIS: misaligned AGN, i.e., any of the above classes with the jet viewed at large angles;
- CLAGN: changing-look AGN, when there are optical spectra at different epochs showing radical changes, such as from a featureless continuum to strong emission lines, thus indicating a change in the accretion history; a CLAGN must not be confused with a jetted AGN where the usual jet activity can hide or reveal some weak lines or features (for example, a BL Lac Object holds its classification when the jet activity overwhelms the weak lines and the Ca H&K break, making the optical spectrum a featureless continuum);
- AMB: ambiguous AGN, when the available information are contradictory or not sufficient for a reliable classification, or even for an educated guess; and
- UNCL: unclassified, no optical spectrum available, no radio information useful to infer any misalignment.

The main differences concern misaligned AGN and unclassified sources. We preferred a generic class UNCL, which includes the 4FGL classes UNK/unk and BCU/bcu.

Regarding the latter, the blazar candidate of uncertain type (BCU/bcu) class is based on the localization in certain areas of some infrared photometric plots (e.g., [10]). However, there are many reasons for having certain infrared colors and not all are related to a jet (for example, see the discussion in [11]).

In addition, even a change in the jet activity can determine a change in the location of the photometric plots, drifting into spaces where different physical mechanisms are supposed to be the drivers of the electromagnetic emission. Last, but not least, it is already well known that the probability for a high-energy gamma-ray source to be a jetted AGN is greater than for any other type of source. Therefore, saying that a certain unknown gamma-ray source, particularly if located at high Galactic latitude, might be a blazar of uncertain type is an almost redundant information[8].

The most critical classification is that of misaligned AGN. There is no direct and clear-cut method to measure the jet viewing angle. All the methods are indirect (e.g., a Ca K&H break in the optical spectrum, obscuration or not in the optical spectrum, radio core vs. extended emission, radio core brightness temperature, and radio spectral index), and suffer drawbacks (see the detailed discussion in [12]). For example, it is known that the Doppler factor δ depends on the bulk Lorentz factor $\Gamma = 1/\sqrt{1-\beta^2}$ (where β is the bulk speed in units of the speed of light in vacuum c) and the viewing angle θ, according to the well-known equation:

$$\delta = \frac{1}{\Gamma\sqrt{1-\beta\cos\theta}} \quad (1)$$

There is some degeneracy as shown in Figure 20 of [12]: $\delta = 1$ can be obtained both with $\theta{\sim}20^\circ$ and $\Gamma = 15$, and with $\theta{\sim}60^\circ$, and $\Gamma = 2$. This means that all the methods based on the difference between beamed and unbeamed are subject to some degeneracy. Many authors set a threshold angle on the basis of different methods: for example, Homan et al. [13] studied the brightness temperature and the apparent speed of the jet components ($\beta_{\rm app}$) and found that most of beamed jetted AGN were within $\theta \lesssim 15^\circ$ (see Figure 7 in [13]), which was more or less confirmed also by [14];

Barthel [15] found a much larger value $\theta{\sim}44.4^\circ$ by using a statistical approach based on the optical properties. Given these uncertainties, the most conservative approach is to refer to published papers, where the geometry of the source was studied in detail by using different and complementary methods. This way is not exempt from drawbacks, as it depends on the different (or not) epochs of the observations, the intrinsic variability of the source, its distance from the Earth, the performance of the adopted instruments. This is the best compromise given the available information.

Our MIS class includes the 4FGL classes RDG/rdg, SSRQ/ssrq, and CSS/css: our choice is dictated by the simple need to separate beamed from unbeamed sources. Further details in the classification of these objects are beyond our aims. Nevertheless, we left in the Notes some additional information regarding the type of misaligned AGN (Fanaroff-Riley type 0, I, II, Broad-Line Radio Galaxy, Narrow-Line Radio Galaxy, etc.).

The AMB class contains those jetted AGN with observational characteristics on the border between other well-defined classes, such as a BL Lac Object and a FRI radiogalaxy. The reasons can be the lack of data to break the degeneracy of the viewing angle or the intrinsic variability of the source or when the host galaxy is dominating the optical spectrum [16]. The possibility of real hybrid objects cannot be ruled out: one can think, for example, about the recent discovery of a radio galaxy, PBC J2333.9 − 2343, which underwent some cataclysmic event, and its jet is now aligned toward the Earth [17][9].

The classical definition of Narrow-Line Seyfert 1 Galaxy (NLS1) is based on the following quantities [18,19]: (i) FWHM(Hβ) $\lesssim$ 2000 km/s; (ii) [OIII]/Hβ < 3; and (iii) FeII bumps. The most recent research suggested that the main indicator of a NLS1 could simply be a narrow permitted Hβ, with 1000 $\lesssim$ FWHM $\lesssim$ 2000 km/s, while FeII bumps might not be so constraining [20]. Therefore, when a measurement of the FWHM of the broad permitted Hβ is available and within the defined range, we reclassify the source as NLS1. These sources were previously classified as FSRQ/fsrq, and, since jetted NLS1s are known

to be the low-luminosity/-mass tail of the FSRQs distribution [21–23], it might seem a useless distinction.

This is due to the adoption of a classification based on an observed property that is easy to measure: the equivalent width (EW) of the optical emission lines, with a threshold of 5 Å (FSRQ and NLS1, strong lines, $EW > 5$ Å; BLLAC, weak or no emission lines, $EW < 5$ Å). However, if we adopt a physical classification (e.g., see [24], Figure 2), then FSRQs would be High-Mass Fast-Cooling (HMFC), while NLS1s would be Low-Mass Fast-Cooling (LMFC), and the difference would be clearer.

This is more evident in the $L_{\rm disk} - P_{\rm jet}$ plane, where NLS1s make a branch different from FSRQs because of their relatively small mass of the central black hole and the high accretion luminosity [24]. Therefore, it is worth keeping this distinction even if, for the sake of simplicity, we still adopt an observation-based classification.

We also decided to keep NLS1s separated from generic Seyfert galaxies (SEY class: type 1, type 2, or intermediate), since, in the latter cases, the physics driving the gamma-ray emission can be quite different, as the result of both a relativistic jet and star-burst activity [25–27].

With the term changing-look AGN (CLAGN), we refer to those sources that can change their classification (e.g., from BLLAC to FSRQ or vice versa) after some dramatic event, such as a change in the accretion or in the jet activity [28–33]. Sometimes the jet activity can determine changes in the observational appearance but not a change in classification: for example, the decrease/increase of equivalent width of the emission lines when the continuum increases/decreases because of the jet activity [34–37] or a shift of the synchrotron peak [38,39]. A word of caution must be set down when comparing optical spectra with very different signal-to-noise ratio (S/N): sometimes, the lack of emission lines or other features might be simply due to a combination of weak lines and low S/N spectra, not to an intrinsic variability of the AGN (e.g., [40]).

We might set a list of high and low confidence classification, but also this option suffers drawbacks as pointed out by the presence of the newly established CLAGN class. This is really the tip of the iceberg. CLAGN shows that cosmic objects can significantly change their classification on human time scales. This label clearly depends on how much the object was observed in the past. For most of the checked sources, we found just one optical spectrum; therefore, it is easy to speculate about the possibility of some not observed change. The opposite case—a very well known source, observed for decades, such as BL Lac—is not a guarantee of a fixed classification (e.g., [41]).

The concluding words of wisdom are that any observation-based classification must be taken *cum grano salis*, i.e., must not be taken literally. It always reflects the available data, the epochs of observation, and the instrumental performance. Most importantly, time must be taken into account: any classification is a time-fixed scheme, while cosmic objects change their appearance in time but not their intrinsic physical nature [42].

Therefore, this revision has to be intended, not as a tedious control, but as a step forward in understanding the nature of these sources. Further studies might require another change in the observation-based classification. This also emphasizes the need of a physics-based classification, as noted above for NLS1s, which would be more stable. Clearly, this type of classification can be done only after detailed studies and observations, and this is not the present case.

Moreover, we also underline that our aim is not to generate a new catalog and/or to compete with the existing ones. This revision was made in the context of preparing a sample of gamma-ray emitting jetted AGN to be used for the calibration of the jet power. However, the information presented here are a useful spin off of the calibration project that we believe will be of use to the community. We hope it will be a starting point and an inspiration for many forthcoming studies.

4. Preliminary Statistics

At the time of writing (20 August 2021), we have checked all the sources within the right ascension interval 0^h–12^h (J2000), corresponding to 1559/2982 sources (∼52%, Figure 1). The full list of sources is available in the Appendix A. For the sake of homogeneity, the redshifts were indicated with three significant digits and are the latest available, although the bibliographic reference reported the first consistent measured value (this means that there could be some slight difference in the latest significant digit between the value in the reference and the value in the table, which refers to the latest—and hopefully—best measurement).

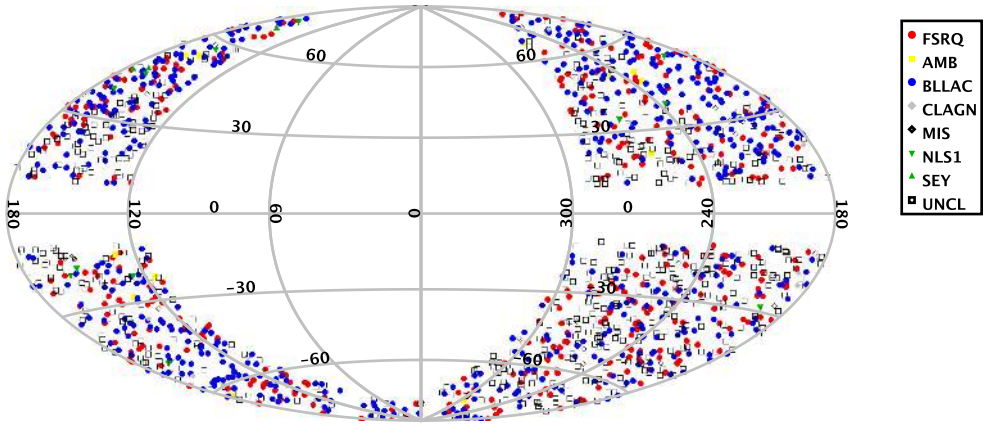

Figure 1. Distribution in the sky (Galactic coordinates) of the checked sources.

The original classification of these 1559 sources in the 4FGL was distributed as follows:

- 1 AGN, 3 agn;
- 15 BLL, 598 bll;
- 16 FSRQ, 353 fsrq;
- 2 NLSY1, 1 nlsy1;
- 3 RDG, 16 rdg;
- 2 css;
- 2 ssrq; and
- 547 bcu.

After our check, here are some preliminary revised statistics on this first set of sources:

- 554/1559 BLLAC (35.5%);
- 370/1559 FSRQ (23.7%);
- 12/1559 NLS1 (0.8%);
- 4/1559 SEY (0.3%);
- 39/1559 MIS (2.5%);
- 11/1559 CLAGN (0.7%);
- 14/1559 AMB (0.9%); and
- 555/1559 UNCL (35.6%).

Only 716 of the 1559 sources do have a redshift (46%, Figure 2). The values are spanning from $z = 0.00828$ (4FGL J0958.3 − 2656 = NGC 3078, AMB) to $z = 3.45$ (4FGL J0337.8 − 1157 = PKS 335 − 122, FSRQ; 4FGL J0833.4 − 0458 = PMN J0833 − 0454, FSRQ). Not all the sources classified as BLLAC have a measured redshift: only 285/554 (51%); the remaining have featureless or noisy spectra. The farthest BLLAC is 4FGL J0124.8 − 0625 = PMN J0124 − 0624 at $z = 2.12$ [7].

A comparison with 4LAC [6] and 4FGL [5] statistics is displayed in Table 1. The 4LAC clean sample is composed of all the extragalactic sources with $|b| > 10^\circ$ and `FLAGS=0`. The `FLAGS=0` in the LAT catalog indicates the absence of systematic problems in the gamma-ray data analysis. However, a `FLAGS>0` does not necessarily mean the presence of artifacts: for

example, Cen A has `FLAGS=512` because it has extended emission due to the jets. Therefore, in our sample, we included all the sources independently on the `FLAGS` value.

The full 4LAC contains all the extragalactic gamma-ray sources, including also those on the Galactic plane. The 4FGL has all the gamma-ray sources detected by *Fermi* LAT, including the Galactic sources (pulsars, pulsar wind nebulae, supernova remnants, ...). We compared our sample also with the original subsample of the 4FGL (4FGL-O) that we used as starting point for our analysis.

4LAC and the corresponding classes in the 4FGL are not exactly matching (4LAC full vs. 4FGL: FSRQ 655 vs. 694; BLLAC 1067 vs. 1131; ∼6% difference in both cases[10]), indicating some changes/update/different opinions in the classification methods adopted by two different working groups of the same *Fermi*/LAT collaboration (the two papers have been submitted almost at the same epoch, with just a few months difference).

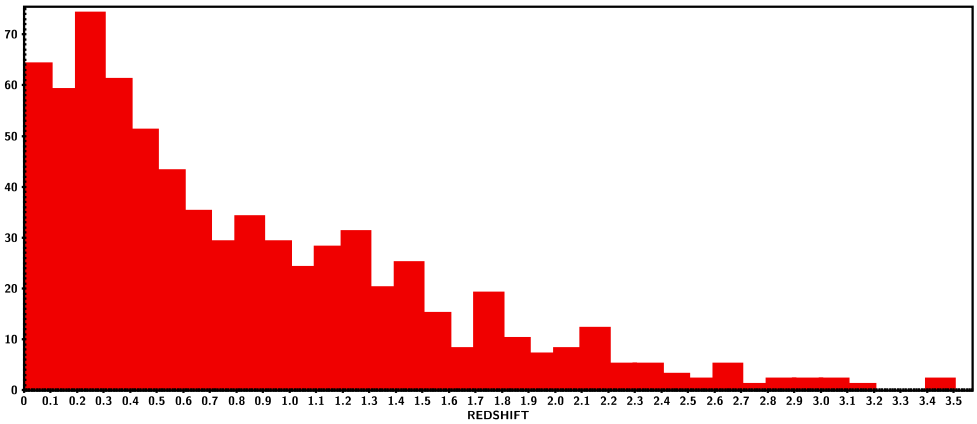

Figure 2. Redshift distribution of the checked sources.

The most striking differences between our list and the original LAT catalogs refer to the secondary classes (MIS, NLS1, and SEY as well as the new classes CLAGN and AMB), while the main classes (BLLAC and FSRQ) have relatively small or no changes in percent. Although, as we have already noted, MIS is the most difficult class to be defined, and we adopted a very conservative approach (the use of published papers), the number of sources in our sample is comparable with the numbers of the full catalogs. It is almost doubled in percent. NLS1 is worth noting, as it is almost tripled in percent. Again, we referred only to published values of FWHM(Hβ), but the quick look of some yet unanalysed optical spectra of the SDSS suggests that some specific data analysis might reveal even more NLS1s. The SEY class is slowly emerging and deserves attention.

Table 1. Comparison with statistics of 4LAC Clean samples (extragalactic sources with $|b| > 10^\circ$ and `FLAGS = 0`), 4LAC full sample (all sky), and 4FGL (data from tables in [5,6]). In the cases of 4LAC and 4FGL, the MIS class corresponds to the sum of the classes RDG/rdg, CSS/css, and SSRQ/ssrq. 4FGL-O refers to the original classification of the same dataset of the 4FGL.

Class	Present Work	4FGL-O	4LAC-Clean	4LAC-Full	4FGL
Nr. Src	1559	1559	2614	2863	5064
BLLAC	554 (35.5%)	613 (39.3%)	1027 (39.3%)	1067 (37.3%)	1131 (22.3%)
FSRQ	370 (23.7%)	369 (23.7%)	591 (22.6%)	655 (22.9%)	694 (13.7%)
NLS1	12 (0.8%)	3 (0.2%)	9 (0.3%)	9 (0.3%)	9 (0.2%)
SEY	4 (0.3%)	0 (0%)	0 (0.0%)	0 (0.0%)	1 (0.02%)
MIS	39 (2.5%)	23 (1.5%)	38 (1.4%)	45 (1.6%)	49 (1.0%)

5. Final Remarks

Starting from the fourth catalog of gamma-ray sources detected by *Fermi*/LAT, we are building a list of gamma-ray emitting jetted AGN to be used in a project of calibration of jet power. We presented here some preliminary statistics on the first half of the selected

sources (RA 0^h–12^h, J2000), which shows the emergence of an unexpected treasure of novelties that are awaiting study. Even with all the required caveats, it is now evident that an observation-based classification of jetted AGN cannot be a time-fixed scheme, but it should be regarded in a more dynamical way, to take into account not only the apparent changes of the cosmic sources but also the improvements in the observing technology as well as the proper use of the archives containing published articles and unpublished data.

In particular, we would like to emphasize the importance of looking at the published papers, because they contain information that cannot be extracted with a simple cross-match between catalogs.

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Data Availability Statement: The list of sources is available in Appendix A. All the publicly available data can be accessed through the hyperlinks.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. List of Gamma-Ray Emitting Jetted Active Galactic Nuclei—Part I—RA 0^h–12^h (J2000)

Columns explanation:

1. 4FGL-DR2 name (JHHHH.H±DDDD);
2. 4FGL-DR2 counterpart;
3. Easier alias (when it is not immediate to find the counterpart either on SIMBAD or on NED);
4. Redshift (three significant digits; an asterisk indicates that the value has been inferred from the image of the host galaxy);
5. Reference where the first measurement of z is reported;
6. 4FGL-DR2 original classification (see the 4FGL catalog paper for explanation);
7. Revised classification:
    - FSRQ: Flat-Spectrum Radio Quasar;
    - BLLAC: BL Lac Object;
    - NLS1: Narrow-Line Seyfert 1 Galaxy;
    - SEY: Seyfert galaxy (Type 1, 2, or intermediate);

- MIS: Misaligned Jetted AGN;
- CLAGN: Changing-look AGN;
- AMB: ambiguous; and
- UNCL: unclassified;

see the main paper for details and explanation of the proposed classification;

8. Host galaxy; and
9. Notes.

Please note that the hyperlinks open directly the web pages with the full-text articles or publicly available optical spectra. All the hyperlinks have been accessed for a check on 4 October 2021.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0001.2 + 4741	B3 2358 + 474	-	-	-	bcu	UNCL	-	-
J0001.2 − 0747	PMN J0001 − 0746	-	-	-	bll	BLLAC	-	Featureless spectrum, Shaw+(2013).
J0001.5 + 2113	TXS 2358 + 209	-	0.439	Muñoz+(2003)	fsrq	FSRQ	-	SIMBAD and NED reported an old $z = 1.106$ by Falco+(1998) based on the lines [CIII], Ne V, He I. Muñoz is based on Ne IV, Mg II, He I, [OIII]. SDSS confirms the Muñoz+(2003) value.
J0001.6 − 4156	2MASS J00013275 − 4155252	-	-	-	bcu	UNCL	-	-
J0002.1 − 6728	SUMSS J000215 − 672653	-	-	-	bcu	BLLAC	-	Featureless, Desai+(2019).
J0002.3 − 0815	WISEA J000236.06 − 081532.4	-	-	-	bcu	UNCL	-	-
J0002.4 − 5156	WISE J000229.20 − 515227.4	-	-	-	bcu	UNCL	-	-
J0003.1 − 5248	RBS 6	-	-	-	bcu	UNCL	-	-
J0003.3 − 1928	PKS 0000 − 197	-	-	-	bcu	UNCL	-	-
J0003.3 − 5905	PMN J0003 − 5905	-	-	-	bcu	UNCL	-	-
J0003.9 − 1149	PMN J0004 − 1148	-	-	-	bll	BLLAC	-	Meisner & Romani (2010) reported $z > 0.86$ on the basis of the non-detection of the host galaxy.
J0004.0 + 0840	SDSS J000359.23 + 084138.1	-	-	-	bcu	BLLAC	-	SDSS inconclusive. Paiano+ (2019) set a lower limit: $z > 1.5$.
J0004.3 + 4614	MG4 J000421 + 4615	GB6 J0004 + 4615	1.81	Sowards-Emmerd+ (2003)	fsrq	FSRQ	-	-
J0004.4 − 4737	PKS 0002 − 478	-	0.880	Shaw+ (2012)	fsrq	FSRQ	-	-
J0005.9 + 3824	S4 0003 + 38	-	0.229	Stickel & Kuher (1994)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0006.3 − 0620	PKS 0003 − 066	-	0.347	Jones+ (2009)	bll	BLLAC	-	-
J0006.4 + 0135	NVSS J000626 + 013611	-	0.787	Paiano+ (2019)	bcu	BLLAC	-	-
J0007.7 + 4008	NVSS J000741 + 400830	-	-	-	bcu	UNCL	-	-
J0008.0 + 4711	MG4 J000800 + 4712	RGB J0007 + 472	-	-	bll	BLLAC	-	Both NED and SIMBAD give $z = 0.28$ from Kock+ (1996), but this value is based on a partial and featureless spectrum. Kock+ suggested that value on the basis of possible absorption features from the host galaxy. Paiano+ (2017), with a better spectrum from GranTeCan, set a lower limit $z > 1.659$.
J0008.0 − 3937	PMN J0008 − 3945	-	-	-	bcu	UNCL	-	-
J0008.4 + 1455	NVSS J000825 + 145635	-	-	-	bcu	UNCL	-	SIMBAD does not even recognize the object. Searching by coordinates found only one star at 1.3′ distance.
J0008.4 − 2339	RBS 16	-	0.147	Schwope+ (2000)	bll	BLLAC	-	-
J0009.1 + 0628	TXS 0006 + 061	PMN J0009 + 0627	-	-	bll	BLLAC	-	SDSS inconclusive.
J0009.3 + 5030	NVSS J000922 + 503028	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0009.7 − 3217	IC 1531	-	0.0256	da Costa+ (1991)	rdg	MIS	E	FRI, Bassi+ (2018).
J0009.8 + 1340	RX J0009.9 + 1341	-	-	-	bcu	UNCL	-	-
J0009.8 − 4317	SUMSS J000949 − 431654	-	-	-	bll	BLLAC	-	Jones+ (2009) (6dF) reported $z = 1.259$, but with poor quality ($q = 1$).
J0010.6 + 2043	TXS 0007 + 205	-	0.598	SDSS	fsrq	FSRQ	-	-
J0010.6 − 3025	PKS 0008 − 307	-	1.19	Landt+ (2001)	fsrq	FSRQ	-	-
J0010.8 − 2154	PKS 0008 − 222	-	-	-	bcu	UNCL	-	-
J0011.4 + 0057	RX J0011.5 + 0058	-	1.491	SDSS	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0011.4 − 4110	PMN J0011 − 4105	-	-	-	bcu	UNCL	-	-
J0011.8 − 3142	SUMSS J001141 − 314220	-	-	-	bcu	UNCL	-	-
J0013.1 − 3955	PKS 0010 − 401	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0013.4 + 0950	1RXS J001328.4 + 094942	-	-	-	bcu	UNCL	-	SIMBAD identifies it as a star.
J0013.6 + 4051	4C +40.01	-	0.255	Thompson+ (1992)	agn	AMB	E	Thompson+ (1992) measured the redshift on the basis of [OIII] line and suggested a classification as NELRG. Véron-Cetty & Véron (2010) classified it as Seyfert 1.9, thus, confirming an obscured object at large viewing angle. However, the MOJAVE Program reports a one-side jet with superluminal speed (∼7c) and high polarization.
J0013.6 − 0424	PKS 0011 − 046	-	1.08	SDSS	fsrq	FSRQ	-	-
J0013.9 − 1854	RBS 30	-	0.0948	Jones+ (2009)	bll	BLLAC	-	-
J0014.1 + 1910	MG3 J001356 + 1910	RGB J0013 + 191	0.477	Shaw+ (2013)	bll	BLLAC	-	-
J0014.1 − 5022	RBS 32	-	-	-	bll	BLLAC	-	Jones+ (2009) reports $z = 0.0105$ with $q = 3$, but no evident feature is visible in the online spectrum to confirm the value.
J0014.2 + 0854	MS 0011.7 + 0837	PMN J0014 + 0853	0.163	SDSS	bll	MIS	-	The SDSS spectrum displays evident lines (Hα+NII, [OIII]), but Rector+ (1999) published a very different spectrum (featureless, see Figure 5), although it measured the same redshift via CaII break D(4000). Change in the spectrum likely due to a change in the accretion or in the jet activity (more than 10 years between the two observations). Rector also reported a FRI classification on the basis of VLA radio maps. Steep radio spectrum (α∼0.64).
J0014.3 − 0500	GALEXASC J001420.46 − 045929.1	SDSS J001420.43 − 045928.8	0.791	SDSS	bcu	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0014.9 + 3212	3C 6	-	-	-	bcu	UNCL	-	-
J0015.2 + 3537	RX J0015.4 + 3536	1RXS J001528.3 + 353641	-	-	bll	BLLAC	-	Featureless, Piranomonte+ (2007).
J0015.9 + 2440	GB6 J0016 + 2440	-	-	-	bcu	UNCL	-	-
J0016.2 − 0016	S3 0013 − 00	-	1.58	SDSS	fsrq	FSRQ	-	-
J0016.5 + 1702	GB6 J0015 + 1700	-	1.72	SDSS	fsrq	FSRQ	-	-
J0017.0 − 0649	PMN J0017 − 0650	-	-	-	bcu	UNCL	-	-
J0017.5 − 0514	PMN J0017 − 0512	-	0.227	Healey+ (2008)	FSRQ	FSRQ	-	-
J0017.8 + 1455	GB6 J0017 + 1450	-	0.303	SDSS	bll	BLLAC	-	-
J0018.4 + 2946	RBS 42	-	-	-	bll	BLLAC	-	Nass+ (1996) reported a featureless low-resolution spectrum. By cross-correlating it with a zero-velocity template, Fischer+ (1998) suggested $z = 0.1$. Shaw+ (2013) found again a featureless spectrum.
J0019.2 − 5640	PMN J0019 − 5641	-	-	-	bcu	UNCL	-	-
J0019.3 − 8152	PMN J0019 − 8152	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0019.6 + 2022	PKS 0017 + 200	-	-	-	bll	BLLAC	-	Chu+ (1986) reported a weak S/N spectrum (no redshift measured), requiring further observations. SDSS inconclusive.
J0019.6 + 7327	S5 0016 + 73	-	1.78	Lawrence+ (1996)	fsrq	FSRQ	-	-
J0021.0 + 0322	2MASS J00205023 + 0323578	-	-	-	bcu	UNCL	-	-
J0021.5 − 2552	CRATES J002132.55 − 255049.3	IVS B0019 − 261	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013) and Titov+ (2017).
J0021.6 − 0855	NVSS J002142 − 090044	-	0.648	Plotkin+ (2010)	bll	BLLAC	-	SDSS.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0021.9 − 5140	1RXS J002159.2 − 514028	-	-	-	bll	BLLAC	-	Arsioli+ (2015) reported $z = 0.25$, based on the host galaxy magnitude.
J0022.0 + 0006	RX J0022.0 + 0006	-	0.306	Brinkmann+ (2000)	bll	BLLAC	-	SDSS.
J0022.1 − 1854	1RXS J002209.2 − 185333	-	-	-	bll	BLLAC	-	Shaw+ (2013) indicated $z > 0.774$ on the basis of absorption features identified as an intervening system, while Ackermann+ (2016) suggested that those features are of the host galaxy and, therefore, set $z = 0.774$.
J0022.5 + 0608	PKS 0019 + 058	-	-	-	bll	BLLAC	-	Sbarufatti+ (2009) found a featureless spectrum and set $z > 0.64$ (EW > 0.38 Å) by using ESO/VLT, while Shaw+ (2013) indicated $z > 0.29$. Trueben-bach & Darling (2017) suggested $z = 2.86$ on the basis of three emission lines (OI, CII, and CIV) observed by Apache Point (3.5 m). This latter spectrum, available online (unprocessed), does not show evident features, and a BL Lac at such a high-z is quite unlikely; the measured redshift does not appear to be reliable.
J0023.7 + 4457	B3 0020 + 446	-	1.06	Healey+ (2008)	fsrq	FSRQ	-	-
J0023.7 − 6820	PKS 0021 − 686	-	0.354	Mahony+ (2011)	bcu	MIS	-	Callingham+ (2017) reported the peak of radio emission at 177 MHz. Steep radio spectrum ($\alpha \sim 0.6$).
J0023.9 + 1603	87GB 002122.5 + 154553	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0024.4 + 4647	B3 0021 + 464	-	-	-	bcu	UNCL	-	-
J0024.7 + 0349	GB6 J0024 + 0349	-	0.546	SDSS	fsrq	FSRQ	-	-
J0025.2 − 2231	PMN J0025 − 2228	-	0.834	Titov+ (2013)	fsrq	FSRQ	-	-
J0025.7 − 4801	SUMSS J002545 − 480356	PMN J0025 − 4803	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0026.6 − 4600	1RXS J002636.3 − 460101	-	-	-	bll	BLLAC	-	Thomas+ (1998) identified it as a BL Lac Object on the basis of a featureless spectrum. Mahony+ (2010) indicated a Galactic object on the basis of 6dF spectrum. However, a Galactic object at $b = -70°.4$ is rather unlikely.
J0028.1 + 7505	GB6 J0028 + 7506	-	-	-	bcu	UNCL	-	-
J0028.4 + 2001	TXS 0025 + 197	-	1.55	SDSS	fsrq	FSRQ	-	-
J0028.8 − 0112	PKS 0026 − 014	-	0.0828	SDSS	bll	BLLAC	-	FRI radio morphology (Capetti+ 2019) but flat radio spectrum of the core (Healey+ 2007).
J0028.9 + 3553	GB6 J0028 + 3550	-	-	-	bcu	UNCL	-	-
J0029.0 − 7044	PKS 0026 − 710	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0029.4 + 2051	NVSS J002928 + 205332	-	-	-	bcu	UNCL	-	-
J0030.2 − 1647	2MASS J00302045 − 1647130	-	0.237	Álvarez Crespo+ (2016)	bll	BLLAC	-	-
J0030.3 − 4224	PKS 0027 − 426	-	0.495	Jackson+ (2002)	fsrq	FSRQ	-	SIMBAD reports $z = 1.66$ from Hewitt & Burbidge (1989), but this object is *not* present in the list. Jackson+ (2002) wrote a note about this wrong redshift making reference to NED, which, in turn, is now corrected.
J0030.6 − 0212	PKS B0027 − 024	-	1.80	SDSS	bcu	FSRQ	-	-
J0031.3 + 0726	NVSS J003119 + 072456	-	-	-	bll	BLLAC	-	Featureless, Marchesi+ (2018).
J0032.3 − 5522	SUMSS J003210 − 552228	-	-	-	bcu	UNCL	-	-
J0032.4 − 2849	PMN J0032 − 2849	-	0.324	Landt & Bignall (2008)	bll	BLLAC	-	-
J0033.3 − 2040	RBS 75	-	0.0727	Schwope (2000)	bll	BLLAC	-	In a cluster of galaxies.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0033.5 − 1921	KUV 00311 − 1938	-	-	-	bll	BLLAC	-	Both SIMBAD and NED indicated $z = 0.61$ from Giommi+ (2005), which, in turn, refer to Bauer+ (2000) and Piranomonte+ (2007). The former did not indicate any redshift and classified it as BL Lac Object, while the latter indicates an uncertain $z = 0.61$ from a featureless spectrum with a weak EW. Shaw+ (2013) indicated $z > 0.29$; Pita+ (2014) set $z > 0.47$.
J0033.9 + 3858	MG3 J003408 + 3901	NVSS J003402 + 390037	-	-	bcu	UNCL	-	-
J0034.0 − 4116	PKS 0031 − 415	-	-	-	bcu	UNCL	-	-
J0035.0 − 5728	PMN J0035 − 5726	-	-	-	bcu	UNCL	-	-
J0035.2 + 1514	RX J0035.2 + 1515	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017). SDSS inconclusive.
J0035.8 − 0837	PMN J0035 − 0836	-	-	-	bcu	UNCL	-	-
J0036.9 + 1832	CRATES J003659.39 + 1832037	NVSS J003659 + 183203	1.59	SDSS	bcu	FSRQ	-	-
J0037.6 + 3653	4C +36.01	-	0.366	Vermeulen & Taylor (1995)	fsrq	FSRQ	-	-
J0037.8 + 1239	NVSS J003750 + 123818	-	0.0890	Shaw+ (2013)	bll	BLLAC	-	-
J0037.9 + 2612	WISE J003719.15 + 261312.6	NVSS J003719 + 261317	0.148	Falco+ (1998)	bll	FSRQ	-	SDSS.
J0038.1 + 0012	NVSS J003808 + 001336	-	-	-	bll	BLLAC	-	Both NED and SIMBAD give $z = 0.739$ based on Croom+ (2009), which, in turn, used a SDSS spectrum and marked it as not reliable. More recent SDSS inconclusive.
J0038.2 − 2459	PKS 0035 − 252	-	0.498	Jones+ (2009)	fsrq	FSRQ	-	-
J0038.7 − 0204	3C 17	-	0.220	Schmidt (1965)	rdg	MIS	-	SDSS. FRII, Balmaverde+ (2019).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0039.0 − 0946	TXS 0036 − 099	-	2.10	Sowards-Emmerd+ (2004)	fsrq	FSRQ	-	-
J0039.1 + 4330	NVSS J003907 + 433015	-	-	-	bcu	UNCL	-	-
J0039.1 − 2219	PMN J0039 − 2220	-	0.0644	Vettolani+ (1989)	bcu	BLLAC	S0	In a cluster.
J0040.3 + 4050	B3 0037 + 405	-	-	-	bll	BLLAC	-	Featureless, Marchesi+ (2018).
J0040.4 − 2340	PMN J0040 − 2340	-	-	-	bll	UNCL	-	Both NED and SIMBAD indicate $z = 0.231$ from Landt & Bignall (2008). However, the authors refer to an unpublished spectrum and flag it as uncertain.
J0040.9 + 3203	TXS 0038 + 319	-	0.632	SDSS	bcu	FSRQ	-	-
J0041.4 + 3800	B3 0038 + 377	-	0.380	Fittingoff+ (2009)	fsrq	FSRQ	-	-
J0041.9 − 4702	RBS 97	-	0.150	Schwope+ (2000)	bcu	BLLAC	-	-
J0042.0 + 3640	RX J0042.0 + 3641	-	-	-	bll	BLLAC	-	Featureless, Piranomonte+ (2007)
J0042.2 + 2319	PKS 0039 + 230	-	1.43	Healey+ (2008)	fsrq	FSRQ	-	SDSS
J0043.5 − 0442	1RXS J004333.7 − 044257	-	-	-	bll	BLLAC	-	Both Jones+ (2009) (6dF) and SDSS inconclusive.
J0043.6 + 2223	TXS 0040 + 221	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J0043.7 − 1116	1RXS J004349.3 − 111612	-	0.264	Álvarez Crespo+ (2016)	bll	BLLAC	-	-
J0043.8 + 3425	GB6 J0043 + 3426	-	0.966	Shaw+ (2012)	fsrq	FSRQ	-	The automatic pipeline of the SDSS spectrum suggest $z = 3.514$, on the basis of a feature identified as Lyα. The same feature was identified by Shaw+ (2012) as Mg II.
J0044.2 − 8424	PKS 0044 − 84	-	1.03	Shaw+ (2012)	fsrq	FSRQ	-	-
J0045.1 − 3706	PKS 0042 − 373	-	1.03	Klindt+ (2017)	bcu	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0045.3 + 2128	GB6 J0045 + 2127	-	0.425	Paiano+ (2020)	bll	BLLAC	-	SDSS.
J0045.7 + 1217	GB6 J0045 + 1217	-	0.255	Paiano+ (2020)	bll	BLLAC	-	SDSS
J0047.1 − 6203	PKS 0045 − 623	-	-	-	bcu	UNCL	-	-
J0047.9 + 2233	GB6 J0048 + 2234	-	1.16	Shaw+ (2012)	fsrq	FSRQ	-	SDSS
J0047.9 + 3947	B3 0045 + 395	-	0.252	Djorgovski+ (1995)	bll	BLLAC	-	-
J0048.6 − 2427	1RXS J004836.9 − 242631	-	-	-	bcu	UNCL	-	-
J0049.0 + 2252	CRATES J004901.37 + 225315.4	PKS J0049 + 2253	0.264	SDSS	bll	MIS	-	In a cluster. Steep radio spectrum with detection at 74 MHz (VLSS), but Liu & Zhang (2002) reported a one-side jet: head-tail radio galaxy?
J0049.1 + 4223	GALEXASC J004859.14 + 422351.4	NVSS J004859 + 422350	0.302	Paiano+ (2017)	bcu	BLLAC	-	-
J0049.4 − 5402	PMN J0049 − 5402	-	-	-	bcu	UNCL	-	-
J0049.5 − 4150	SUMSS J004938 − 415140	-	-	-	bcu	UNCL	-	-
J0049.6 − 4500	PMN J0049 − 4457	-	0.121	Schectman+ (1996)	bcu	FSRQ	-	Schwope+ (2000) classified it as Seyfert.
J0049.7 + 0237	PKS 0047 + 023	-	1.47	Shaw+ (2013)	bll	BLLAC	-	SDSS inconclusive.
J0050.0 − 5736	PKS 0047 − 579	-	1.80	Peterson+ (1976)	fsrq	FSRQ	-	-
J0050.4 − 0452	PKS 0047 − 051	-	0.920	Healey+ (2008)	fsrq	FSRQ	-	-
J0050.7 − 0929	PKS 0048 − 09	-	0.635	Shaw+ (2013)	BLL	BLLAC	-	SDSS inconclusive.
J0051.1 − 0648	PKS 0048 − 071	-	1.98	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0051.2 − 6242	1RXS J005117.7 − 624154	-	-	-	bll	BLLAC	-	Featureless, Masetti+ (2013).
J0051.5 − 4220	PKS 0048 − 427	-	1.75	White+ (1988)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0052.9 − 6644	PMN J0052 − 6641	ATLBS J0052.8 − 6641	-	-	bcu	MIS	-	MIS (composite) from Australia Telescope Low-Brightness Survey (ATLBS) by Subrahmanyan+ (2010). Steep radio spectrum.
J0054.4 + 8627	WN B0046.2 + 8611	VCS5 J0052 + 8627	-	-	bcu	UNCL	-	-
J0054.7 − 2455	FRBA J0054 − 2455	-	-	-	bll	BLLAC	-	SIMBAD gives $z = 0.61$ from Neronov+ (2015), who, in turn, did not give any reference. Featureless spectra are reported by Masetti+ (2013) and Shaw+ (2013).
J0054.8 − 1954	TXS 0052 − 201	-	-	-	bcu	UNCL	-	-
J0055.1 − 1219	TXS 0052 − 125	-	-	-	bcu	UNCL	-	-
J0056.3 − 0935	TXS 0053 − 098	-	0.103	SDSS	bll	MIS	-	FRI, head-tail, Miraghaei & Best (2017).
J0056.4 − 2118	PMN J0056 − 2117	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0056.5 − 3936	NVSS J005620 − 394144	-	0.308	Vettolani+ (1998)	bcu	AMB	-	Classified as double radio source by Zanichelli+ (2001), but without further specific notes. Flat radio spectrum.
J0056.6 − 4452	PKS 0054 − 451	-	-	-	bcu	BLLAC	-	Featureless, Titov+ (2017).
J0056.6 − 5317	CRATES J005630.93 − 531931.5	-	-	-	bcu	UNCL	-	-
J0056.8 + 1626	TXS 0054 + 161	-	0.206	Sowards-Emmerd+ (2005)	bll	BLLAC	-	-
J0057.0 + 4101	87GB 005415.3 + 404404	-	-	-	bcu	UNCL	-	-
J0057.3 + 2216	87GB 005452.5 + 220227	-	-	-	bcu	BLLAC	-	Featureless, Healey+ (2008).
J0057.7 + 3023	NGC 315	-	0.0167	Colla+ (1975)	rdg	MIS	E	Classified as FRI by Venturi+ (1993). Barth+ (1999) classified it as LINER 1.9 in an elliptical galaxy.
J0058.0 − 0539	PKS 0055 − 059	-	1.25	Titov+ (2011)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0058.0 − 3233	PKS 0055 − 328	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0058.3 + 1723	RX J00582 + 1723	-	-	-	bll	UNCL	-	Nass+ (1996) suggested a classification as BLLAC on the basis of the X-ray/optical B flux ratio.
J0058.4 + 3315	MG3 J005830 + 3311	NVSS J005832 + 331117	1.37	Shaw+ (2012)	fsrq	FSRQ	-	-
J0059.2 + 0006	PKS 0056 − 00	-	0.719	SDSS	fsrq	FSRQ	-	-
J0059.3 − 0152	RX J0059.3 − 0150	-	0.144	Shaw+ (2013)	bll	BLLAC	-	SDSS
J0059.5 − 3338	PKS B0057 − 338	-	0.874	Tinney (1999)	fsrq	FSRQ	-	-
J0059.5 − 3512	1RXS J005932.3 − 351049	-	-	-	bll	BLLAC	-	Featureless, Mahony+ (2010).
J0100.3 + 0745	GB6 J0100 + 0745	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0101.0 − 0059	NVSS J010058 − 005547	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0101.7 − 5455	MRSS 151 − 121576	-	-	-	bcu	UNCL	-	No entry in SIMBAD.
J0101.8 − 7543	PKS 0101 − 76	-	1.02	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0102.0 + 1639	TXS 0059 + 163	-	-	-	bcu	UNCL	-	-
J0102.4 + 0942	2MASS J01021713 + 0944098	-	0.421	Paiano+ (2017)	bcu	BLLAC	-	SDSS
J0102.4 + 4214	GB6 J0102 + 4214	-	0.874	Shaw+ (2012)	fsrq	NLS1	-	Shaw+ (2012) reported FWHM(Hβ) = 1900 km/s.
J0102.6 − 5639	PKS 0100 − 568	-	-	-	bcu	UNCL	-	-
J0102.7 − 2001	PMN J0102 − 2001	-	-	-	bcu	BLLAC	-	Featureless, Arsioli+ (2015).
J0103.1 + 4954	GB6 J0103 + 4959	-	-	-	bcu	UNCL	-	-
J0103.5 + 1526	TXS 0100 + 151	-	0.246	SDSS	bll	BLLAC	E	-
J0103.8 + 1321	NVSS J010345 + 132346	-	0.490	Álvarez Crespo+ (2016)	bll	BLLAC	-	-
J0104.8 − 2416	PKS 0102 − 245	-	1.747	Shaw+ (2012)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0105.1 + 3929	GB6 J0105 + 3928	-	0.440	Shaw+ (2013)	bll	BLLAC	-	Marlow+ (2000) reported $z = 0.083$ on the basis of two possible lines (Hα, [OII]), but they themselves flagged it as uncertain. The value measured by Shaw+ (2013) is based on features of the host galaxy.
J0106.9 − 4832	PMN J0106 − 4831	-	-	-	bcu	UNCL	-	-
J0107.3 − 1210	PMN J0107 − 1211	-	-	-	bcu	UNCL	-	-
J0107.4 + 0334	PMN J0107 + 0333	-	-	-	bll	BLLAC	-	Featureless, SDSS.
J0108.1 − 0039	PKS 0105 − 008	-	1.37	Strittmatter+ (1974)	fsrq	FSRQ	E	SDSS.
J0108.6 + 0134	4C +01.02	-	2.11	Burbidge (1968)	fsrq	FSRQ	-	SDSS.
J0109.1 + 1815	MG1 J010908 + 1816	RBS 157	0.444	Shaw+ (2013)	bll	BLLAC	-	SDSS. NED reports $z = 0.145$ from Bauer+ (2000). However, it is not possible to find that spectrum in order to understand how they estimated z and no specific notes are available in their paper.
J0109.3 + 2401	GB6 J0109 + 2400	-	0.493	SDSS	bcu	BLLAC	-	-
J0110.0 − 4019	RBS 158	-	0.313	Fischer+ (1998)	bll	BLLAC	-	-
J0110.2 + 4151	6C B010709.9 + 413321	RGB J0110 + 418	0.0960	Laurent-Muehleisen+ (1998)	bll	BLLAC	-	-
J0110.7 − 1254	1RXS J011050.0 − 125455	-	-	-	bll	BLLAC	-	Featureless, Mahony+ (2010) and Arsioli+ (2015). Fischer+ (1998) reported $z = 0.234$ by cross-correlating with a zero-velocity template spectrum.
J0111.4 + 0534	1RXS J011130.5 + 053612	-	0.347	Nass+ (1996)	bll	BLLAC	-	SDSS
J0111.5 − 2546	NVSS J011130 − 254531	-	-	-	bcu	UNCL	-	-
J0112.0 − 6634	PKS 0110 − 668	-	1.19	Titov+ (2011)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0112.1 + 2245	S2 0109 + 22	-	0.265	Healey+ (2008)	BLL	BLLAC	-	This result was challenged by Paiano+ (2008), who reported a featureless spectrum. However, Paiano reported $R = 14.8$, brighter than $R = 15.5$ reported by Healey. It is likely that jet activity has hidden the weak features observed by the latter. The galaxy is $15''$ far from S2 0109 + 22 reported by Paiano, with redshift similar to Healey's, is likely to be in the same cluster, but it has $R = 18.3$. Even it falls in the slit, it cannot contaminate the spectrum of S2 0109 + 22 (a 3 mag difference). The conclusions of Paiano are challenged by their own Figure 5: they wrote that the Ca H&K break can disappear for $z > 0.40$; however, in that case, R would have been 19.4, while they reported $R = 14.8$. Therefore, it is likely that they did not observe the calcium break simply because of an increased jet activity, while Healey observed the weak features because the object was in a low optical state.
J0112.1 − 0321	TXS 0110 − 037	-	0.772	SDSS	fsrq	FSRQ	-	-
J0112.6 − 3158	RX J011232.8 − 320140	-	-	-	bll	BLLAC	-	-
J0112.8 + 3208	4C +31.03	-	0.603	Wills & Wills (1976)	fsrq	FSRQ	-	-
J0112.8 − 7506	2MASS J01123146 − 7506179	-	-	-	bll	UNCL	-	-
J0113.1 − 3553	PMN J0113 − 3551	-	1.22	Healey+ (2008)	fsrq	FSRQ	-	-
J0113.4 + 4948	S4 0110 + 49	-	0.389	Henstock+ (1997)	fsrq	FSRQ	-	-
J0113.7 + 0225	UGC 773	-	0.0470	Wills & Wills (1976)	bll	BLLAC	E	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0114.8 + 1326	GB6 J0114 + 1325	-	0.583*	Stadnik & Romani (2014)	bll	BLLAC	E	Featureless, Shaw+ (2013). SDSS inconclusive.
J0114.9 − 3400	1RXS J011501.3 − 340008	-	0.482	Piranomonte+ (2007)	bll	BLLAC	-	-
J0115.1 + 2622	1RXS J011451.8 + 262337	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J0115.1 − 0129	PKS 0112 − 017	-	1.37	SDSS	fsrq	FSRQ	-	-
J0115.6 + 0356	PMN J0115 + 0356	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0115.8 + 2519	RX J0115.7 + 2519	-	0.376	SDSS	bll	BLLAC	E	-
J0116.0 − 1136	PKS 0113 − 118	-	0.671	Wright+ (1983)	fsrq	FSRQ	-	-
J0116.0 − 2745	1RXS J011555.6 − 274428	-	-	-	bll	BLLAC	-	Featureless, Croom+ 2004.
J0116.2 − 6153	SUMSS J011619 − 615343	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0116.5 − 2812	1RXS J011637.7 − 281146	-	-	-	bll	BLLAC	-	Featureless, Arsioli+ (2015).
J0116.5 − 3046	PKS 0113 − 310	-	1.41	Croom+ (2004)	fsrq	FSRQ	-	-
J0117.5 − 2442	1RXS J011746.6 − 244329	-	0.279	Piranomonte+ (2007)	bll	BLLAC	-	-
J0117.8 − 2109	PKS 0115 − 214	-	1.49	Healey+ (2008)	fsrq	FSRQ	-	-
J0118.7 − 0848	AT20G J011844 − 085058	-	-	-	bcu	UNCL	-	NED gives a photometric redshift $z = 2.03$ from SDSS (no spectrum) by Richards+ (2004).
J0118.9 − 2141	PKS 0116 − 219	-	1.16	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0119.0 − 1458	1RXS J011905.4 − 145906	-	-	-	bll	BLLAC	-	6dF redshift survey by Jones+ (2009) suggests $z = 0.115$ ($q = 3$).
J0119.4 − 5354	PKS 0117 − 542	-	-	-	bcu	UNCL	-	-
J0119.6 + 4158	2MASX J01200274 + 4200139	-	-	-	bcu	UNCL	-	-
J0119.9 + 4053	CRATES J012018 + 405314	GB6 J0120 + 4053	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0120.4 − 2701	PKS 0118 − 272	-	-	-	bll	BLLAC	-	Featureless, Falomo (1989).
J0121.7 + 5153	2MASS J01213367 + 5155520	NVSS J012133 + 515557	-	-	bcu	UNCL	-	-
J0121.8 − 3916	NVSS J012152 − 391547	-	-	-	bcu	UNCL	-	-
J0122.1 − 3004	1RXS J012203.6 − 300507	-	-	-	bcu	UNCL	-	-
J0123.1 + 3421	1ES 0120 + 340	-	0.272	Perlman+ (1996)	bll	BLLAC	-	-
J0123.7 − 2311	1RXS J012338.2 − 231100	-	0.404	Schwope+ (2000)	bll	BLLAC	-	-
J0124.8 − 0625	PMN J0124 − 0624	-	2.12	Shaw+ (2013)	bll	BLLAC	-	This seems to be the farthest known BL Lac Object.
J0125.3 − 2548	PKS 0122 − 260	-	-	-	bll	BLLAC	-	Featureless spectrum, Titov+ (2011).
J0125.4 + 3200	MG3 J012541 + 3152	NVSS J012543 + 315314	-	-	bcu	UNCL	-	-
J0125.7 − 0015	PKS 0122 − 005	-	2.28	MacAlpine & Feldman (1982)	fsrq	FSRQ	-	SDSS.
J0126.0 − 2221	PKS 0123 − 226	-	0.717	Baker+ (1999)	fsrq	FSRQ	-	-
J0126.5 − 1553	WISEA J012708.49 − 155554.1	PMN J0127 − 1556	-	-	bcu	UNCL	-	-
J0127.1 + 3310	NVSS J012656 + 330727	1RXS J012657.1 + 330730	-	-	bll	BLLAC	-	Featureless, Piranomonte+ (2007). SDSS inconslusive.
J0127.2 + 0324	NVSS J012713 + 032259	-	-	-	bll	BLLAC	-	Featureless, Marchesi+ (2018). SDSS inconclusive.
J0127.2 − 0819	PMN J0127 − 0821	FBQS J0127 − 0821	-	-	bll	BLLAC	-	Featureless spectrum. Collinge+ (2005) reported $z = 0.362$, but it is flagged as uncertain. Plotkin+ (2010) did not indicate any z, but a lower limit from the host galaxy ($z > 0.488$). SDSS inconclusive.
J0127.4 − 4813	PMN J0127 − 4813	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0127.9 + 4857	GB6 J0128 + 4901	-	0.0670	Marcha et al. (1996)	bll	AMB	-	Rather strange object, a hybrid between BL Lac object and FRI, according to Marcha+ (1996) and Jackson+Marcha (1999). The optical spectrum shows Hα+[NII] and [OIII] lines, but not Hβ, suggesting the presence of partial covering, and hence a large viewing angle. LAT spectrum is rather soft ($\Gamma\sim$2.6) favoring the MIS classification, rather than BLLAC. Lister classified it as radio galaxy in his MOJAVE project.
J0128.5 + 4440	GB6 J0128 + 4439	-	0.228	Marlow+ (2000)	fsrq	FSRQ	-	-
J0129.7 + 3436	TXS 0126 + 343	-	-	-	bcu	AMB	-	SDSS inconclusive. Radio morphology from Douglas+ (1996) is symmetric double with lobes, but the TGSS indicates a point-source. The radio spectrum from SIMBAD/Specfind is steep, but the TGSS-NVSS slope is inverted.
J0129.8 + 1440	4C +14.06	-	1.63	SDSS	fsrq	FSRQ	-	-
J0130.6 + 1844	MG1 J013030 + 1843	NVSS J013030 + 184321	-	-	bcu	UNCL	-	SDSS inconclusive.
J0132.7 − 0804	PKS 0130 − 083	-	0.148	Bauer+ (2000)	bcu	SEY	-	Bauer+ (2000) also classified it as Sy 1.5.
J0132.7 − 1654	PKS 0130 − 17	-	1.02	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0132.8 + 4324	B3 0129 + 431	-	-	-	bcu	BLLAC	-	Featureless, Hook+ (1996) and Henstock+ (1997).
J0132.8 − 4413	SUMSS J013306 − 441422	-	-	-	bll	BLLAC	-	Classified as a BL Lac Object by Landoni+ (2015), but without any explanation.
J0133.1 − 5201	PKS 0131 − 522	-	0.0200	Johnston+ (1995)	bcu	FSRQ	-	-
J0133.2 − 4533	1RXS J013308.8 − 453528	-	-	-	bcu	UNCL	-	-
J0134.3 − 3842	PMN J0134 − 3843	-	2.14	Iovino+ (1996)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0134.5 + 2638	RX J0134.4 + 2638	-	0.571	Marchesi+ (2018)	fsrq	CLAGN	-	This source is rather intriguing and deserves further studies. Shaw+ (2013) and Paiano+ (2020) reported featureless spectra and classified it as BL Lac object, with lower limits for z ($z > 0.15$ for Paiano; she also suggested that the MgII line reported by Marchesi is an artifact). However, Marchesi+ (2018) found a prominent emission line at 4400 Å, which is identified as Mg II. Therefore, they measured $z = 0.571$ and classified the source as FSRQ. The SDSS spectrum is featureless. The instruments used by Shaw and Paiano started from 4150 Å, while Marchesi and SDSS started from 3500 Å. The observations dates are: 2010 October 14, Shaw; 2015 February 2, SDSS; 2017 October 10, Marchesi; 2017 December 3, Paiano. The variability expected from a jetted AGN can explain differences in spectra from observations separated by years. Even the two months of separation from Marchesi and Paiano observations could be still well explained in terms of the source variability. In addition, it is worth noting that the expected feature at 4400 Å is close to the lower wavelength boundary of the instrument used by Paiano, although the EW measured by Marchesi (EW = 64 Å) would make it measurable even with low instrument performance. Last, but not least, the other spectra collected on the same night by Marchesi did not record any signal on the same wavelength. This source deserves a monitoring campaign. It might be a case similar to PMN J2345 − 1555.
J0135.1 + 0255	1RXS J013506.7 + 025558	-	0.372	SDSS	bcu	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0136.5 + 3906	B3 0133 + 388	-	-	-	bll	BLLAC	-	Featureless, the latest observation was done by Paiano+ (2017). SIMBAD reported $z = 0.75$ from Neronov+ (2015), but it seems to be the lower limit measured by Shaw+ (2013).
J0137.0 + 4751	OC 457	-	0.859	Lawrence+ (1986)	fsrq	FSRQ	-	-
J0137.6 − 2430	PKS 0135 − 247	-	0.837	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0138.0 + 2247	GB6 J0138 + 2248	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0138.5 − 4613	PMN J0138 − 4614	2MASX J01383386 − 4614174	0.0901	Jones+ (2009)	bcu	BLLAC	-	-
J0139.0 + 2601	WISE J013859.14 + 260015.7	-	0.347	SDSS	bll	BLLAC	-	-
J0140.6 + 8736	WN B0126.6 + 8722	-	-	-	bcu	UNCL	-	-
J0140.6 − 0758	RX J0140.7 − 0758	-	-	-	bll	BLLAC	-	Featureless, Sbarufatti+ (2009).
J0141.4 − 0928	PKS 0139 − 09	-	0.733	Stocke+Rector (1997)	bll	BLLAC	-	Stocke+Rector (1997) reported an absorption line MgII at $z = 0.5$, and two weak emission lines (MgII, [OII]) at $z = 0.733$. This value is confirmed by Shaw+ (2013), but not by Paiano+ (2020), likely due to jet activity. SDSS inconclusive.
J0142.7 − 0543	PKS 0140 − 059	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2013).
J0143.1 − 3622	PMN J0143 − 3623	-	-	-	bcu	UNCL	-	-
J0143.5 − 3156	PKS 0140 − 322	-	0.375	Croom+ (2004)	bcu	FSRQ	-	See also Londish+ (2007) for the classification as Type 1 AGN.
J0143.7 − 5846	SUMSS J014347 − 584550	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0144.6 + 2705	TXS 0141 + 268	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2009).
J0145.0 − 2732	PKS 0142 − 278	-	1.15	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0145.9 + 2319	TXS 0143 + 230	-	-	-	bcu	BLLAC	-	SDSS inconclusive.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0146.0 − 6746	SUMSS J014554 − 674646	-	-	-	bcu	UNCL	-	-
J0146.3 + 4606	B3 0143 + 458	-	-	-	bcu	UNCL	-	-
J0146.9 − 5202	PKS 0144 − 522	-	0.0981	Jones+ (2009)	bll	BLLAC	-	-
J0148.6 + 0127	PMN J0148 + 0129	-	0.940	Shaw+ (2013)	bll	BLLAC	-	-
J0149.6 − 0734	PMN J0149 − 0733	-	-	-	bcu	UNCL	-	-
J0150.6 − 5448	PMN J0150 − 5450	-	-	-	bcu	UNCL	-	-
J0151.0 + 0539	PMN J0151 + 0540	-	-	-	bcu	UNCL	-	SDSS inconclusive.
J0151.3 + 8601	WN B0140.0 + 8546	-	0.150	Álvarez Crespo+ (2016)	bll	BLLAC	-	-
J0151.4 − 3607	PMN J0151 − 3605	-	-	-	bcu	UNCL	-	The 3FGL (Ackermann+ 2015) reported $z = 0.681$, but there is no information on the origin of this measurement. No references on optical spectra are available neither on SIMBAD nor on NED.
J0152.2 + 2206	PKS 0149 + 21	-	1.32	Wampler+ (1984)	fsrq	FSRQ	-	SDSS
J0152.2 + 3714	B2 0149 + 37	-	-	-	bcu	UNCL	-	The 3FGL (Ackermann+ 2015) gives $z = 0.761$, but there is no information about the origin of this measurement. No other published papers with any spectroscopic redshift measurement.
J0152.6 + 0147	PMN J0152 + 0146	-	0.080	Laurent-Muehleisen+ (1998)	bll	BLLAC	-	-
J0153.0 + 7517	1RXS J015308.4 + 751756	-	-	-	bll	UNCL	-	-
J0153.5 − 5107	PKS 0152 − 513	-	1.58	Eracleous+Halpern (1994)	fsrq	FSRQ	-	Savage+Bolton (1979) reported $z = 0.44$, but it is not indicated on which basis.
J0153.9 + 0823	GB6 J0154 + 0823	-	0.681	Shaw+ (2013)	bll	BLLAC	-	SDSS inconclusive.
J0154.3 − 0236	TXS 0151 − 028	-	0.0823	Jones+ (2009)	bcu	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0155.0 + 4433	GB6 J0154 + 4433	-	-	-	bll	BLLAC	-	Featureless, Marlow+ (2000) and Shaw+ (2013).
J0155.4 − 0625	PMN J0155 − 0621	-	-	-	bcu	UNCL	-	-
J0156.1 + 1502	RX J0156.0 + 1502	-	-	-	bcu	BLLAC	-	Featureless spectrum. Nass+ (1996) suggested $z = 0.08$ by cross-correlating with a zero-velocity template spectrum. SDSS inconclusive.
J0156.5 + 3914	MG4 J015630 + 3913	VCS3 J0156 + 3914	0.446	Peña-Herazo+ (2021)	bcu	FSRQ	-	LAMOST
J0156.6 − 1758	PMN J0156 − 1800	-	-	-	bcu	UNCL	-	-
J0156.8 − 4744	2MASS J01564603 − 4744174	-	-	-	bll	UNCL	-	-
J0156.9 + 4648	MG4 J015651 + 4648	-	-	-	bcu	UNCL	-	-
J0156.9 − 5301	1RXS J015658.6 − 530208	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0157.7 − 4614	PMN J0157 − 4614	-	2.29	Shaw+ (2012)	fsrq	FSRQ	-	-
J0158.5 − 3932	PMN J0158 − 3932	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013) and Landoni+ (2015).
J0158.8 + 0101	GB6 J0158 + 0101	PMN J0158 + 0101	0.454	Paiano+ (2019)	fsrq	BLLAC	-	SDSS inconclusive.
J0159.3 − 4523	PMN J0159 − 4515	-	-	-	bcu	UNCL	-	-
J0159.5 + 1046	RX J0159.5 + 1047	-	0.195	Shaw+ (2013)	bll	BLLAC	-	-
J0159.7 − 2740	PMN J0159 − 2739	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0200.3 − 4109	1RXS J020021.0 − 410936	-	0.0539	Jones+ (2009)	bcu	BLLAC	-	-
J0200.6 − 6637	PMN J0201 − 6638	-	1.28	Titov+ (2017)	bcu	FSRQ	-	-
J0201.1 + 0036	MS 0158.5 + 0019	-	0.298	Stocke+ (1991)	bll	BLLAC	-	SDSS.
J0201.1 − 4347	GALEXASC J020110.83 − 434654.8	-	-	-	bcu	UNCL	-	-
J0202.4 + 0849	TXS 0159 + 085	-	0.629	Shaw+ (2012)	fsrq	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0202.6 − 0258	WISE J020239.94 − 030207.9	-	1.35	Becker+ (2001)	fsrq	FSRQ	-	SDSS
J0202.7 + 4204	B3 0159 + 418	-	0.94*	Meisner+Romani (2010)	bll	BLLAC	E	-
J0202.9 − 0225	RX J0202.9 − 0223	-	-	-	bcu	UNCL	-	-
J0203.6 + 7233	S5 0159 + 723	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0203.7 + 3042	NVSS J020344 + 304238	-	0.761	SDSS	bll	FSRQ	-	-
J0204.0 − 3334	1RXS J020413.6 − 333345	-	0.617	Piranomonte+ (2007)	bll	BLLAC	-	-
J0204.1 − 2919	PMN J0204 − 2923	-	-	-	bcu	UNCL	-	-
J0204.3 + 2417	B2 0201 + 24	-	-	-	bcu	UNCL	-	-
J0204.8 + 1513	4C +15.05	-	0.405	Perlman+ (1998)	bcu	FSRQ	-	Classified as CSS quasar, An+ (2016), but SPECFIND gives a rather flat spectrum $\alpha \sim -0.1$. The value of redshift was challenged by Jones+ (2018), which referred to Stickel+ (1996). Stickel reported $z = 0.833$ on the basis of two lines identified as [OII] and [NeII]. The same lines were identified by Perlman as Hβ and [OIII], together with other lines in the spectrum (Hα), and Olguín Iglesias+ (2016) supported the Perlman's redshift on the basis of the study of the host galaxy.
J0205.0 − 1700	PKS 0202 − 17	-	1.74	Kinman+ (1967)	fsrq	FSRQ	-	The first value is reported by Kinman+ (1967), who, in turn, referred to a spectrum taken by Arp with 200-inches at Mt Palomar. However, neither data nor values were reported. The value of the redshift was later confirmed by many authors (e.g., 6dF).
J0205.2 + 3212	B2 0202 + 31	-	1.47	Burbidge (1970)	fsrq	FSRQ	-	-
J0206.4 − 1151	PMN J0206 − 1150	-	1.66	Healey+ (2008)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0206.8 − 5744	SUMSS J020640 − 574948	-	-	-	bcu	UNCL	-	-
J0207.4 − 3855	PKS 0205 − 391	-	0.254	Machalski+Condon (1999)	bcu	UNCL	-	The paper reporting the redshift does not explain anything else on the spectral characteristics.
J0207.5 − 1049	PMN J0207 − 1047	-	-	-	bcu	UNCL	-	-
J0207.9 + 2203	NVSS J020801 + 220241	-	-	-	bcu	UNCL	-	SDSS inconclusive.
J0208.3 − 6838	PKS 0206 − 688	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0208.5 − 0046	PKS 0205 − 010	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0208.6 + 3523	MS 0205.7 + 3509	-	0.318	Falomo+ (1997)	bll	BLLAC	E	There was a debate about the redshift, because the early identification with a spiral host galaxy was wrong (first value of z in Stocke+ 1991; BL Lac off center of the spiral host in Stocke+ (1995), spiral in foreground, microlensing suggested). Falomo+ (1997) found a nebulosity coincident with the BL Lac object, which was identified as an elliptical galaxy and confirmed the redshift.
J0209.3 + 4449	1RXS J020917.6 + 444951	-	-	-	bll	BLLAC	-	Featureless, Bauer+ (2000).
J0209.3 − 5228	PMN J0209 − 5229	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0209.9 + 7229	S5 0205 + 722	-	0.895	Vermeulen+ (1996)	bll	FSRQ	-	-
J0210.1 + 2518	GB6 J0210 + 2517	-	-	-	bcu	UNCL	-	-
J0210.5 − 1445	PKS 0207 − 149	-	-	-	bcu	UNCL	-	-
J0210.7 − 5101	PKS 0208 − 512	-	1.00	Wilkes+ (1983)	FSRQ	FSRQ	-	-
J0211.1 − 0646	NVSS J021109 − 064551	-	-	-	bcu	UNCL	-	-
J0211.2 + 1051	MG1 J021114 + 1051	-	0.200*	Meisner+Romani (2010)	BLL	BLLAC	E	-
J0212.2 − 0219	RX J0212.3 − 0222	-	0.169	SDSS	bcu	BLLAC	-	-
J0212.2 − 2559	PMN J0212 − 2558	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0212.4 − 3502	RBS 292	-	0.393	Schwope+ (2000)	bll	BLLAC	-	-
J0212.8 − 2721	PMN J0212 − 2719	-	-	-	bcu	UNCL	-	-
J0212.9 + 2244	MG3 J021252 + 2246	-	0.459	Shaw+ (2013)	bll	BLLAC	-	-
J0213.8 − 6949	2MASS J02135882 − 6951360	-	-	-	bcu	UNCL	-	-
J0214.1 − 4733	2MASS J02140989 − 4732357	-	-	-	bcu	UNCL	-	Grazian+ (2002) identified it as star (therefore the X and γ-ray emission could be due to a XRB), while Arsioli+ (2015) suggest it could be a HBL.
J0214.2 − 7025	PMN J0214 − 7027	-	-	-	bcu	UNCL	-	-
J0214.4 − 5822	PMN J0214 − 5822	-	-	-	bcu	UNCL	-	-
J0214.6 − 4333	1RXS J021439.0 − 433319	-	-	-	bcu	UNCL	-	-
J0214.8 − 6150	PKS 0212 − 620	-	-	-	bcu	UNCL	-	-
J0215.3 + 7555	WN B0210.3 + 7540	-	-	-	bcu	UNCL	-	-
J0215.9 + 0300	PMN J0215 + 0300	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J0216.5 + 2313	RBS 298	-	0.288	Fischer+ (1998)	bll	BLLAC	-	-
J0216.6 − 1015	PMN J0216 − 1017	-	-	-	bcu	UNCL	-	-
J0216.8 + 0510	NVSS J021655 + 051018	-	-	-	bcu	UNCL	-	SDSS inconclusive.
J0216.8 − 6635	RBS 300	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0217.0 − 0821	PKS 0214 − 085	-	0.607	Shaw+ (2012)	fsrq	AMB	-	SDSS spectrum is a bit noisy, with weak and narrow lines suggesting partial covering. Radio spectrum is flat; gamma-ray spectrum is soft. Could be SEY or NLS1.
J0217.2 + 0837	ZS 0214 + 083	-	0.0850	Shaw+ (2013)	bll	BLLAC	-	Gorshkov+Konnikova (1983) earlier suggested a quasar classification and $z = 1.4$, but they themselves recognized it could be a spurious identification given the weakness of the lines.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0217.4 + 7352	S5 0212 + 73	-	2.37	Lawrence+ (1986)	fsrq	FSRQ	-	-
J0217.8 + 0144	PKS 0215 + 015	-	1.72	Foltz+ (1987)	fsrq	CLAGN	-	Early detections suggested a BL Lac identification, with featureless spectrum and many absorption lines due to intervening systems. The first estimate of the redshift was by Blades+ (1985), who identified the Lyα forest. Then, Foltz+ (1987) detected two emission lines (SiIV, CIV), consistent with Blades' estimates. The equivalent width of CIV (18Å) points to a FSRQ classification, but also to a changing-look AGN. The BL Lac-type spectrum was taken when the source was faint, while the FSRQ-type spectrum was observed when the source was bright. This seems to be due to a change in the accretion rate rather than to the jet activity.
J0218.9 + 3643	MG3 J021846 + 3641	-	-	-	bcu	UNCL	-	-
J0218.9 − 2305	PMN J0218 − 2307	-	-	-	bcu	UNCL	-	-
J0219.0 + 2443	87GB 021610.9 + 243205	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J0219.1 − 1724	1RXS J021905.8 − 172503	-	0.128	Wolter+ (1998)	bll	BLLAC	-	-
J0219.5 + 0724	GB6 J0219 + 0727	-	-	-	bll	UNCL	-	SDSS inconclusive.
J0220.2 + 3246	CRATES J022048 + 324106	5C 6.237	1.62	Hook+ (1996)	fsrq	FSRQ	-	There is a typo in the counterpart name in the 4FGL: it is written CRATES J022048+324116, but it should be CRATES J022048+324106 (RA 35.2002 = 02 20 48.05; Dec +32.6851 = 32 41 06.4).
J0220.8 − 0841	RX J0220.8 − 0842	-	0.525	Smith+ (2007)	bll	BLLAC	-	SDSS inconclusive.
J0221.1 + 3556	B2 0218 + 357	B2 0218 + 35	0.96	Yonehara+ (2008)	FSRQ	BLLAC	-	Gravitationally lensed object. Lens at $z = 0.68$. NED erroneously reports this latter value for z.
J0221.2 − 1312	TXS 0218 − 132	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0221.5 + 2513	2MASS J02212698 + 2514338	-	-	-	bcu	UNCL	-	-
J0221.8 + 3730	GB6 J0222 + 3731	-	-	-	bcu	UNCL	-	-
J0222.0 − 1616	PKS 0219 − 164	-	0.698	Wilkes+ (1986)	fsrq	FSRQ	-	-
J0222.6 + 4302	3C 66A	-	0.340	Torres-Zafra+ (2018)	BLL	BLLAC	-	Long-standing debate on the value of z because all the taken spectra are almost featureless. Bu+ (2019) reported a hint of Lyα (2.2 σ with HST/COS) consistent with the expected redshift.
J0223.0 − 3447	PKS 0220 − 349	-	1.49	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J0223.1 − 1117	1RXS J022314.6 − 111741	-	-	-	bll	BLLAC	-	Featureless, Masetti+ (2013). Jones+ (2009) suggested $z = 0.0421$ from 6dF spectrum, but with quality flag 3.
J0223.2 − 1653	PKS 0221 − 171	-	1.01	Titov+ (2011)	fsrq	FSRQ	-	-
J0223.5 + 3912	B3 0220 + 390	-	-	-	bcu	UNCL	-	-
J0223.5 − 0928	PMN J0223 − 0925	-	1.00	SDSS	bcu	FSRQ	-	Warning: noisy spectrum.
J0224.0 − 1850	GALEXASC J022404.29 − 185029.9	NVSS J022404 − 185029	-	-	bcu	UNCL	-	-
J0224.0 − 7941	PMN J0223 − 7940	-	-	-	bll	UNCL	-	-
J0224.2 + 0700	PKS 0221 + 067	-	0.511	White+ (1988)	fsrq	NLS1	-	FWHM(Hβ) = 27Å$\sim$1100 km/s, and strong [OIII], flat radio spectrum, soft gamma-ray spectrum.
J0224.2 + 1616	NVSS J022411 + 161500	-	-	-	bcu	UNCL	-	-
J0224.9 + 1843	TXS 0222 + 185	-	2.69	Schwope+ (2000)	fsrq	FSRQ	-	-
J0225.1 − 2604	PMN J0225 − 2603	-	-	-	bcu	UNCL	-	-
J0225.6 − 4502	PMN J0225 − 4503	-	-	-	bcu	UNCL	-	-
J0225.8 + 1310	NVSS J022551 + 131046	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0226.3 − 1845	PKS 0224 − 189	-	1.68	Titov+ (2017)	bcu	FSRQ	-	Warning: SIMBAD coordinates are wrong.
J0226.5 + 0938	NVSS J022634 + 093843	-	-	-	fsrq	UNCL	-	-
J0226.5 − 4441	RBS 318	-	-	-	bll	BLLAC	-	Featureless, (Jones+ 2009).
J0226.6 − 0553	PMN J0226 − 0552	-	-	-	bcu	UNCL	-	-
J0226.7 + 2312	GB6 J0226 + 2311	-	-	-	bcu	UNCL	-	-
J0227.2 + 3928	B2 0224 + 39	-	1.57	Vigotti+ (1997)	fsrq	FSRQ	-	-
J0227.3 + 0201	RX J0227.2 + 0201	-	0.457	Sbarufatti+ (2005)	bll	BLLAC	-	-
J0227.8 + 2246	NVSS J022744 + 224834	-	-	-	bcu	UNCL	-	-
J0228.0 − 3026	PKS 0225 − 306	-	0.303	Croom+ (2004)	fsrq	FSRQ	-	-
J0228.1 + 8208	WN B0220.3 + 8153	-	-	-	bcu	UNCL	-	-
J0228.2 − 3102	PMN J0228 − 3102	-	-	-	bcu	UNCL	-	-
J0228.3 − 5547	PKS 0226 − 559	-	2.46	Healey+ (2008)	fsrq	FSRQ	-	-
J0228.5 − 2234	NVSS J022832 − 223350	-	-	-	bcu	UNCL	-	-
J0229.5 − 3644	PKS 0227 − 369	-	2.11	Hook+ (2003)	fsrq	FSRQ	-	-
J0230.8 + 4032	B3 0227 + 403	-	1.02	Henstock+ (1997)	fsrq	FSRQ	-	-
J0231.2 − 4745	PMN J0231 − 4746	-	0.765	Healey+ (2008)	fsrq	FSRQ	-	-
J0231.2 − 5754	PKS 0229 − 581	-	0.0320	Fairall (1980)	bll	BLLAC	SB	Host galaxy with inner ring (Buta 1995).
J0231.8 + 1322	4C +13.14	-	2.06	Schmidt (1968)	fsrq	FSRQ	-	-
J0232.5 − 1118	PMN J0232 − 1120	-	-	-	bcu	BLLAC	-	Jones+ (2009) reported $z = 0.209$ from a spectrum of the 6dF, but with quality flag 3.
J0232.8 + 2018	1ES 0229 + 200	-	0.140	Schachter+ (1993)	bll	BLLAC	-	-
J0232.9 + 2608	B2 0230 + 25	-	-	-	bll	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0233.0 + 3740	NVSS J023308 + 374201	-	-	-	bcu	UNCL	-	-
J0233.5 + 0654	TXS 0230 + 067	-	-	-	bcu	UNCL	-	-
J0233.9 + 8041	1RXS J023428.6 + 804341	-	-	-	bcu	UNCL	-	-
J0234.3 − 0628	SDSS J023410.30 − 062825.7	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2019). SDSS inconclusive.
J0235.6 − 2939	PHL 1389	-	-	-	bll	UNCL	-	Croom+ (2004) found $z = 0$ (quality flag 11) and Kilkenny+ (2016) classified it as B/sdB star (hence the γ-ray emission could be due to a XRB with a neutron star?). Arsioli+ (2015) suggest it could be a BL Lac object with $z > 0.66$.
J0236.8 − 6136	PKS 0235 − 618	-	0.465	Healey+ (2008)	fsrq	FSRQ	-	-
J0237.6 + 0923	OD 58	-	-	-	bcu	UNCL	-	-
J0237.6 − 3602	RBS 334	-	0.411	Pita+ (2014)	bll	BLLAC	-	-
J0237.7 + 0206	PKS 0235 + 017	NGC 1004	0.0216	Huchra+ (1983)	rdg	MIS	E	Steep radio spectrum. Condon+ (2002) reported "very extended bent-tail radio source". Warning: there is some confusion in the ADS entry for the Huchra's reference paper: it is titled "X-ray spectra of Active Galactic Nuclei", but the PDF is the correct paper ("A survey of galaxy redshifts. IV. The data").
J0237.8 + 2848	4C +28.07	-	1.21	Shaw+ (2012)	FSRQ	FSRQ	-	The first reported measurement of the redshift seems to be Baldwin+ (1978), but I cannot find the pdf on the web to confirm it.
J0238.1 − 3905	1RXS J023800.5 − 390505	-	-	-	bll	UNCL	-	The 3FGL (Ackermann+ 2015) reported $z = 0.2$, but without any reference or information on the origin of this measurement.
J0238.2 + 1531	CRATES J023819 + 153323	NVSS J023819 + 153321	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0238.4 − 3116	1RXS J023832.6 − 311658	-	0.232	Shaw+ (2013)	bll	BLLAC	-	-
J0238.6 + 1637	PKS 0235 + 164	AO 0235 + 164	0.940	Cohen+ (1987)	BLL	BLLAC	-	-
J0239.5 + 1326	GB6 J0239 + 1327	-	-	-	bcu	UNCL	-	-
J0239.5 − 1353	CRATES J023939.13 − 135409.6	-	-	-	bcu	UNCL	-	-
J0239.7 + 0415	PKS 0237 + 040	-	0.976	Schmidt (1977)	fsrq	FSRQ	-	SDSS
J0240.8 − 3401	NVSS J024047 − 340018	-	-	-	bcu	UNCL	-	-
J0241.0 − 0505	PKS 0238 − 052	-	-	-	bll	UNCL	-	-
J0241.9 − 1603	1RXS J024151.6 − 160339	-	-	-	bcu	UNCL	-	-
J0242.3 + 1102	OD 166	-	2.68	Afanas'ev+ (2005)	fsrq	FSRQ	-	-
J0242.6 + 1735	NVSS J024248 + 173700	-	-	-	bcu	UNCL	-	-
J0242.9 + 0045	FIRST J024302.9 + 004627	-	0.409	Becker+ (2001)	bll	BLLAC	-	SDSS
J0243.2 − 0550	PKS 0240 − 060	-	1.80	Baldwin+ (1981)	fsrq	FSRQ	-	-
J0243.4 + 7119	S5 0238 + 711	-	-	-	bll	BLLAC	-	Featureless, (Paiano+ 2017).
J0243.7 + 0321	PKS 0241 + 031	-	-	-	bcu	UNCL	-	-
J0244.6 − 5819	RBS 351	-	0.265	Schwope+ (2000)	bll	BLLAC	-	-
J0244.7 + 1316	GB6 J0244 + 1320	-	-	-	bcu	UNCL	-	-
J0245.1 − 0257	PMN J0245 − 0255	-	-	-	bll	UNCL	-	SDSS inconclusive. Kepler+ (2015) classified it as white dwarf.
J0245.4 + 2408	B2 0242 + 23	-	2.25	Shaw+ (2012)	fsrq	FSRQ	-	-
J0245.4 − 5950	PMN J0244 − 5948	-	-	-	bcu	UNCL	-	-
J0245.5 − 4502	PKS 0244 − 452	-	0.283	Maza+ (1995)	fsrq	FSRQ	-	6dF
J0245.9 − 4650	PKS 0244 − 470	-	1.38	Mahony+ (2011)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0246.6 − 3348	TXS 0244 − 340	-	-	-	bcu	UNCL	-	-
J0248.0 + 2232	1RXS J024800.1 + 223136	-	-	-	bcu	UNCL	-	-
J0250.2 − 8224	PMN J0251 − 8226	-	-	-	bcu	UNCL	-	-
J0250.6 + 1712	RGB J0250 + 172	-	0.243	Archambault+ (2016)	bll	BLLAC	-	-
J0250.6 + 8435	WN B0239.6 + 8423	-	-	-	bcu	UNCL	-	-
J0251.5 − 5958	PKS 0250 − 602	-	1.37	Healey+ (2008)	fsrq	FSRQ	-	-
J0252.8 − 2219	PKS 0250 − 225	-	1.43	Healey+ (2008)	fsrq	FSRQ	-	-
J0252.9 + 3834	B2 0249 + 38	-	1.12	Henstock+ (1997)	fsrq	FSRQ	-	-
J0253.2 − 0124	FBQS J0253 − 0124	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0253.2 − 5441	PKS 0252 − 549	-	0.537	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0253.5 + 3216	MG3 J025334 + 3217	-	0.859	Ricci+ (2015)	fsrq	FSRQ	-	-
J0255.8 + 0534	PMN J0255 + 0533	-	-	-	bll	UNCL	-	SDSS inconclusive.
J0256.3 + 0334	PKS B0253 + 033	-	-	-	bll	UNCL	-	-
J0257.0 + 3358	GB6 J0257 + 3357	-	-	-	bcu	UNCL	-	-
J0257.9 − 1215	PMN J0257 − 1211	-	1.39	Shaw+ (2012)	fsrq	FSRQ	-	-
J0258.1 + 2030	MG3 J025805 + 2029	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0259.4 + 0308	1RXS J025923.7 + 030736	-	-	-	bcu	UNCL	-	-
J0259.4 + 0746	PKS 0256 + 075	-	0.893	Stickel+ (1989)	fsrq	FSRQ	-	-
J0259.5 + 1924	TXS 0256 + 192	-	0.545	Caccianiga+ (2000)	fsrq	FSRQ	-	-
J0259.5 − 1705	NVSS J025933 − 170540	-	-	-	bcu	UNCL	-	-
J0301.0 − 1652	PMN J0301 − 1652	-	-	-	bcu	BLLAC	-	Featureless, Titov+ (2017).
J0301.4 − 3124	PKS 0259 − 316	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0301.6 − 7155	PKS 0301 − 721	-	0.823	Titov+ (2013)	fsrq	FSRQ	-	-
J0301.9 − 2731	NVSS J030158 − 272754	-	-	-	bcu	UNCL	-	-
J0303.2 + 3149	B2 0259 + 31	-	-	-	bcu	UNCL	-	-
J0303.3 + 0555	GB6 J0303 + 0554	-	0.196	Fischer+ (1998)	bll	BLLAC	-	-
J0303.3 − 7913	PMN J0303 − 7914	-	1.11	Healey+ (2008)	fsrq	FSRQ	-	-
J0303.4 − 2407	PKS 0301 − 243	-	0.263	Pesce+ (1995)	BLL	BLLAC	-	-
J0303.4 − 5232	AT20G J030328 − 523433	-	-	-	bcu	UNCL	-	-
J0303.6 − 6211	PKS 0302 − 623	-	1.35	Healey+ (2008)	fsrq	FSRQ	-	-
J0304.4 − 2833	RBS 385	-	-	-	bll	BLLAC	-	Featureless, Arsioli+ (2015).
J0304.5 + 3349	4C +33.06	-	-	-	bcu	UNCL	-	-
J0304.5 − 0054	RX J0304.5 − 0054	-	0.511	SDSS	bll	BLLAC	-	Brinkmann+ (2000) reported $z = 0.33$, but there is neither the spectrum nor any explanation on how this value was obtained.
J0304.9 − 0606	PMN J0304 − 0608	-	-	-	bll	UNCL	-	-
J0305.1 − 1608	PKS 0302 − 16	-	0.312	Paiano+ (2017)	bll	BLLAC	-	-
J0307.8 − 0419	LEDA 095522	-	0.0289	Wegner+ (1999)	bcu	BLLAC	E	In cluster.
J0308.1 − 2852	2MASS J03081686 − 2851054	-	-	-	bcu	UNCL	-	-
J0308.4 + 0407	NGC 1218	-	0.0286	Schmidt (1965)	rdg	MIS	S0	Classified as LERG, FRI by Balmaverde+ (2021).
J0309.0 + 1029	PKS 0306 + 102	-	0.863	Veron (1994)	fsrq	FSRQ	-	-
J0309.4 − 4000	PKS 0307 − 402	-	-	-	bcu	UNCL	-	-
J0309.7 − 0745	NVSS J030943 − 074427	-	-	-	bll	BLLAC	-	Featureless, Massaro+ (2015).
J0309.9 − 6058	PKS 0308 − 611	-	1.48	Healey+ (2008)	fsrq	FSRQ	-	-
J0310.6 − 5017	1RXS J031036.0 − 501615	-	-	-	bll	UNCL	-	-
J0310.8 − 1041	PMN J0310 − 1037	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0310.9 + 3815	B3 0307 + 380	-	0.816	Vermeulen+Taylor (1995)	fsrq	SEY	-	Redshift confirmed by SDSS. Intermediate Seyfert, Hβ narrow (FWHM= 15Å$\sim$510 km/s), flat radio spectrum, soft gamma-ray spectrum. There is an error in the Vizier version of Shaw+ (2012): the coordinates of B3 0307 + 380 are associated to the 1FGL J0342.2 + 3859.
J0311.5 − 4402	GALEXASC J031103.24 − 440227.8	-	-	-	bcu	UNCL	-	-
J0311.6 + 4134	B3 0308 + 413	-	-	-	bcu	UNCL	-	-
J0312.5 − 2221	NVSS J031235 − 222118	-	-	-	bll	UNCL	-	-
J0312.8 + 0134	PKS 0310 + 013	-	0.664	Strittmatter+ (1974)	fsrq	FSRQ	-	-
J0312.9 + 3614	V Zw 326	-	0.0715	Sargent (1970)	bll	BLLAC	-	-
J0312.9 + 4119	B3 0309 + 411B	S4 0309 + 41	0.134	de Bruyn (1989)	rdg	MIS	-	Broad-Line Radio Galaxy, FRII (de Bruyn 1989).
J0313.0 + 0229	TXS 0310 + 022	-	0.994	Pursimo+ (2013)	bcu	FSRQ	-	-
J0314.3 + 0620	NVSS J031423 + 061955	-	-	-	bll	BLLAC	-	Arsioli+ (2015) classified it as BL Lac Object with $z = 0.62$ with an uncertainty flag, but there is no information about this flag.
J0314.3 − 5103	PMN J0314 − 5104	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0314.6 − 6549	PKS 0313 − 660	-	0.636	Perlman+ (1998)	fsrq	FSRQ	-	-
J0315.9 − 1033	PKS 0313 − 107	-	1.57	Shaw+ (2012)	fsrq	FSRQ	-	-
J0316.0 − 5626	1RXS J031613.4 − 562545	-	-	-	bcu	UNCL	-	-
J0316.2 + 0905	GB6 J0316 + 0904	-	0.372*	Stadnik+Romani (2014)	bll	BLLAC	-	-
J0316.2 − 2608	RBS 405	-	0.443	Sbarufatti+ (2005)	bll	BLLAC	-	-
J0316.2 − 6437	SUMSS J031614 − 643732	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0316.8 + 4120	IC 310	-	0.0190	Arp (1968)	RDG	MIS	SA0	SDSS. Seyfert 1. Large viewing angle, Homan+ (2021, subm). Detailed classification in Gendron-Marsolais+ (2020)
J0316.9 − 0625	PMN J0317 − 0623	-	-	-	bcu	UNCL	-	-
J0317.7 − 2804	PKS 0315 − 282	-	1.17	Kapahi+ (1998)	fsrq	FSRQ	-	Kapahi+ (1998) also classified it as CSS on the basis of radio observations ($\alpha \sim 0.52$), but the radio spectral index according to `specfind` is ∼0.45. Borderline object. 2dF spectrum.
J0317.8 − 4414	PKS 0316 − 444	-	0.0760	Melnick+Quintana (1981)	bcu	MIS	S0	In cluster. Takizawa+ (2003) suggest it could be similar to M87 on the basis of X-ray observations with *Chandra*. Steep radio spectrum.
J0318.7 + 2135	MG3 J031849 + 2135	-	-	-	bll	UNCL	-	-
J0319.4 − 7045	MRSS 054 − 102986	-	-	-	bcu	UNCL	-	-
J0319.8 + 1845	1E 0317.0 + 1835	-	0.190	Gioia+ (1984)	bll	BLLAC	-	-
J0319.8 + 4130	NGC 1275	-	0.0176	Humason (1932)	RDG	MIS	cD	Classified as FRI by Fanaroff+Riley (1974)
J0320.6 + 1125	1RXS J032037.9 + 112503	-	-	-	bcu	UNCL	-	-
J0321.3 + 0425	NVSS J032130 + 042628	-	-	-	bcu	UNCL	-	-
J0321.3 − 1612	PMN J0321 − 1612	-	-	-	bll	UNCL	-	-
J0322.0 + 2335	MG3 J032201 + 2336	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0322.9 + 0940	MG1 J032256 + 0941	-	-	-	bcu	UNCL	-	-
J0323.7 − 0111	1RXS J032342.6 − 011131	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0324.3 − 1313	NVSS J032430 − 131002	-	-	-	bcu	UNCL	-	-
J0324.8 + 3412	1H 0323 + 342	-	0.063	Zhou+ (2007)	nlsy1	NLS1	Sb	-
J0325.0 − 2416	PKS 0323 − 244	-	1.16	Hook+ (2003)	fsrq	FSRQ	-	-
J0325.3 + 3332	2MASX J03251760 + 3332435	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0325.5 − 5635	1RXS J032521.8 − 563543	-	0.0610	Grazian+ (2002)	bll	BLLAC	-	-
J0325.6 − 1646	RBS 421	-	0.291	Schwope+ (2000)	bll	BLLAC	-	-
J0325.7 + 2225	TXS 0322 + 222	-	2.06	Halpern+ (2003)	fsrq	FSRQ	-	-
J0325.9 − 1843	PMN J0325 − 1843	-	-	-	bcu	UNCL	-	-
J0326.2 + 0225	1H 0323 + 022	-	0.147	Filippenko+ (1986)	bll	BLLAC	-	-
J0326.7 − 3404	NVSS J032644 − 340330	-	-	-	bcu	UNCL	-	-
J0327.5 − 1805	CRATES J032743.34 − 180342.0	ICRF J032743.3 − 180342	0.730	Titov+ (2017)	bcu	FSRQ	-	-
J0328.8 − 5715	WISEA J032852.69 − 571605.5	-	-	-	bll	UNCL	-	-
J0330.6 + 0438	GB6 J0330 + 0439	-	-	-	bcu	UNCL	-	-
J0331.1 − 5243	PGC 013066	-	0.0666	Lucey+ (1983)	bcu	MIS	E	FR0 according to Glowacki+ (2017).
J0331.3 − 6156	PMN J0331 − 6155	-	-	-	bll	UNCL	-	-
J0331.8 − 7040	SUMSS J033202 − 703952	-	-	-	bcu	UNCL	-	-
J0332.1 − 1123	1RXS J033223.2 − 111938	-	0.207	Álvarez Crespo+ (2016)	fsrq	FSRQ	-	-
J0332.8 + 1557	GB6 J0332 + 1556	-	-	-	bcu	UNCL	-	-
J0333.1 + 8227	1RXS J033208.6 + 822654	-	-	-	bcu	UNCL	-	-
J0333.3 + 0233	NVSS J033321 + 023110	-	-	-	bcu	UNCL	-	-
J0333.7 + 2916	TXS 0330 + 291	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J0333.7 + 7851	WN B0326.7 + 7840	-	-	-	bll	UNCL	-	-
J0333.8 + 4007	B3 0330 + 399	-	-	-	bcu	UNCL	-	-
J0334.2 − 3725	PMN J0334 − 3725	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0334.2 − 4008	PKS 0332 − 403	-	1.36	Shaw+ (2013)	bll	BLLAC	-	The first value of $z = 1.445$ is reported by Barbieri+ (1975), referring to Burbidge+Strittmatter (1972), which, in turn, does not contain the source. The origin of that value of z cannot be found. Landoni+ (2015) found a featureless spectrum, likely due to a high activity of the jet.
J0334.3 + 3920	4C +39.12	-	0.0206	Peterson (1979)	rdg	MIS	E	Low-Power Compact radio galaxy (FR0?) according to Giovannini+ (2001).
J0335.1 − 4459	SUMSS J033513 − 445939	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0336.4 + 3224	NRAO 140	-	1.26	Kristian+Sandage (1970)	fsrq	FSRQ	-	-
J0336.5 − 0348	1RXS J033623.3 − 034727	-	0.160	Bauer+ (2000)	bll	BLLAC	-	-
J0336.8 − 3612	PKS 0335 − 364	-	1.54	Cristiani+Koehler (1987)	fsrq	FSRQ	-	-
J0337.8 − 1157	PKS 0335 − 122	-	3.45	Chu+ (1986)	fsrq	FSRQ	-	-
J0338.1 − 2443	2E 0336.0 − 2453	-	0.251	Halpern+ (1997)	bll	BLLAC	-	-
J0338.5 + 1302	RX J0338.4 + 1302	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017).
J0338.7 − 5706	1RXS J033832.0 − 570449	-	-	-	bcu	BLLAC	-	Featureless, Schwope+ (2000).
J0339.2 − 1736	PKS 0336 − 177	-	0.0656	Bauer+ (2000)	bll	MIS	S0	FR0 according to Glowacki+ (2017).
J0339.5 − 0146	PKS 0336 − 01	-	0.852	Bolton+Wall (1970)	fsrq	FSRQ	-	-
J0340.4 − 2422	NVSS J034022 − 242411	-	-	-	bcu	UNCL	-	-
J0340.5 − 0256	TXS 0338 − 030	-	-	-	bcu	UNCL	-	-
J0340.5 − 2118	PKS 0338 − 214	-	0.223	Sbarufatti+ (2005)	bll	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0342.2 + 3858	GB6 J0342 + 3858	-	-	-	fsrq	UNCL	-	Massaro+ (2009) classified it as FSRQ with $z = 0.945$, but there is no indication about the origin of that redshift. In the fifth edition, the classification changed to blazar of uncertain type, although the value of redshift is still there.
J0342.8 − 3007	PKS 0340 − 302	-	-	-	bcu	UNCL	-	-
J0343.2 − 2529	PKS 0341 − 256	-	1.42	Hook+ (2003)	fsrq	FSRQ	-	-
J0343.2 − 6444	PMN J0343 − 6442	-	-	-	bll	UNCL	-	-
J0343.4 + 3621	OE 367	-	1.48	Vermeulen+Taylor (1995)	fsrq	FSRQ	-	-
J0344.2 + 3203*c*	1RXS J034418.2 + 320903	-	-	-	bcu	UNCL	-	The young stellar cluster IC 348 is 3′ distant from the ROSAT counterpart (Preibisch+Zinnecker 2004). The letter c in the 4FGL name indicates an interstellar clump.
J0344.4 + 3432	1RXS J034424.5 + 343016	-	-	-	bcu	UNCL	-	-
J0345.2 − 2353	NVSS J034518 − 235218	-	-	-	bll	UNCL	-	Jones+ (2009) reported $z = 0.104$, but with quality flag 3.
J0345.5 − 3301	PKS 0343 − 330	-	-	-	bcu	UNCL	-	-
J0347.7 − 3616	PKS 0346 − 364	-	-	-	bcu	UNCL	-	Fornax cluster, $z = 0.0046$? MIS? (Robertson+Roach 1990).
J0348.5 − 2749	PKS 0346 − 27	-	0.991	White+ (1988)	fsrq	FSRQ	-	-
J0348.6 − 1609	PKS 0346 − 163	-	0.39*	Meisner+Romani (2010)	bll	BLLAC	-	-
J0348.8 − 0828	AT20G J034845 − 082422	-	-	-	bcu	UNCL	-	-
J0348.9 − 4859	PKS 0347 − 491	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0349.4 − 1159	1ES 0347 − 121	-	0.185	Schachter+ (1993)	bll	BLLAC	-	There is another value of $z = 0.0321$ from a 6dF spectrum showing prominent emission lines identified as the Hβ/[OIII] complex (Jones+ 2009, quality factor 4). Sbarufatti+ (2005) found an agreement between their imaging redshift and the Schachter's one. Therefore, the 6dF spectrum seems somehow wrong. The SEDs published by several authors display the typical characteristics of a BL Lac object, which are inconsistent with the strong emission lines in the 6dF spectrum.
J0349.6 + 2410	TXS 0346 + 241	-	-	-	bcu	UNCL	-	-
J0349.8 − 2103	PKS 0347 − 211	-	2.944	Ellison+ (2001)	fsrq	FSRQ	-	-
J0350.0 + 0640	NVSS J034957 + 064126	-	-	-	bcu	UNCL	-	-
J0350.4 − 5144	1RXS J035037.0 − 514457	-	-	-	bcu	UNCL	-	-
J0350.6 − 3226	PKS 0348 − 326	-	0.927	Hook+ (2003)	bcu	FSRQ	-	-
J0350.8 − 2814	GALEXASC J035051.31 − 281633.0	-	-	-	bcu	UNCL	-	-
J0352.0 − 2516	TXS 0350 − 253	-	-	-	bcu	UNCL	-	-
J0352.9 − 3623	XRS J0353 − 3623	-	-	-	bll	BLLAC	-	Featureless, Falomo+Ulrich (2000) estimated $z = 0.4$ from the photometry of the host galaxy.
J0353.0 − 6831	PKS 0352 − 686	-	0.087	Masetti+ (2006)	bll	MIS	-	Classified as FR0 by Glowacki+ (2017) (z wrong in that paper).
J0353.7 + 8257	WN B0343.1 + 8247	-	0.0694	Bauer+ (2000)	bll	BLLAC	-	Marchesi+ (2018) reported a featureless spectrum, likely due to a change in the jet activity.
J0354.7 + 8009	S5 0346 + 80	-	-	-	bll	BLLAC	-	Henstock+ (1997) published a noisy and inconclusive spectrum with weak lines. Likely a BL Lac Object.
J0354.7 − 1617	PKS 0352 − 164	-	1.19	Jauncey+ (1984)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0355.3 + 3909	CRATES J035515 + 390907	NVSS J035516 + 390910	-	-	bcu	UNCL	-	-
J0356.1 − 1329	NVSS J035611 − 132908	-	-	-	bcu	UNCL	-	-
J0357.0 − 4955	PKS 0355 − 500	-	0.643	Shaw+ (2013)	bll	BLLAC	-	-
J0357.2 + 2320	MG3 J035721 + 2319	QSO J0357 + 2319	-	-	bcu	UNCL	-	Massaro+ (2015) reported $z = 1.484$, but with an uncertainty flag and no indication of the origin. Dallacasa+ (2000) classified it as GPS/HFP.
J0357.2 − 0319	2MASS J03572609 − 0317596	-	-	-	bcu	UNCL	-	-
J0357.6 − 4625	PKS 0355 − 465	-	-	-	bcu	UNCL	-	NED gives $z = 0.09996$ from the 6dF DR1 (Jones+ 2004), but the data base is no longer available. The source is no longer present in the 6dF DR3 (Jones+ 2009).
J0358.0 − 6946	PMN J0357 − 6948	-	-	-	bcu	UNCL	-	-
J0358.1 − 5954	AT20G J035814 − 595233	-	-	-	bll	UNCL	-	-
J0358.6 + 0634	PMN J0358 + 0629	-	-	-	bcu	UNCL	-	-
J0358.7 + 7649	WN B0351.8 + 7640	-	-	-	bcu	UNCL	-	-
J0359.0 − 3053	NVSS J035856 − 305446	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2013). Arsioli+ (2015) gives $z = 0.650$, but with a uncertainty flag. No indication of the origin of this value.
J0359.4 − 2616	PKS 0357 − 264	-	-	-	bll	BLLAC	-	Drinkwater+ (1997) reported $z = 1.47$, but the published spectrum is almost featureless, and there is no indication on which lines the value of z is based. Hook+ (2003) reported another featureless spectrum, and challenged the Drinkwater's measurement.
J0400.7 + 3920	GB6 J0400 + 3921	-	-	-	bcu	UNCL	-	-
J0401.0 − 5353	1RXS J040111.9 − 535456	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0401.3 + 0412	MG1 J040119 + 0412	PMN J0401 + 0413	0.306	Sowards-Emmerd+ (2005)	bcu	BLLAC	E	-
J0401.7 + 2112	TXS 0358 + 210	-	0.834	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	-
J0401.9 − 2034	PMN J0401 − 2034	-	-	-	bcu	UNCL	-	-
J0402.0 + 2737	87GB 035856.9 + 272842	-	-	-	bcu	UNCL	-	-
J0402.0 − 2616	PKS 0359 − 264	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0402.1 − 3147	PKS 0400 − 319	-	1.29	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J0403.3 + 2601	OF 200	-	2.11	Schmidt (1977)	fsrq	FSRQ	-	-
J0403.5 − 2437	TXS 0401 − 248	-	0.598	Healey+ (2008)	bll	FSRQ	-	-
J0403.9 − 3605	PKS 0402 − 362	-	1.42	Surdej+Swings (1981)	FSRQ	FSRQ	-	-
J0404.1 − 1715	PMN J0404 − 1718	-	-	-	bcu	UNCL	-	-
J0404.3 − 1559	PMN J0404 − 1559	-	-	-	bcu	UNCL	-	-
J0405.6 − 1308	PKS 0403 − 13	-	0.571	Lynds (1967)	fsrq	FSRQ	-	-
J0406.0 − 5407	SUMSS J040608 − 540445	-	-	-	bcu	UNCL	-	-
J0407.0 − 3826	PKS 0405 − 385	-	1.28	Veron+ (1990)	fsrq	FSRQ	-	-
J0407.5 + 0741	TXS 0404 + 075	-	1.13	Sowards-Emmerd+ (2003)	bll	FSRQ	-	Reclassified as FSRQ by Shaw+ (2012).
J0409.4 + 3201	NVSS J040928 + 320245	-	-	-	bcu	UNCL	-	-
J0409.8 − 0359	NVSS J040946 − 040003	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017).
J0411.7 + 3041	GB6 J0411 + 3040	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0412.3 + 0239	PKS 0409 + 025	-	-	-	bcu	UNCL	-	-
J0413.1 − 5332	PMN J0413 − 5332	-	1.02	Shaw+ (2012)	fsrq	FSRQ	-	-
J0414.6 − 0842	NVSS J041433 − 084206	-	-	-	bcu	BLLAC	-	Featureless, Paiano+ (2019).
J0414.8 − 5338	RBS 526	-	-	-	bcu	BLLAC	-	Featureless, Schwope+ (2000).
J0415.2 − 5741	1RXS J041505.7 − 574237	-	-	-	bcu	UNCL	-	-
J0416.0 − 4743	PMN J0415 − 4737	-	-	-	bcu	UNCL	-	-
J0416.0 − 6628	PMN J0416 − 6629	-	-	-	bcu	UNCL	-	-
J0416.2 − 4353	SUMSS J041613 − 435057	-	-	-	fsrq	UNCL	-	-
J0416.5 − 1852	PKS 0414 − 189	-	1.54	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0416.9 + 0105	1ES 0414 + 009	-	0.287	Halpern+ (1991)	bll	BLLAC	-	-
J0418.1 − 0252	PKS B0415 − 029	-	-	-	bcu	UNCL	-	-
J0418.4 + 3414	GB6 J0418 + 3411	-	-	-	bcu	UNCL	-	-
J0420.0 + 0805	PMN J0419 + 0804	-	-	-	bcu	UNCL	-	-
J0420.3 − 3745	NVSS J042025 − 374443	-	-	-	bcu	UNCL	-	-
J0420.3 − 6016	1RXS J042012.8 − 601446	-	-	-	bcu	UNCL	-	-
J0421.0 − 0752	PKS 0418 − 079	-	-	-	bcu	UNCL	-	-
J0422.1 − 0644	PMN J0422 − 0643	-	0.242	Shaw+ (2012)	fsrq	FSRQ	-	Shaw+ (2012) measured FWHM(Hβ) = 2500 $\pm$ 800 km/s: candidate NLS1?
J0422.3 + 1951	MS 0419.3 + 1943	-	0.512	Stocke+ (1991)	bll	BLLAC	-	-
J0422.8 + 0225	PKS 0420 + 022	-	2.28	Hook+ (2003)	fsrq	FSRQ	-	-
J0423.1 + 2106	TXS 0420 + 210	-	-	-	bcu	UNCL	-	-
J0423.3 − 0120	PKS 0420 − 01	-	0.915	Bolton+ (1970)	FSRQ	FSRQ	-	-
J0424.7 + 0036	PKS 0422 + 00	-	0.268	Shaw+ (2013)	bll	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0424.9 − 5331	PMN J0425 − 5331	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015). The 3LAC indicated $z = 0.39$, but it seems to be the lower limit suggested by Shaw+ (2013), yet on the basis of a featureless spectrum.
J0426.7 + 6826	4C +68.05	-	-	-	bcu	UNCL	-	-
J0427.3 − 3900	PMN J0427 − 3900	-	-	-	bcu	UNCL	-	-
J0428.6 − 3756	PKS 0426 − 380	-	1.11	Heidt+ (2004)	bll	BLLAC	-	-
J0428.7 − 5003	PMN J0428 − 5005	-	-	-	bcu	UNCL	-	-
J0429.0 − 0006	TXS 0426 − 002	-	-	-	bcu	UNCL	-	-
J0429.3 − 3238	NVSS J042900 − 323638	RBS 545	-	-	bll	BLLAC	-	Featureless, Arsioli+ (2015).
J0429.3 − 4326	PKS 0427 − 435	-	1.42	Hook+ (2003)	fsrq	FSRQ	-	-
J0429.8 + 2843	MG2 J042948 + 2843	NVSS J042950 + 284252	-	-	bcu	UNCL	-	-
J0429.9 − 3101	MRSS 421 − 156568	NVSS J042958 − 305933	-	-	bcu	UNCL	-	-
J0430.2 − 0356	PMN J0431 − 0406	-	0.623	Titov+ (2013)	bcu	FSRQ	-	-
J0430.3 + 1654	MG1 J043022 + 1655	-	-	-	bcu	UNCL	-	-
J0430.3 − 2507	PMN J0430 − 2507	-	0.516	Shaw+ (2012)	bll	BLLAC	-	-
J0431.8 + 7403	GB6 J0431 + 7403	-	-	-	bll	BLLAC	-	Featureless, Marchesi+ (2018).
J0432.0 + 1732	TXS 0429 + 174	-	-	-	bcu	BLLAC	-	Landt+ (2004, 2008) reported a featureless spectrum with a tentative $z = 0.143$ based on absorption features (it would be a lower limit).
J0433.0 + 0522	3C 120	-	0.0336	Arp (1968)	RDG	MIS	S0	BLRG, Sy1, FRI, Walker+ (1987)
J0433.1 + 3227	NVSS J043307 + 322840	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0433.5 − 1039	1RXS J043333.5 − 104220	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0433.6 + 2905	MG2 J043337 + 2905	IVS B0430 + 289	-	-	bll	BLLAC	-	Many authors reported a featureless spectrum. However, Massaro+ (2009) gave $z = 0.97$ with a uncertain flag and without information on the origin of this value. Paiano+ (2020) found a doubtful emission feature, which could be MgII (hence, $z = 0.91$).
J0433.6 − 6030	PKS 0432 − 606	-	0.930	Titov+ (2013)	fsrq	FSRQ	-	-
J0433.7 − 5725	SUMSS J043344 − 572613	-	-	-	bcu	UNCL	-	-
J0434.1 − 2014	TXS 0431 − 203	-	0.928	Shaw+ (2013)	bll	BLLAC	-	-
J0434.4 − 2342	PMN J0434 − 2342	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0434.7 + 0922	TXS 0431 + 092	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0435.4 − 2623	1RXS J043518.7 − 262120	-	-	-	bcu	UNCL	-	-
J0436.7 − 7148	PKS 0437 − 719	-	-	-	bcu	UNCL	-	-
J0436.8 − 5223	AT20G J043652 − 521639	-	-	-	bcu	UNCL	-	-
J0437.2 − 5846	PKS 0435 − 587	-	-	-	bcu	UNCL	-	-
J0437.4 − 6155	PMN J0437 − 6157	-	-	-	bcu	UNCL	-	-
J0438.4 − 1254	PKS 0436 − 129	-	1.28	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0438.7 − 3441	SUMSS J043612 − 342230	-	-	-	bcu	UNCL	-	-
J0438.9 − 4521	PKS 0437 − 454	-	2.02	Shaw+ (2013)	bll	BLLAC	-	One of the farthest BL Lac Objects.
J0439.2 + 2151	IERS B0435 + 217	-	-	-	bcu	UNCL	-	-
J0439.4 − 3202	1RXS J043931.4 − 320045	-	-	-	bcu	UNCL	-	-
J0439.8 − 1859	1SXPS J043949.5 − 190102	-	-	-	bll	UNCL	-	-
J0440.2 − 2458	RBS 570	-	-	-	bll	BLLAC	-	Schwope+ (2000) set $z = 0.6$, but with uncertain flag.
J0440.3 − 4333	PKS 0438 − 43	-	2.85	Morton+ (1987)	fsrq	FSRQ	-	-
J0440.4 + 1440	TXS 0437 + 145	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0440.8 + 2749	B2 0437 + 27B	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0441.3 − 2617	1RXS J044120.5 − 261659	-	-	-	bcu	UNCL	-	-
J0441.5 + 1505	1RXS J044127.8 + 150455	-	0.109	Piranomonte+ (2007)	bll	BLLAC	-	-
J0442.6 − 0017	PKS 0440 − 00	-	0.844	Schmidt (1977)	fsrq	NLS1	-	Shaw+ (2012) measured FWHM(Hβ) = 1700 ± 1100.
J0442.7 + 6142	GB6 J0442 + 6140	-	-	-	bcu	UNCL	-	-
J0443.3 − 6652	PMN J0443 − 6651	-	-	-	bcu	UNCL	-	-
J0443.4 − 4152	1RXS J044328.4 − 415151	-	-	-	bll	BLLAC	-	Featureless, Arsioli+ (2015).
J0444.5 + 0719	PMN J0444 + 0717	-	-	-	bcu	UNCL	-	-
J0445.1 − 6012	PMN J0444 − 6014	-	0.097	Abdo+ (2010)	fsrq	FSRQ	-	-
J0447.2 − 2539	2MASS J04472149 − 2539302	-	-	-	bcu	UNCL	-	-
J0447.4 − 2747	MRC 0445 − 278	-	-	-	bcu	UNCL	-	-
J0448.6 − 1632	RBS 589	-	-	-	bll	BLLAC	-	Featureless, Chang+ (2017).
J0449.1 + 1121	PKS 0446 + 11	-	2.15	Shaw+ (2012)	fsrq	CLAGN	-	First value of $z = 1.2$ is reported by von Montigny+ (1995), but with no indication of the origin. This value is challenged by Halpern+ (2003), who found a featureless spectrum (epoch 1996–2002), and Afanas'ev+ (2005) observed a featureless spectrum in 2001–2002. The spectrum taken by Shaw+ (2012) clearly shows a prominent CIV at $z = 2.15$ (epoch unknown, but clearly in the 2010s). Changing-look AGN.
J0449.2 + 6329	S4 0444 + 63	-	0.781	Stickel+Kuhr (1993)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0449.4 − 4350	PKS 0447 − 439	-	0.205	Perlman+ (1998)	bll	BLLAC	-	The first identification as FSRQ/Sy1 at $z = 0.107$ by Craig & Fruscione (1997) is wrong. This source is $\sim 1.2'$ distant from the radio position. The Perlman's counterpart is almost coincident with the radio coordinates, and the redshift value is confirmed by Prandini+ (2012). However, this value, based on the Ca H&K break, is not confirmed by Pita+ (2014), but the non-detection could be due to increased jet activity.
J0449.6 − 8100	PKS 0454 − 81	-	0.444	Stickel+ (1989)	fsrq	FSRQ	-	-
J0450.3 − 4419	PMN J0450 − 4418	-	-	-	bcu	UNCL	-	-
J0450.4 + 7230	NVSS J045109 + 723014	-	-	-	bcu	UNCL	-	-
J0450.7 − 4938	AT20G J045102 − 493626	-	-	-	bcu	UNCL	-	-
J0451.8 − 4651	PKS 0450 − 469	-	0.602	Titov+ (2013)	fsrq	FSRQ	-	-
J0452.0 + 2100	1RXS J045214.8 + 210307	-	-	-	bcu	UNCL	-	-
J0453.1 + 6322	NVSS J045312 + 632117	-	-	-	bll	UNCL	-	-
J0453.1 − 2806	PKS 0451 − 28	-	2.56	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0455.7 − 4617	PKS 0454 − 46	-	0.858	Fricke+ (1983)	fsrq	FSRQ	-	-
J0456.2 + 2702	MG2 J045613 + 2702	-	-	-	bcu	UNCL	-	-
J0456.4 − 4043	PMN J0456 − 4041	-	-	-	bcu	UNCL	-	-
J0456.6 − 3136	PMN J0456 − 3135	-	0.865	Shaw+ (2012)	fsrq	FSRQ	-	-
J0457.0 + 0646	4C +06.21	-	0.405	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J0457.0 − 2324	PKS 0454 − 234	-	1.01	Stickel+ (1989)	FSRQ	BLLAC	-	-
J0458.0 + 1152	NVSS J045804 + 115142	-	-	-	bcu	UNCL	-	-
J0459.4 + 1921	1RXS J045931.5 + 192242	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0500.6 − 4911	PMN J0500 − 4912	-	-	-	bll	UNCL	-	-
J0501.0 + 2424	1RXS J050107.1 + 242318	-	-	-	bcu	UNCL	-	-
J0501.2 − 0158	S3 0458 − 02	-	2.29	Strittmatter+ (1974)	fsrq	FSRQ	-	-
J0502.4 + 0609	PKS 0459 + 060	-	1.11	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J0502.5 + 1340	PKS 0459 + 135	-	0.35	Truebenbach+Darling (2017)	bll	BLLAC	-	-
J0502.9 + 6533	1E 0458.1 + 6530	-	-	-	bll	UNCL	-	-
J0503.1 − 6045	PKS 0503 − 608	-	1.04	Titov+ (2013)	fsrq	FSRQ	-	-
J0503.5 − 1116	1RXS J050335.6 − 111504	-	-	-	bll	BLLAC	-	Featureless, Arsioli+ (2015).
J0505.3 + 0459	PKS 0502 + 049	-	0.954	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J0505.6 + 0415	MG1 050533 + 0415	RGB J0505 + 042	0.424	Pita+ (2014)	bll	BLLAC	-	The value of $z = 0.0272$ by Bauer+ (2000) seems to be wrong.
J0505.6 + 6405	TXS 0500 + 640	-	-	-	bcu	UNCL	-	-
J0505.6 − 1558	TXS 0503 − 160	-	-	-	bll	UNCL	-	-
J0505.8 − 0419	S3 0503 − 04	-	1.48	Veron (1994)	fsrq	FSRQ	-	-
J0505.8 − 3817	1RXS J050559.9 − 382059	-	0.182	Jones+ (2009)	bll	BLLAC	-	-
J0506.0 + 6113	RX J0505.9 + 6113	-	-	-	bll	BLLAC	-	Paiano+ (2020) reported a featureless spectrum, with a hint of Ca H&K break, which would imply $z = 0.538$.
J0506.0 − 0357*c*	NVSS J050605 − 040152	-	-	-	bcu	UNCL	-	-
J0506.7 − 0857	1WGA J0506.6 − 0857	-	-	-	bll	UNCL	-	-
J0506.9 + 0323	NVSS J050650 + 032401	-	-	-	bcu	BLLAC	-	Featureless, Paiano+ (2019).
J0506.9 − 5435	1ES 0505 − 546	-	-	-	bll	BLLAC	-	Featureless, Masetti+ (2013).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0507.4 − 3346	1RXS J050727.6 − 334628	-	-	-	bcu	UNCL	-	The 6dF spectrum by Jones+ (2009) is unreliable (q = 1).
J0507.7 − 6104	PMN J0507 − 6104	-	1.09	Shaw+ (2012)	fsrq	FSRQ	-	-
J0507.9 + 6737	1ES 0502 + 675	-	0.340	Shaw+ (2013)	bll	BLLAC	-	There are two more estimates of z: one from Perlman (1998, $z = 0.314$), reported by Scarpa+ (1999) as private communication; the other ($z = 0.416$) is from Landt+ (2002), who challenged Perlman's measurement and proposed the new one after an inspection of the same spectrum. However, it was not possible to find such a spectrum in both publications and elsewhere. The only spectrum available online is that published by Shaw+ (2013).
J0508.2 − 1937	PMN J0508 − 1936	-	1.88	Álvarez Crespo+ (2016)	fsrq	FSRQ	-	-
J0509.1 + 1943	TXS 0506 + 196	-	-	-	bcu	UNCL	-	-
J0509.4 + 0542	TXS 0506 + 056	-	0.336	Paiano+ (2018)	bll	BLLAC	-	Neutrino blazar.
J0509.4 + 1012	PKS 0506 + 101	-	0.621	Shaw+ (2012)	fsrq	CLAGN	-	Afanas'ev+ (2005) observed a featureless spectrum: changing-look AGN.
J0509.6 + 8425	S5 0454 + 84	-	0.112	Torrealba+ (2012)	bll	BLLAC	-	There is a long debate on the value of z. Lawrence+ (1996) suggested $z = 0.112$ on the basis of a weak detection of [OIII]—confirmed by Torrealba+ (2012)—but Stocke+Rector (1997) suggested $z > 1.34$ on the basis of an absorption feature identified as MgII. Warning: this lower limit is often confused as a measured value many times in the literature and by SIMBAD and NED. Scarpa+ (2000) supported the high-z lower limit on the basis of the host galaxy unresolved by HST. However, it is known that high-z BL Lac Objects are quite rare and unlikely.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0509.6 − 0402	1H 0506 − 039	-	-	-	bll	BLLAC	-	There is a value $z = 0.304$ available in the literature, but it was not possible to find either the origin of this measurement or a new spectrum confirming the value. The first paper found reporting this value is Laurent-Muehleisen+ (1993), but it has no reference. The BL Lac nature was confirmed by high-energy observations.
J0509.9 − 6417	RBS 625	-	-	-	bcu	UNCL	-	-
J0510.0 + 1800	PKS 0507 + 17	-	0.416	Perlman+ (1998)	fsrq	CLAGN	-	Labiano+ (2007) reported $z = 0.3$ by referring to de Vries+ (1997). However, the latter does not give any z for this source. On the contrary, de Vries+ (2000) published a new spectrum confirming Perlman's value, but with weaker lines and suggesting a BL Lac nature. This implies a changing-look AGN. Note that Shaw+ (2013) associated the gamma-ray source with another counterpart placed at $\sim 7.4'$ from PKS 0507 + 17 and with a featureless spectrum.
J0510.4 − 1809	CRATES J051015.50 − 181227.8	-	-	-	bcu	UNCL	-	-
J0511.4 − 6804	PMN J0511 − 6806	-	-	-	bcu	UNCL	-	Warning: in the field of the Large Magellanic Cloud.
J0513.9 − 3746	NVSS J051404 − 374607	-	-	-	bll	UNCL	-	-
J0514.5 + 6247	GB6 J0514 + 6244	-	-	-	bcu	UNCL	-	-
J0515.5 − 0125	NVSS J051536 − 012427	-	-	-	bcu	UNCL	-	-
J0515.6 − 4556	PKS 0514 − 459	-	0.194	Stickel+ (1993)	fsrq	FSRQ	-	The authors reported narrow Hα (FWHM$\sim$2000 km/s). Check for NLS1 or NLRG.
J0515.8 + 1527	GB6 J0515 + 1527	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0515.9 + 0537	TXS 0513 + 054	-	-	-	bcu	UNCL	-	-
J0516.1 − 7240	PKS 0517 − 726	-	-	-	bcu	UNCL	-	-
J0516.4 + 7350	GB6 J0516 + 7350	-	0.251	Shaw+ (2013)	bll	BLLAC	-	-
J0516.7 − 6207	PKS 0516 − 621	-	1.30	Shaw+ (2012)	bll	BLLAC	-	-
J0516.8 − 0509	PMN J0517 − 0520	-	1.41	Titov+ (2003)	bcu	FSRQ	-	-
J0517.5 + 0858	PMN J0517 + 0858	-	0.328	Shaw+ (2012)	fsrq	FSRQ	-	-
J0517.7 − 1758	PMN J0517 − 1756	-	-	-	bcu	UNCL	-	-
J0519.0 + 0851	TXS 0516 + 087	-	-	-	bcu	UNCL	-	-
J0519.6 − 4544	Pictor A	-	0.0342	Schmidt (1965)	rdg	MIS	SA0	FRII, BLRG, Seyfert 1, Angioni+ (2020)
J0521.2 + 1637	3C 138	-	0.759	Lynds+ (1966)	css	MIS	-	CSS, Seyfert 1.5, steep radio spectrum (borderline), details Dallacasa+ (2021)
J0521.3 − 1734	TXS 0519 − 176	-	0.347	Titov+ (2013)	fsrq	FSRQ	-	No line measurements, but the visual inspection of the spectrum shows prominent [OIII] lines, weak Hβ, and FeII bumps. NLS1 or even SEY.
J0521.6 + 0103	NVSS J052140 + 010257	-	-	-	bll	UNCL	-	The SDSS inconclusive.
J0521.8 − 3848	PKS 0520 − 388	-	-	-	bcu	UNCL	-	-
J0522.9 − 3628	PKS 0521 − 36	-	0.055	Westerlund+Stokes (1966)	AGN	CLAGN	-	Changing-look AGN (Ulrich 1981). Early optical spectroscopic observations revealed an almost featureless spectrum but with some weak features that allowed measuring the z (BL Lac Object type). More recent spectra displayed prominent emission lines typical of BLRG/Seyfert 1 galaxies (e.g., Stickel+ (1993), Sbarufatti+ (2006)). The radio morphology is FRI-type, with a viewing angle larger than 10 degrees (Angioni+ (2019)).
J0524.6 − 2819	PMN J0524 − 2818	-	-	-	bcu	UNCL	-	-
J0525.4 − 4600	PKS 0524 − 460	-	1.48	Stickel+ (1993)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0525.6 − 2008	PMN J0525 − 2010	-	-	-	bcu	UNCL	-	-
J0525.6 − 6013	SUMSS J052542 − 601341	-	-	-	bcu	UNCL	-	-
J0525.8 − 0052	PMN J0525 − 0051	-	-	-	bll	UNCL	-	-
J0526.1 + 6318	GB6 J0526 + 6317	-	-	-	bcu	UNCL	-	-
J0526.2 − 4830	PKS 0524 − 485	-	1.30	Shaw+ (2012)	fsrq	FSRQ	-	-
J0526.7 − 1519	NVSS J052645 − 151900	-	-	-	bcu	UNCL	-	-
J0527.3 − 6223	PMN J0527 − 6225	-	0.0835	Huchra+ (2012)	bcu	BLLAC	-	-
J0528.7 − 5920	1RXS J052846.9 − 592000	-	1.13	Anderson+Filipovic (2009)	bll	BLLAC	-	-
J0529.1 + 0935	GB6 J0529 + 0934	-	-	-	bcu	UNCL	-	-
J0529.1 − 0101	PMN J0529 − 0058	-	-	-	bcu	UNCL	-	-
J0529.3 − 7243	PKS 0530 − 727	-	-	-	bcu	UNCL	-	-
J0529.4 − 0521	PMN J0529 − 0519	-	0.685	Healey+ (2008)	fsrq	FSRQ	-	-
J0530.9 + 1332	PKS 0528 + 134	-	2.07	Hunter+ (1993)	FSRQ	FSRQ	-	-
J0532.0 − 4827	PMN J0531 − 4827	-	0.812	Titov+ (2017)	BLL	BLLAC	-	-
J0532.6 + 0732	OG 50	-	1.25	Sowards-Emmerd+ (2005)	FSRQ	FSRQ	-	-
J0532.8 − 3941	PKS 0531 − 397	-	-	-	bcu	UNCL	-	-
J0532.9 − 8325	PKS 0541 − 834	-	0.774	Shaw+ (2012)	fsrq	FSRQ	-	-
J0533.0 − 8446	PMN J0532 − 8447	-	-	-	bcu	UNCL	-	-
J0533.1 − 6119	MRC 0534 − 613A	PKS 0534 − 61	-	-	bcu	UNCL	-	-
J0533.3 − 5549	PMN J0533 − 5549	-	-	-	bcu	UNCL	-	-
J0533.8 − 3749	PKS 0532 − 378	-	1.67	Drinkwater+ (1997)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0536.0 − 2754	PMN J0535 − 2751	-	-	-	bcu	UNCL	-	-
J0536.4 − 3343	1RXS J053629.4 − 334302	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0536.4 − 3401	PKS 0534 − 340	-	0.684	Caccianiga+ (2000)	fsrq	FSRQ	-	6dF spectrum.
J0536.5 − 2548	GALEXASC J053626.90 − 254747.9	-	-	-	bcu	UNCL	-	-
J0537.7 − 5717	1RXS J053749.3 − 571844	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0538.2 − 3910	NVSS J053810 − 390844	-	-	-	bcu	BLLAC	-	Featureless, Shaw+ (2013).
J0538.6 + 0443	NVSS J053847 + 044222	-	-	-	bcu	UNCL	-	-
J0538.8 − 4405	PKS 0537 − 441	-	0.894	Peterson+ (1976)	BLL	BLLAC	-	-
J0539.7 − 0521*c*	TXS 0537 − 052	-	-	-	bcu	UNCL	-	-
J0539.9 − 2839	PKS 0537 − 286	-	3.11	Wright+ (1978)	fsrq	FSRQ	-	-
J0540.5 + 5823	GB6 J0540 + 5823	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0540.8 − 5415	PKS 0539 − 543	-	1.19	Healey+ (2008)	fsrq	FSRQ	-	-
J0541.1 − 4854	1RXS J054106.1 − 485408	-	-	-	bcu	UNCL	-	-
J0541.4 − 7334	PKS 0542 − 735	PKS 0543 − 735 (NED)	-	-	bcu	UNCL	-	In the field of LMC.
J0541.6 − 0541	PKS 0539 − 057	-	0.839	Stickel+Kuhr (1993)	fsrq	FSRQ	-	Chu+ (1986) suggested $z = 2.32$ (uncertain) on the basis of one emission line identified as CIV.
J0542.8 − 3458	PMN J0542 − 3500	-	-	-	bcu	UNCL	-	-
J0542.9 − 0913	PMN J0542 − 0913	-	-	-	bcu	UNCL	-	-
J0543.9 − 5531	1RXS J054357.3 − 553206	-	0.273	Pita+ (2014)	bll	BLLAC	-	-
J0545.0 + 0613*c*	NVSS J054529 + 061955	-	-	-	bcu	UNCL	-	-
J0546.9 − 2206	1RXS J054656.9 − 220500	-	0.247	Caccianiga+ (2002)	bll	BLLAC	-	Arsioli+ (2015) reported $z = 0.28$, but there is no indication on the origin of this measurement.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0548.5 − 5218	PMN J0548 − 5218	-	-	-	bcu	UNCL	-	-
J0550.3 − 5733	PKS 0549 − 575	-	2.00	Healey+ (2008)	fsrq	FSRQ	-	-
J0550.5 − 3216	PKS 0548 − 322	-	0.0689	Fosbury+Disney (1976)	bll	BLLAC	-	-
J0551.0 − 1622	PMN J0550 − 1621	-	-	-	bcu	UNCL	-	-
J0551.8 − 3517	PMN J0551 − 3515	-	-	-	bcu	UNCL	-	-
J0552.8 + 0313	PKS 0550 + 032	-	-	-	bcu	UNCL	-	-
J0553.5 − 2034	NVSS J055333 − 203417	-	-	-	bll	UNCL	-	-
J0554.3 − 1009*c*	PMN J0555 − 1002	-	-	-	bcu	UNCL	-	-
J0555.1 + 0304	GB6 J0555 + 0304	-	-	-	bcu	UNCL	-	-
J0556.2 − 4352	SUMSS J055618 − 435146	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0557.3 − 0615	1RXS J055717.0 − 061705	-	-	-	bcu	UNCL	-	-
J0557.6 − 0721	PMN J0557 − 0719	-	-	-	bcu	UNCL	-	-
J0558.0 − 3837	EXO 0556.4 − 3838	-	0.302	Sbarufatti+ (2005)	bll	BLLAC	-	-
J0558.1 − 2859	TXS 0556 − 289	-	-	-	bcu	UNCL	-	McCarthy+ (1996) suggest a radio galaxy classification.
J0558.8 − 7459	PKS 0600 − 749	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0559.9 + 6409	GB6 J0559 + 6409	-	-	-	bcu	UNCL	-	-
J0600.6 − 3939	PKS 0558 − 396	-	1.66	Perlman+ (1998)	fsrq	FSRQ	-	-
J0601.1 − 7035	PKS 0601 − 70	-	2.41	Shaw+ (2012)	fsrq	FSRQ	-	-
J0601.3 + 5444	GB6 J0601 + 5443	-	-	-	bcu	UNCL	-	-
J0601.3 − 7238	PMN J0601 − 7238	-	-	-	bll	UNCL	-	-
J0601.8 − 2003	PMN J0601 − 2004	-	1.22	Shaw+ (2012)	fsrq	FSRQ	-	-
J0602.0 + 5315	GB6 J0601 + 5315	-	0.0522	Paiano+ (2020)	bcu	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0602.7 − 0007	PMN J0602 − 0004	-	-	-	bcu	UNCL	-	-
J0602.8 − 4019	SUMSS J060251 − 401845	-	-	-	bll	UNCL	-	-
J0604.1 − 4816	1ES 0602 − 482	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2015).
J0604.5 − 4851	SUMSS J060433 − 484947	-	-	-	bcu	UNCL	-	-
J0604.8 + 4411	S4 0600 + 44	-	1.14	Vermeulen+Taylor (1995)	bcu	FSRQ	-	-
J0604.9 − 0000	GB6 J0604 + 0000	-	-	-	bcu	UNCL	-	-
J0606.5 − 4730	RX J060635.9 − 473001	-	0.0298	Pietsch+ (1998)	bcu	BLLAC	E	LINER
J0606.9 + 4402	CRATES J060650 + 440144	B3 0603 + 440	-	-	bcu	UNCL	-	-
J0607.2 − 2518	1RXS J060714.2 − 251855	-	0.275	Piranomonte+ (2007)	bll	BLLAC	-	-
J0607.4 + 4739	TXS 0603 + 476	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0608.0 + 6721	S4 0602 + 67	-	-	-	fsrq	UNCL	-	SIMBAD, NED, and many authors refer to Kellermann+ (1998), who reported $z = 1.97$. However, this is a value taken either from the literature or from archives. The authors did not make any explicit reference, so it is not possible to find the original spectrum. No other recent observation was published.
J0608.0 − 0835	PKS 0605 − 08	-	0.871	Allington-Smith+ (1991)	fsrq	FSRQ	-	-
J0608.1 − 1521	PMN J0608 − 1520	-	1.09	Shaw+ (2012)	fsrq	FSRQ	-	-
J0608.1 − 6028	PKS 0607 − 605	-	1.10	Landoni+ (2013)	fsrq	FSRQ	-	-
J0608.9 − 5456	PKS 0607 − 549	-	-	-	bcu	UNCL	-	-
J0609.0 − 2219	PKS 0606 − 223	-	1.92	Spinrad+ (1979)	fsrq	FSRQ	-	-
J0609.2 − 0247	NVSS J060915 − 024754	-	-	-	bll	BLLAC	-	Featureless, Massaro+ (2015).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0610.1 − 1848	PMN J0610 − 1847	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0610.9 − 6054	PKS 0609 − 609	-	1.77	Healey+ (2008)	fsrq	FSRQ	-	-
J0611.1 + 4325	7C 0607 + 4324	-	-	-	bcu	UNCL	-	-
J0611.6 − 2712	PMN J0611 − 2709	-	-	-	bcu	UNCL	-	-
J0612.5 − 3138	PKS 0610 − 316	-	0.873	Hook+ (2003)	fsrq	FSRQ	-	-
J0612.5 − 3934	PMN J0612 − 3939	-	-	-	bcu	UNCL	-	-
J0612.8 + 4122	B3 0609 + 413	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0614.8 + 6136	GB6 J0614 + 6139	-	-	-	bcu	UNCL	-	-
J0615.3 − 3117	PKS 0613 − 312	-	-	-	bll	BLLAC	-	Featureless, Hook+ (2003).
J0616.1 − 1732	1RXS J061609.5 − 173313	-	-	-	bll	UNCL	-	-
J0616.7 − 1049	PMN J0616 − 1040	-	-	-	bcu	UNCL	-	-
J0616.9 + 4340	GB6 J0617 + 4340	-	-	-	bcu	UNCL	-	-
J0617.2 + 5701	87GB 061258.1 + 570222	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0617.7 − 1715	IVS B0615 − 172	-	0.098	Shaw+ (2013)	bll	BLLAC	-	There is another value—$z = 0.32$—reported in the 1FGL, but without any information except for a forthcoming paper (Piranomonte+D'Elia 2010, in preparation) that was never published.
J0618.1 − 2428	PMN J0618 − 2426	-	0.299	Álvarez Crespo+ (2016)	fsrq	FSRQ	-	-
J0618.9 − 1138	TXS 0616 − 116	-	-	-	bcu	UNCL	-	NED reports $z = 0.97$ from Liang+Liu (2003). However, that paper did not deal with the optical identification: there is just an acknowledgement to G. Z. Xie for optical observations. No other more recent observation has been published to confirm this value of redshift.
J0620.5 − 2512	PKS 0618 − 252	-	1.90	Ellison+ (2004)	bcu	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0621.2 − 2213	PMN J0621 − 2213	-	-	-	bcu	UNCL	-	-
J0621.2 − 4648	IVS B0619 − 468	-	1.21	Titov+ (2017)	bcu	FSRQ	-	-
J0621.7 − 3411	1RXS J062150.0 − 341140	-	0.529	Piranomonte+ (2007)	bll	BLLAC	-	-
J0622.3 − 2605	PMN J0622 − 2605	-	0.414	Jones+ (2009)	bll	BLLAC	-	6dF spectrum ($q = 4$).
J0622.4 − 6433	RX J062308.0 − 643619	-	0.129	Keel+ (1988)	fsrq	FSRQ	-	-
J0622.7 − 4141	SUMSS J062242 − 414357	-	-	-	bcu	UNCL	-	-
J0623.0 − 3010	PMN J0623 − 3010	-	-	-	bcu	UNCL	-	-
J0623.7 − 3348	PMN J0623 − 3350	-	-	-	bcu	UNCL	-	-
J0623.9 − 5259	MS 06225 − 5256	-	-	-	bll	BLLAC	-	Landoni+ (2013) reported $z = 0.513$ in Table 2, but also $z = 0.443$ in Figure 6. Upon request, Landoni confirmed $z = 0.513$. However, the value remains uncertain because the spectrum is featureless, and z is calculated with reference to a zero-velocity template.
J0624.2 − 2943	1RXS J062422.3 − 294449	-	-	-	bcu	UNCL	-	-
J0625.3 + 4439	GB6 J0625 + 4440	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0625.8 − 5441	PMN J0625 − 5438	-	2.05	Healey+ (2008)	fsrq	FSRQ	-	-
J0626.4 − 1712	2MASS J06262650 − 1710467	-	-	-	bll	UNCL	-	-
J0626.4 − 4259	2MASS J06263670 − 4258059	-	-	-	bll	UNCL	-	-
J0627.0 − 3529	PKS 0625 − 35	-	0.0546	Tadhunter+ (1993)	rgd	MIS	E	FRI, Ekers+ (1989)

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0628.6 + 6900	GB6 J0629 + 6900	-	-	-	bcu	UNCL	-	SIMBAD gives $z = 0.37$ likely from Jannuzi+ (1998), but that optical source HS 0624 + 6907 is about 6′ from the radio position. Therefore, the association is likely to be wrong.
J0628.8 − 6250	PKS 0628 − 627	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0629.3 − 1959	PKS 0627 − 199	-	1.72	Shaw+ (2013)	bll	BLLAC	-	-
J0630.2 + 3228	NVSS J063010 + 322608	-	-	-	bcu	UNCL	-	-
J0630.9 − 2406	TXS 0628 − 240	-	-	-	bll	BLLAC	-	Featureless, Landt (2012).
J0633.4 − 2222	PMN J0633 − 2223	-	1.51	Healey+ (2008)	fsrq	FSRQ	-	-
J0634.9 − 2335	PMN J0634 − 2335	-	1.53	Ackermann+ (2011)	fsrq	FSRQ	-	-
J0635.6 − 7518	PKS 0637 − 75	-	0.659	Monroe+ (2016)	fsrq	FSRQ	-	-
J0636.5 + 7138	GB6 J0636 + 7138	-	-	-	bcu	UNCL	-	-
J0637.4 − 3537	WISE J063746.40 − 353648.3	PKS 0636 − 355	-	-	bcu	UNCL	-	-
J0638.2 + 6020	GB6 J0638 + 6016	-	-	-	bcu	UNCL	-	-
J0638.6 + 7320	S5 0633 + 73	-	1.85	Stickel+Kuhr (1996)	fsrq	FSRQ	-	-
J0638.7 + 5658	GB6 J0638 + 5701	-	-	-	bcu	UNCL	-	-
J0639.6 + 3503	B2 0635 + 35	-	-	-	bcu	UNCL	-	-
J0643.2 − 5356	PMN J0643 − 5358	-	-	-	bcu	UNCL	-	-
J0644.4 − 6712	PKS 0644 − 671	-	1.93	Klindt+ (2017)	bcu	FSRQ	-	-
J0644.6 + 6039	NVSS J064435 + 603849	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017). SIMBAD proposes $z = 0.832$ from Sowards-Emmerd+ (2005), but this paper does not have this source in its list.
J0644.6 − 2853	NVSS J064443 − 285116	-	-	-	bcu	UNCL	-	6dF inconclusive.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0646.7 − 3913	PKS 0644 − 390	-	0.681	Hook+ (2003)	fsrq	FSRQ	-	-
J0647.0 − 5138	1ES 0646 − 515	-	-	-	bcu	UNCL	-	-
J0647.7 − 4418	SUMSS J064744 − 441946	-	-	-	bcu	UNCL	-	-
J0647.7 − 6058	PMN J0647 − 6058	-	-	-	bcu	UNCL	-	There is a spectroscopic observation by Shaw+ (2013), but it is inconclusive.
J0647.8 + 4527	B3 0644 + 454	-	-	-	bcu	UNCL	-	-
J0648.0 − 3045	PKS 0646 − 306	-	1.15	Hook+ (2003)	fsrq	FSRQ	-	-
J0648.4 − 6941	1RXS J064850.3 − 694519	-	-	-	bcu	UNCL	-	-
J0649.5 − 3139	NVSS J064933 − 313917	-	-	-	bll	UNCL	-	-
J0650.5 − 2851	PMN J0650 − 2849	-	-	-	bcu	UNCL	-	-
J0650.7 + 2503	1ES 0647 + 250	-	0.41*	Kotilainen+ (2011)	bll	BLLAC	-	A first tentative estimate of $z = 0.203$ by Falomo+Kotilainen (1999) is still often adopted, but seems to be wrong. The current redshift is estimated from the imaging of the host galaxy and is consistent with Meisner+Romani (2010). The most recent high S/N observation by Paiano+ (2017) still resulted in no features.
J0651.0 + 4013	RX J0651.0 + 4013	-	-	-	bcu	UNCL	-	-
J0651.4 + 6525	NVSS J065125 + 652458	-	-	-	bcu	UNCL	-	-
J0651.5 + 7956	WN B0643.2 + 7959	-	-	-	bcu	UNCL	-	-
J0652.1 − 4813	1RXS J065201.0 − 480858	-	-	-	bcu	UNCL	-	-
J0653.7 + 2815	GB6 J0653 + 2816	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J0654.0 − 4152	LEDA 571171	AT20G J065359 − 415144	0.091	Mahony+ (2011)	bcu	MIS	-	FRI according to Glowaki+ (2017). The 6dF redshift by Jones+ (2009) is wrong, likely due to a contaminating star.
J0654.3 + 5042	GB6 J0654 + 5042	-	1.25	Shaw+ (2012)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0654.4 + 4514	B3 0650 + 453	-	0.933	Henstock+ (1997)	FSRQ	FSRQ	-	-
J0654.6 − 4952	SUMSS J065518 − 495205	-	-	-	bcu	UNCL	-	-
J0654.7 + 4246	B3 0651 + 428	-	0.126	Marcha+ (1996)	bll	BLLAC	-	-
J0656.3 + 4235	4C +42.22	-	0.059	Laurent-Muheleisen+ (1998)	bll	BLLAC	E	-
J0658.1 − 5840	PMN J0658 − 5840	-	0.421	Titov+ (2013)	bcu	FSRQ	-	-
J0658.2 + 2709	B2 0655 + 27A	-	-	-	bcu	UNCL	-	-
J0659.6 − 2742	TXS 0657 − 276	-	1.73	Healey+ (2008)	fsrq	FSRQ	-	-
J0659.6 − 6742	1RXS J065933.5 − 674356	-	-	-	bcu	UNCL	-	-
J0700.1 − 6311	SUMSS J065958 − 631238	-	-	-	bcu	UNCL	-	-
J0700.5 − 6610	PKS 0700 − 661	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0701.5 + 2511	1RXS J070132.1 + 250950	-	-	-	bcu	UNCL	-	-
J0701.5 − 4634	PKS 0700 − 465	-	0.822	Hook+ (2003)	fsrq	FSRQ	-	-
J0703.2 − 3914	1RXS J070312.7 − 391417	-	-	-	bll	UNCL	-	-
J0704.7 + 4508	B3 0701 + 451	-	-	-	bcu	UNCL	-	-
J0704.8 + 4907	87GB 070112.8 + 491056	-	-	-	bcu	UNCL	-	-
J0705.7 − 4848	PMN J0705 − 4847	-	-	-	bcu	UNCL	-	-
J0705.9 + 5309	GB6 J0706 + 5309	-	-	-	bcu	UNCL	-	-
J0706.5 + 3744	GB6 J0706 + 3744	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0706.8 + 7742	NVSS J070651 + 774137	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0706.9 + 6109	TXS 0702 + 612	-	-	-	bll	UNCL	-	There is only an extremely noisy spectrum by Henstock+ (1997).
J0708.9 + 4839	NGC 2329	-	0.0192	Peterson (1979)	rdg	MIS	S0	FRI, Wide-Angle Tail Ferretti+ (1985).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0709.1 + 2241	GB6 J0708 + 2241	-	0.297	Paiano+ (2020)	bll	BLLAC	-	-
J0710.4 + 5908	1H 0658 + 595	-	0.125	Giommi+ (1991)	bll	BLLAC	-	-
J0710.8 − 3851	AT20G J071043 − 385037	PMN J0710 − 3850	0.129	Nkundabakura+Meintjes (2012)	fsrq	FSRQ	-	-
J0710.9 + 4733	S4 0707 + 47	-	1.29	Stickel+Kuhr (1994)	bll	FSRQ	-	-
J0712.4 + 5724	RX J0712.3 + 5719	-	0.095	Beckmann+ (2003)	bll	BLLAC	-	-
J0712.7 + 5033	GB6 J0712 + 5033	-	0.502	Shaw+ (2013)	bll	BLLAC	-	-
J0713.0 + 5738	GB6 J0713 + 5738	-	-	-	bcu	UNCL	-	-
J0713.5 + 2537	NVSS J071336 + 254016	-	-	-	bcu	UNCL	-	-
J0713.8 + 1935	MG2 J071354 + 1934	GB6 J0713 + 1935	0.540	Shaw+ (2009)	fsrq	FSRQ	-	-
J0714.4 + 1110	NVSS J071416 + 110830	-	-	-	bcu	UNCL	-	-
J0715.3 − 6828	PMN J0715 − 6829	-	-	-	bcu	UNCL	-	-
J0715.6 − 4528	SUMSS J071544 − 453031	-	-	-	bll	UNCL	-	-
J0717.7 − 5519	1RXS J071745.4 − 552024	-	-	-	bcu	UNCL	-	-
J0718.0 + 4536	S4 0714 + 45	-	0.943	Stickel+Kuehr (1994)	fsrq	FSRQ	-	-
J0718.6 − 4319	PMN J0718 − 4319	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0719.1 − 7055	1RXS J071910.3 − 705411	-	-	-	bcu	UNCL	-	-
J0719.3 + 3307	B2 0716 + 33	-	0.779	White+ (2000)	fsrq	CLAGN	-	Likely a changing-look AGN, because early observations reported a featureless spectrum (Wills+ (1986)).
J0719.7 − 4012	1RXS J071939.2 − 401153	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0720.0 − 6237	PMN J0719 − 6218	IVS B0718 − 622	1.25	Titov+ (2013)	bcu	FSRQ	-	There is a discrepancy between SIMBAD and NED coordinates (the two positions are ∼8′ distant from each other). The source corresponding to the coordinates given in the 4FGL is that of NED.
J0721.9 + 7120	S5 0716 + 71	-	0.31*	Nilsson+ (2008)	BLL	BLLAC	-	-
J0722.7 + 3606	MG2 J072255 + 3606	NVSS J072257 + 360619	-	-	bcu	UNCL	-	-
J0723.4 + 5841	RX J0723.2 + 5841	-	-	-	bll	UNCL	-	Appenzeller+ (1998) reported a blue galaxy coincident with the radio counterpart and suggest it could be a BL Lac Object, but there are no indication of any optical spectrum.
J0723.5 + 2900	GB6 J0723 + 2859	-	0.966	Shaw+ (2012)	fsrq	FSRQ	-	-
J0723.7 + 2050	GB6 J0723 + 2051	-	-	-	bcu	UNCL	-	-
J0725.2 + 1425	4C +14.23	-	1.04	Healey+ (2008)	FSRQ	FSRQ	-	-
J0726.1 + 8114	WN B0716.0 + 8119	-	-	-	bcu	UNCL	-	-
J0726.4 − 4727	PMN J0726 − 4728	-	1.69	Healey+ (2008)	fsrq	FSRQ	-	-
J0727.1 + 3734	SDSS J072659.51 + 373423.0	-	0.791	Landoni+ (2018)	bll	BLLAC	-	SDSS inconclusive.
J0728.0 + 6735	NVSS J072854 + 673225	-	-	-	bcu	UNCL	-	-
J0728.2 + 4827	GB6 J0727 + 4827	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J0728.5 + 6128	GB6 J0729 + 6129	-	-	-	bcu	UNCL	-	-
J0729.1 + 5703	TXS 0724 + 571	-	0.424	Vermeulen+Taylor (1995)	fsrq	FSRQ	-	-
J0730.4 + 3308	1RXS J073026.0 + 330727	-	0.112	Bauer+ (2000)	bll	BLLAC	-	SDSS inconclusive.
J0730.7 − 6602	PMN J0730 − 6602	-	0.106	Klindt+ (2017)	bll	BLLAC	-	-
J0731.2 − 1403	PMN J0731 − 1402	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0731.9 + 2805	RGB J0731 + 280	-	0.248	Wei+ (1999)	bll	BLLAC	-	SDSS.
J0732.7 − 4638	PKS 0731 − 465	-	-	-	bcu	UNCL	-	-
J0733.0 + 4915	TXS 0729 + 493	-	-	-	bcu	UNCL	-	-
J0733.1 + 5910	GB6 J0733 + 5909	-	-	-	bcu	UNCL	-	-
J0733.4 + 5152	NVSS J073326 + 515355	-	0.0650	Becerra González+ (2020)	bcu	BLLAC	E	-
J0733.5 − 5445	SUMSS J073334 − 544544	-	-	-	bcu	UNCL	-	-
J0733.6 + 3649	GB6 J0733 + 3650	-	1.24	Djorgovski+ (2010)	bcu	BLLAC	-	-
J0733.7 + 0205*c*	4C +02.20	-	-	-	bcu	UNCL	-	-
J0733.7 + 4110	GB6 J0733 + 4111	-	-	-	bll	BLLAC	-	Although there is a SDSS spectrum available, the weak features do not allow to clearly measure the redshift. SDSS gives $z = 0.195$, but Mishra+ (2018), on the basis of the same spectrum, indicated $z = 1.899$, while Massaro+ (2009) give $z = 0.67$ (but, in this case, the origin of this value is not evident). A better, conclusive spectrum is not available.
J0733.8 + 0455	GB6 J0733 + 0456	-	3.01	Healey+ (2008)	fsrq	FSRQ	-	-
J0734.0 + 5021	TXS 0730 + 504	-	0.720	Henstock+ (1997)	fsrq	FSRQ	-	-
J0734.4 − 7711	PKS 0736 − 770	-	-	-	bcu	UNCL	-	-
J0737.3 − 8247	SUMSS J073706 − 824836	-	-	-	bcu	UNCL	-	-
J0738.1 + 1742	PKS 0735 + 17	-	0.45*	Nilsson+ (2012)	bll	BLLAC	-	It is often found in the literature that the value of $z = 0.424$, but this is a lower limit due to the detection of absorption lines (MgII) by Carswell+ (1974).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0738.4 + 1539	NVSS J073824 + 153839	-	-	-	bcu	UNCL	-	-
J0739.2 + 0137	PKS 0736 + 01	-	0.191	Lynds (1967)	fsrq	FSRQ	-	-
J0739.8 − 6722	1RXS J073928.1 − 672147	-	-	-	bcu	UNCL	-	-
J0740.9 + 3203	LEDA 1979979	-	0.179	SDSS	bll	BLLAC	-	-
J0741.0 + 3226	NVSS J074054 + 322600	-	0.946	Smith+ (2007)	bll	BLLAC	-	SDSS inconclusive.
J0741.2 − 5140	PMN J0740 − 5137	-	-	-	bcu	UNCL	-	-
J0741.4 − 4709	PMN J0741 − 4709	-	0.765	Healey+ (2008)	fsrq	FSRQ	-	-
J0742.1 + 4902	GB6 J0742 + 4900	-	2.32	Jorgenson+ (2006)	fsrq	FSRQ	-	SDSS
J0742.6 + 5443	GB6 J0742 + 5444	-	0.723	Halpern+Eracleous (1997)	fsrq	FSRQ	-	-
J0742.9 − 5242	PMN J0742 − 5241	-	-	-	bcu	UNCL	-	-
J0743.0 − 5622	PMN J0743 − 5619	-	2.32	Healey+ (2008)	fsrq	FSRQ	-	-
J0743.1 + 1713	TXS 0740 + 173	-	-	-	bll	BLLAC	-	Featureless, Healey+ (2008). SDSS inconclusive.
J0743.3 − 4912*c*	MRC 0741 − 490	-	-	-	bcu	UNCL	-	-
J0744.1 + 7434	MS 0737.9 + 7441	-	0.315	Stocke+ (1991)	bll	BLLAC	-	-
J0744.2 − 6918	PKS 0744 − 691	-	-	-	bcu	UNCL	-	-
J0746.0 − 0039	PKS 0743 − 006	-	0.994	White+ (1988)	fsrq	FSRQ	-	Fricke+ (1983) reported a featureless spectrum, thus, classifying it as BL Lac Object. However, the position is about 6″ distant from the radio position. The SDSS image shows three close sources, and thus some confusion is possible. White's position is coincident with the PKS coordinates.
J0746.3 − 0225	2MASS J07462703 − 0225492	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0746.4 + 2546	B2 0743 + 25	-	2.99	Sambruna+ (2006)	fsrq	FSRQ	-	Extreme MeV blazar. SDSS.
J0746.5 + 2730	OI 272	-	-	-	fsrq	UNCL	-	SDSS inconclusive.
J0746.6 − 4754	PMN J0746 − 4755	-	-	-	bll	BLLAC	-	Featureless, Ricci+ (2015).
J0747.5 + 0905	RX J0747.3 + 0905	-	-	-	bll	BLLAC	-	Featureless, Bauer+ (2000).
J0747.5 − 4927	2MASS J07472476 − 4926332	-	-	-	bcu	UNCL	-	-
J0748.3 + 4928	NVSS J074837 + 493040	-	-	-	bcu	UNCL	-	-
J0748.3 + 8511	NVSS J074715 + 851208	-	-	-	bcu	UNCL	-	-
J0748.6 + 2400	OI 275	-	0.410	Stickel+ (1989)	fsrq	FSRQ	-	SDSS.
J0749.2 + 2314	RX J0749.2 + 2313	-	0.174	Brinkmann+ (2000)	bll	BLLAC	-	SDSS. Interestingly, Massaro+ (2015) reported a featureless spectrum, likely due to an increased jet activity.
J0749.3 + 4453	SDSS J074916.88 + 445232.1	-	0.559	SDSS	bcu	FSRQ	-	-
J0749.4 + 1058	TXS 0746 + 110	-	-	-	bcu	BLLAC	-	Afanas'ev+ (2005) claimed $z = 0.214$, but it is a lower limit, because it was measured on absorption features. No emission line was found.
J0749.6 + 1324	SDSS J074935.95 + 132156.0	-	-	-	bcu	UNCL	-	-
J0749.7 + 7450	RX J0749.4 + 7451	-	0.605	Beckmann+ (2003)	bll	BLLAC	-	-
J0749.9 + 1823	TXS 0747 + 185	-	1.16	SDSS	fsrq	FSRQ	-	-
J0750.8 + 1229	OI 280	-	0.889	Wilkes+ (1983)	fsrq	FSRQ	-	-
J0751.0 + 7908	JVAS J0750 + 7909	-	-	-	bcu	UNCL	-	-
J0751.0 − 5131	PMN J0751 − 5134	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0751.4 + 2655	MG2 J075139 + 2657	NVSS J075137 + 265707	-	-	bcu	UNCL	-	SDSS inconclusive.
J0751.4 − 0421	PMN J0751 − 0421	-	-	-	bcu	UNCL	-	-
J0752.2 + 3313	OI 380	-	1.94	Schmidt(1977)	fsrq	FSRQ	-	SDSS
J0753.0 + 5353	4C +54.15	-	0.73*	Sbarufatti+ (2005)	bll	BLLAC	-	SIMBAD, NED, and other papers reported $z = 0.2$ from Stickel+Kuhr (1993), but this is a lower limit, not a measured value. The most recent spectroscopic observation by Shaw+ (2013) still found no emission lines.
J0753.9 + 0923	TXS 0751 + 095	-	-	-	bcu	UNCL	-	-
J0754.0 + 0451	GB6 J0754 + 0452	-	-	-	bcu	UNCL	-	-
J0754.7 + 4823	GB1 0751 + 485	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0756.3 − 6431	SUMSS J075625 − 643031	-	-	-	bll	UNCL	-	-
J0757.1 + 0956	PKS 0754 + 100	-	0.266	Carangelo+ (2003)	bll	BLLAC	-	-
J0758.1 + 1134	TXS 0755 + 117	-	0.569	Afanas'ev+ (2005)	fsrq	FSRQ	-	SDSS
J0758.7 + 3746	NGC 2484	3C 189	0.041	Colla+ (1975)	rdg	MIS	S0	SDSS, FRI/LERG, Owen+Laing (1989)
J0758.9 + 2703	SDSS J075846.99 + 270515.5	-	0.099	SDSS	bll	BLLAC	-	-
J0759.6 + 1321	SDSS J075936.13 + 132117.8	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0800.3 + 5611	1RXS J080017.3 + 561116	-	-	-	bcu	UNCL	-	-
J0800.9 + 4401	B3 0757 + 441	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0801.1 + 1335	NVSS J080115 + 133643	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0801.1 + 6444	RX J0801.0 + 6444	-	-	-	bll	BLLAC	-	A tentative $z = 0.2$ was proposed by Caccianiga+ (2002).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0801.3 + 6631	GB6 J0801 + 6639	-	-	-	bcu	UNCL	-	-
J0802.0 + 1006	NVSS J080159 + 100535	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017).
J0802.3 − 0942	WISEA J080215.63 − 094250.9	-	-	-	bcu	UNCL	-	-
J0803.0 + 2439	NVSS J080307 + 243749	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0803.2 − 0337	TXS 0800 − 034	-	0.365	Chang+ (2019)	fsrq	BLLAC	-	It is not clear the origin of this value, but it is indicated as a firm value.
J0803.5 + 2046	GB6 B0800 + 2046	GB6 J0803 + 2038	2.67	SDSS	bcu	FSRQ	-	-
J0804.5 + 0414	TXS 0802 + 043	-	-	-	bcu	UNCL	-	-
J0804.9 − 0624	1RXS J080458.3 − 062432	-	-	-	bcu	UNCL	-	-
J0805.0 + 6746	GB6 J0805 + 6745	-	-	-	bcu	UNCL	-	-
J0805.1 + 7744	WN B0759.6 + 7744	-	-	-	bcu	UNCL	-	-
J0805.2 − 0110	PKS B0802 − 010	-	1.39	Healey+ (2008)	fsrq	FSRQ	-	Jackson+ (2002) give $z = 0.088$ on the basis of the association with the cluster Zw 0802 − 01. However, the radio positions differ by 41″.
J0805.4 + 6147	TXS 0800 + 618	-	3.03	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	-
J0805.4 + 7534	RX J0805.4 + 7534	-	0.121	Nass+ (1996)	bll	BLLAC	-	-
J0805.9 + 3834	NVSS J080551 + 383538	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0806.1 − 0458	CRATES J080608.79 − 045411.4	-	-	-	bcu	UNCL	-	-
J0806.5 + 4503	B3 0803 + 452	-	2.11	Henstock+ (1997)	fsrq	FSRQ	-	SDSS.
J0806.5 + 5930	SBS 0802 + 596	-	-	-	bll	BLLAC	-	Nilsson+ (2003) suggested $z = 0.3$ on the basis of the imaging of the host galaxy.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0807.0 − 6102	PMN J0806 − 6101	-	-	-	bcu	UNCL	-	-
J0807.1 − 0541	PKS 0804 − 05	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0807.2 − 7630	PMN J0807 − 7629	-	-	-	bcu	UNCL	-	-
J0807.7 − 1206	CRATES J080736.06 − 120745.9	-	-	-	bcu	UNCL	-	-
J0808.2 − 0751	PKS 0805 − 07	-	1.84	White+ (1988)	fsrq	FSRQ	-	-
J0808.5 + 4950	OJ 508	-	1.43	Hewitt+Burbidge (1987)	fsrq	FSRQ	-	SDSS. There are two more values, obviously wrong: $z = 0.351$ from Arp+ (1990) and $z = 0.29$ from Zieba+Chyzy (1991).
J0809.3 + 4053	S4 0805 + 41	-	1.42	Xu+ (1994)	fsrq	FSRQ	-	SDSS.
J0809.5 + 5341	87GB 080551.6 + 535010	-	2.13	Healey+ (2008)	fsrq	FSRQ	-	SDSS
J0809.6 + 3455	B2 0806 + 35	-	0.082	Marcha+ (1996)	bll	BLLAC	-	SDSS
J0809.8 + 5218	1ES 0806 + 524	-	0.138	Bade+ (1998)	BLL	BLLAC	-	SDSS inconclusive.
J0811.0 − 7529	PMN J0810 − 7530	-	-	-	bll	BLLAC	-	Ackermann+ (2016) give $z = 0.689$, but this is a lower limit from absorption features in the spectrum, as indicated by Shaw+ (2013).
J0811.4 + 0146	OJ 014	-	1.15	Sbarufatti+ (2005)	bll	BLLAC	-	-
J0812.0 + 0237	PMN J0811 + 0237	-	0.173	Paiano+ (2020)	bll	BLLAC	-	-
J0812.3 + 1143	GB6 J0812 + 1141	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0812.5 + 0711	MG1 J081238 + 0712	PMN J0812 + 0711	-	-	bcu	UNCL	-	-
J0812.6 + 2821	RX J0812.5 + 2820	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J0812.8 + 6507	GB6 J0812 + 6508	-	-	-	bll	BLLAC	-	Featureless, Massaro+ (2015).
J0812.9 + 5555	NVSS J081251 + 555422	-	0.383	Plotkin+ (2008)	bll	BLLAC	-	SDSS inconclusive.
J0813.7 − 0356	NVSS J081338 − 035716	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0814.2 − 1013	NVSS J081411 − 101208	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J0814.4 + 2941	RX J0814.4 + 2941	-	0.374	SDSS	bll	FSRQ	-	-
J0814.4 + 6926	1RXS J081407.6 + 692549	-	-	-	bcu	UNCL	-	-
J0814.6 + 6430	GB6 J0814 + 6431	-	0.239	Shaw+ (2013)	bll	BLLAC	-	-
J0815.6 + 3641	OJ 230	-	1.03	Mavrides+Mutus (1984)	fsrq	FSRQ	-	SDSS.
J0815.9 + 2951	2MASX J08153642 + 2950218	-	0.331	Brand+ (2005)	bcu	BLLAC	-	SDSS. The source is in a sample of radio galaxies, but there is no indication of what type, and the radio spectrum is flat ($\alpha \sim 0.3$).
J0816.1 + 4909	NVSS J081609 + 491005	-	-	-	bll	BLLAC	-	SDSS and LAMOST (1, 2) spectra inconclusive.
J0816.3 + 5739	SBS 0812 + 578	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). LAMOST inconclusive.
J0816.4 − 1311	PMN J0816 − 1311	-	-	-	bll	BLLAC	-	The latest observation made by Paiano+ (2020) still reported a featureless spectrum. 6dF gives $z = 0.04598$, but with quality 3.
J0816.9 + 2050	SDSS J081649.78 + 205106.4	-	-	-	bll	BLLAC	-	SDSS inconclusive.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0817.1 + 1955	CRATES J081705 + 195836	-	-	-	bcu	UNCL	-	The coordinates of the counterpart given by 4FGL do not match the coordinates of the indicated radio source (difference ∼10″). Since neither SIMBAD nor NED have such CRATES source, I have considered the RA and DEC given in the 4FGL (124°.2729, +19°.9786). The radio source 87 GB 081412.0 + 200757 matches these coordinates. There is one redshift $z = 0.138$ given by Glikman+ (2007), who also indicated a Sb morphology of the host galaxy. However, it seems to be an error: the SDSS show only one spiral galaxy at ∼34″ from the position of the radio source. There is another optical counterpart coincident with the radio coordinates, but with a noisy spectrum, and thus the value from the automatic pipeline is unreliable. If this is confirmed to be the counterpart of the γ-ray source, then it is likely to be a BL Lac Object.
J0817.8 + 3243	RX J0817.9 + 3243	-	-	-	bll	BLLAC	-	SDSS and LAMOST (1, 2) inconclusive.
J0817.8 − 0934	TXS 0815 − 094	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). Meisner+Romani (2010) suggested an uncertain $z = 0.71$ on the basis of the imaging of the host galaxy.
J0818.2 + 4222	S4 0814 + 42	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS and LAMOST inconclusive.
J0818.4 + 2816	GB6 J0818 + 2813	-	0.225	Plotkin+ (2008)	bll	BLLAC	-	SDSS.
J0818.7 + 3153	B2 0815 + 32	-	-	-	bll	BLLAC	-	SDSS gives $z = 0.109$ on the basis of one feature identified as Hα. However, the spectrum is quite noisy and the identification rather doubtful.
J0818.8 + 3229	RX J0818.9 + 3227	-	0.651	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	SDSS gives $z = 2.017$, but it likely a wrong identification due to the low S/N.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0819.0 + 2746	5C 07.119	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0819.4 + 4035	GB6 J0819 + 4037	-	0.389	SDSS	bll	BLLAC	-	Véron-Cetty+Véron (2006) give the same value of z, but with reference to White+ (2000), and, in turn, did not report any z and commented with "uncertain quasar classification".
J0819.4 − 0756	RX J0819.2 − 0756	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J0820.3 + 3639	MG2 J082018 + 3640	FIRST J082020.2 + 364004	-	-	bll	BLLAC	-	SDSS inconclusive.
J0820.9 + 2353	GB6 J0820 + 2353	FIRST J082051.2 + 235345	0.402	SDSS	bll	BLLAC	-	-
J0820.9 − 1258	PKS 0818 − 128	OJ −131	0.539	Landoni+ (2013)	bll	BLLAC	-	There are several values of z, likely due to the weakness of the emission features. Landoni+ (2013) reported FWHM(Hβ) = 1100 km/s, but this is likely due to the weakness of the emission line (EW∼0.7 Å) caused by a high jet activity (see Foschini 2012).
J0821.1 + 1007	SDSS J082054.81 + 100609.4	-	0.954	SDSS	bcu	FSRQ	-	-
J0823.1 + 4042	B3 0819 + 408	-	0.865	SDSS	fsrq	FSRQ	-	-
J0823.1 − 6330	1RXS J082316.0 − 632928	-	-	-	bll	BLLAC	-	Featureless, Chang+ (2017).
J0823.3 + 2224	OJ 233	-	0.951	Stickel+ (1991)	bll	BLLAC	-	SDSS
J0824.4 + 2440	B2 0821 + 24	-	1.24	Willot+ (1998)	fsrq	FSRQ	-	-
J0824.7 + 5552	OJ 535	-	1.42	Wills+Wills (1976)	fsrq	FSRQ	-	SDSS

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0824.9 + 3915	4C +39.23	-	1.22	Schmidt (1974)	fsrq	FSRQ	-	Please note that ADS scanned the first printing of the Schmidt's paper, which does not include the table with the redshifts because of an error, and ADS did not upload the Errata Corrige, where the table is printed. It was necessary to retrieve the correct paper from our local library. There are also data from SDSS.
J0825.8 + 0309	PKS 0823 + 033	-	0.506	Stickel+ (1991)	bll	BLLAC	-	-
J0826.4 − 6404	SUMSS J082627 − 640414	-	-	-	bll	UNCL	-	-
J0827.0 − 0708	PMN J0827 − 0708	-	-	-	bll	UNCL	-	Massaro+ (2013) reported $z = 0.12$, but the origin is unknown. They cited 6dF (Jones+ (2009)), which, in turn, reported $z = 0$ with quality factor 1. Another value of $z = 0.247$ is given by 3FGL (Ackermann+ (2015)), but—again—the origin is unknown. In addition, 3FGL classified this source as bcu, which should be unlikely with the optical spectrum.
J0827.8 + 5221	TXS 0824 + 524	-	0.338	Hook+ (1996)	fsrq	FSRQ	-	SDSS
J0828.0 + 2307	NVSS J082801 + 231215	-	-	-	bll	BLLAC	-	Brand+ (2005) gave $z = 0.24$, but this was obtained with two methods (model, cross-correlation with template), which, in turn, gave consistent results. SDSS inconclusive.
J0828.3 + 4152	B3 0824 + 420	-	0.226	Wei+ (1999)	bll	MIS	-	SDSS. Steep radio spectrum.
J0828.6 − 0747	NVSS J082854 − 074854	-	-	-	bcu	UNCL	-	-
J0829.0 + 1755	TXS 0826 + 180	-	0.0894	Bauer+ (2000)	bll	MIS	E	SDSS. Miraghei+Best (2017) indicated a FRI morphology.
J0829.4 + 0857	TXS 0826 + 091	-	0.866	Landt+ (2001)	fsrq	MIS	-	Landt+ (2001) indicated a steep radio spectrum, confirmed by `specfind`.
J0829.6 − 1140	NVSS J082939 − 114103	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0829.7 − 5856	PMN J0829 − 5856	-	-	-	bcu	UNCL	-	-
J0830.0 + 5231	RX J0830.1 + 5230	-	0.206	SDSS	bcu	BLLAC	-	-
J0830.1 − 0946	1RXS J083014.6 − 094455	-	-	-	bcu	UNCL	-	-
J0830.8 + 2410	S3 0827 + 24	-	0.941	Steidel+Sargent (1991)	FSRQ	FSRQ	-	SDSS
J0831.4 + 2631	MG2 J083121 + 2629	NVSS J083118 + 263025	-	-	bcu	UNCL	-	-
J0831.5 + 1747	GB6 J0831 + 1746	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0831.8 + 0429	PKS 0829 + 046	-	0.174	Falomo (1991)	bll	BLLAC	-	SDSS
J0832.2 + 2753	OJ 250	-	-	-	bcu	UNCL	-	Wills+Wills (1976) indicated a M-type star spectrum. No other recent spectra have been published. BLLAC?
J0832.4 + 4912	OJ 448	-	0.548	Stickel+ (1993)	bll	BLLAC	-	SDSS inconclusive.
J0833.4 − 0458	PMN J0833 − 0454	-	3.45	Paliya+ (2020)	fsrq	FSRQ	-	-
J0833.9 + 4223	OJ 451	-	0.249	Henstock+ (1997)	fsrq	CLAGN	-	SDSS shows evident emission lines. On the opposite, LAMOST spectra are quite noisy, but the Hα seems to be confirmed, although much weaker than SDSS spectrum (1, 2, 3). Likely a changing-look AGN: also Hook+ (1996) found a noisy and featureless spectrum before Henstock.
J0834.6 + 4402	B3 0831 + 442	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS and LAMOST inconclusive.
J0835.0 + 6243	GB6 J0834 + 6249	-	-	-	bcu	UNCL	-	-
J0835.2 − 2243	PMN J0834 − 2241	-	1.06	Healey+ (2008)	fsrq	FSRQ	-	-
J0835.7 + 0936	GB6 J0835 + 0936	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0836.2 + 2141	MG2 J083615 + 2138	-	-	-	bcu	UNCL	-	-
J0836.5 − 2026	PKS 0834 − 20	-	2.75	Fricke+ (1983)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0837.3 + 1458	RGB J0837 + 149	BWE 0834 + 1508	0.278	Plotkin+ (2010)	bll	BLLAC	E	SDSS.
J0839.4 + 1803	TXS 0836 + 182	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive. Abraham+ (1991) estimated a doubtful $z \sim$ 0.27–0.28 on the basis of the imaging of the host galaxy.
J0839.7 + 3540	NVSS J083943 + 354001	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS and LAMOST inconclusive.
J0839.8 + 0105	PKS 0837 + 012	-	1.12	Owen+ (1995)	fsrq	FSRQ	-	-
J0840.8 + 1317	3C 207	-	0.680	Lynds (1967)	ssrq	MIS	-	FRII, HERG, steep radio spectrum Laing+ (1983). SDSS.
J0841.3 + 7053	4C +71.07	-	2.17	Stickel+ (1989)	FSRQ	FSRQ	-	-
J0842.3 − 6053	PMN J0842 − 6053	-	-	-	bcu	UNCL	-	-
J0842.5 + 0251	NVSS J084225 + 025251	-	0.425	SDSS	bll	BLLAC	-	The SDSS spectrum is rather noisy, but the redshift was confirmed by observations at NTT by Kügler+ (2014).
J0842.7 + 6656	TXS 0838 + 671	-	-	-	bcu	UNCL	-	-
J0843.0 − 0853	PMN J0843 − 0848	-	-	-	bcu	UNCL	-	-
J0844.2 + 5312	NVSS J084411 + 531250	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS and LAMOST inconclusive.
J0845.4 + 0442	MG1 J084516 + 0439	PMN J0845 + 0440	-	-	bcu	UNCL	-	-
J0846.5 − 2609	TXS 0844 − 259	-	-	-	bcu	UNCL	-	-
J0846.9 + 4608	WISE J084734.29 + 460928.0	B3 0844 + 463	1.22	SDSS	fsrq	FSRQ	-	-
J0847.0 − 2336	PMN J0847 − 2337	-	0.059	Shaw+ (2013)	bcu	BLLAC	-	-
J0847.2 + 1134	RX J0847.1 + 1133	-	0.198	Cao+ (1999)	bll	BLLAC	-	SDSS

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0847.9 − 0702	TXS 0845 − 068	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0848.0 − 0524	PKS 0845 − 051	-	1.24	Wright+ (1979)	fsrq	FSRQ	-	-
J0848.7 + 0508	SDSS J084839.66 + 050617.8	-	-	-	bll	BLLAC	-	Featureless, Masetti+ (2013).
J0848.7 + 7017	GB6 J0848 + 7017	-	-	-	bcu	BLLAC	-	Featureless, Paiano+ (2019).
J0848.9 + 0205	PMN J0849 + 0206	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0849.1 + 6607	GB6 J0848 + 6605	-	-	-	bll	BLLAC	-	Featureless, Massaro+ (2015).
J0849.5 + 0456	TXS 0846 + 051	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0850.0 + 4855	GB6 J0850 + 4855	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J0850.0 + 5108	SBS 0846 + 513	-	0.584	Zhou+ (2005)	NLSY1	NLS1	-	SDSS
J0850.1 − 1212	PMN J0850 − 1213	-	0.566	Halpern+Eracleous (1997)	fsrq	FSRQ	-	-
J0850.5 + 3455	RX J0850.5 + 3455	-	0.145	Brinkmann+ (2000)	bll	BLLAC	E	SDSS.
J0851.5 + 5528	GB6 J0851 + 5528	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0852.2 + 2834	B2 0849 + 28	-	1.29	Stocke+ (1983)	fsrq	FSRQ	-	SDSS
J0854.0 + 2753	SDSS J085410.16 + 275421.7	-	0.494	SDSS	bll	BLLAC	-	-
J0854.3 + 4408	B3 0850 + 443	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J0854.8 + 2006	OJ 287	-	0.306	Miller+ (1978)	BLL	BLLAC	-	SDSS and LAMOST (eight spectra) inconclusive. Miller's value was confirmed by Sitko+Junkkarinen (1985) during an observation with the jet in low state.
J0855.4 − 0714	PKS 0852 − 07	3C 209	-	-	bcu	UNCL	-	-
J0855.9 + 7144	GB6 J0856 + 7146	-	0.541	Pursimo+ (2013)	fsrq	FSRQ	-	-
J0856.6 − 1105	PMN J0856 − 1105	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0856.8 + 2056	TXS 0853 + 211	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0856.8 + 8559	NVSS J085740 + 860344	-	-	-	bcu	UNCL	-	-
J0857.7 + 0137	RX J0857.8 + 0135	-	0.281	SDSS	bll	BLLAC	-	-
J0857.9 − 1949	PKS 0855 − 19	-	0.660	White+ (1988)	fsrq	FSRQ	-	-
J0858.1 + 1405	3C 212	-	1.05	SDSS	ssrq	MIS	-	FRII according to Laing+ (1983).
J0859.4 + 6218	1RXS J085930.5 + 621737	-	-	-	bll	UNCL	-	-
J0859.4 + 8345	1RXS J085916.5 + 834450	-	0.327	Beckmann+ (2003)	bll	BLLAC	-	-
J0900.6 − 7408	AT20G J085959 − 741401	-	-	-	bcu	UNCL	-	-
J0900.7 − 1243	TXS 0858 − 125	-	-	-	bcu	UNCL	-	-
J0901.2 + 6742	TXS 0856 + 679	-	-	-	bll	BLLAC	-	Featureless, Massaro+ (2015).
J0901.4 + 4542	NVSS J090208 + 454433	-	0.288	SDSS	bll	BLLAC	-	-
J0901.5 + 6711	1RXS J090140.8 + 671158	-	-	-	bcu	UNCL	-	-
J0902.4 + 2051	NVSS J090226 + 205045	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J0902.4 + 6440	GB6 J0902 + 6444	-	-	-	bcu	UNCL	-	SDSS inconclusive.
J0903.1 + 4652	S4 0859 + 47	-	1.465	Lawrence+ (1996)	fsrq	FSRQ	-	SDSS
J0904.0 + 2724	B2 0900 + 27	-	1.72	SDSS	bcu	FSRQ	-	-
J0904.6 + 4238	4C +42.28	-	1.34	SDSS	fsrq	FSRQ	-	-
J0905.6 + 1358	MG1 J090534 + 1358	NVSS J090535 + 135803	0.224	Paiano+ (2020)	bll	BLLAC	-	Tentative (reliable). SDSS and LAMOST inconclusive.
J0906.2 − 1707	CRATES J0906 − 1706	-	-	-	bcu	UNCL	-	-
J0906.3 − 0905	PMN J0906 − 0905	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0906.7 + 4950	87GB 090322.8 + 500444	-	1.64	Glikman+ (2004)	fsrq	FSRQ	-	SDSS

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0908.9 + 2311	RX J0908.9 + 2311	-	0.432	Rosa-González+ (2017)	bll	BLLAC	-	-
J0909.1 + 0121	PKS 0906 + 01	-	1.02	Burbidge+Strittmatter (1972)	fsrq	FSRQ	-	SDSS
J0909.6 + 0159	PKS 0907 + 022	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS inconclusive.
J0909.7 + 3104	B2 0906 + 31	-	0.272	Bauer+ (2000)	bll	BLLAC	E	SDSS
J0909.7 − 0230	PKS 0907 − 023	-	0.957	Wills+Lynds (1978)	fsrq	FSRQ	-	-
J0910.0 + 4257	3C 216	-	0.670	Smith+Spinrad (1980)	css	CLAGN	-	CSS/HERG, see Barthel+ (1988) and Best+Heckman (2012). Schmidt (1968) reported a featureless spectrum, implying a changing-look AGN. SDSS, LAMOST.
J0910.6 + 2247	TXS 0907 + 230	-	2.68	Healey+ (2008)	fsrq	FSRQ	-	SDSS
J0910.6 + 3329	Ton 1015	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive. Bauer+ (2000), Shaw+ (2013), and Paiano+ (2020) all reported featureless spectra. Please note an error in the CDS catalog of Bauer+ (2000), which affected also the entries in SIMBAD and NED databases: it is reported $z = 0.354$, but the paper reported a featureless spectrum.
J0910.8 + 3859	FBQS J091052.0 + 390202	-	0.199	SDSS	bll	BLLAC	-	-
J0911.7 + 3349	MG2 J091151 + 3349	-	0.456	SDSS	bll	BLLAC	-	-
J0912.2 + 2800	RX J0912.2 + 2759	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS and LAMOST inconclusive.
J0912.2 + 4127	B3 0908 + 416B	-	2.57	Shaw+ (2012)	fsrq	FSRQ	-	SDSS
J0912.2 − 2751	PMN J0912 − 2752	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0912.5 + 1556	RX J0912.5 + 1555	NVSS J091230 + 155529	0.212	Bauer+ (2000)	bll	BLLAC	-	Warning: RX J0912.5 + 1555 is usually associated with the cluster Abell 763 ($z = 0.0851$). The closest radio source is NVSS J091230 + 155529, but it is a background BL Lac not associated to the cluster.
J0912.9 − 2102	MRC 0910 − 208	-	0.198	Jones+ (2009)	bll	BLLAC	-	Although the quality flag is 3 (reliable > 90%), the Ca H&K break is clearly visible.
J0913.3 + 8133	1RXS J091324.6 + 813318	-	0.639	Beckmann+ (2003)	bll	BLLAC	-	-
J0914.1 − 0202	1RXS J091407.9 − 015949	-	-	-	bcu	UNCL	-	-
J0914.4 + 0249	PKS 0912 + 029	-	0.427	Drinkwater+ (1997)	fsrq	FSRQ	-	SDSS
J0915.4 − 3027	PMN J0915 − 3030	-	-	-	bcu	UNCL	-	-
J0915.9 + 2933	Ton 396	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017). SDSS inconclusive.
J0916.7 + 3856	4C +38.28	-	1.268	Allington-Smith+ (1988)	fsrq	FSRQ	-	SDSS
J0916.7 + 5238	RX J0916.8 + 5238	-	0.190	Nass+ (1996)	bll	BLLAC	E	SDSS
J0917.1 − 2131	PKS 0915 − 213	-	0.847	Wright+ (1979)	fsrq	FSRQ	-	-
J0917.3 − 0342	NVSS J091714 − 034315	-	0.308	Álvarez Crespo+ (2016)	bll	BLLAC	-	-
J0918.9 − 0625	PMN J0918 − 0628	-	-	-	bcu	UNCL	-	-
J0919.3 − 2202	1RXS J091926.5 − 220052	-	-	-	bcu	UNCL	-	-
J0920.3 − 0443	TXS 0917 − 044	-	-	-	bcu	UNCL	-	-
J0920.9 + 4441	S4 0917 + 44	-	2.188	Hewitt+Burbidge (1987)	fsrq	FSRQ	-	SDSS. Complex radio morphology (core+lobe, jet bending ∼60°, Neff+Hutchings (1990)), but with a flat radio spectrum and superluminal motion (β_{app}∼13c) according to the MOJAVE project.
J0920.9 − 2256	NVSS J092057 − 225721	-	-	-	bll	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0921.6 + 6216	OK 630	-	1.447	Stickel+Kühr (1993)	fsrq	FSRQ	-	SDSS
J0921.7 + 2336	NVSS J092145 + 233548	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J0922.4 − 0528	TXS 0919 − 052	-	0.974	Healey+ (2008)	fsrq	AMB	-	Healey+ (2008) classified it as NLRG, because of FWHM $\lesssim$ 1000 km/s (no images of the optical spectrum are available), but the radio spectrum is flat (from NED, $\alpha \sim 0.3$). Perhaps SEY?
J0922.6 + 0434	GB6 J0922 + 0433	-	-	-	bcu	UNCL	-	-
J0922.6 + 4454	NVSS J092235 + 445749	-	0.457	SDSS	bcu	SEY	-	Intermediate. Deller+Middleberg (2014) reported a compact radio source. The radio spectrum is flat.
J0923.5 + 3852	B2 0920 + 39	-	-	-	bcu	UNCL	-	-
J0923.5 + 4125	B3 0920 + 416	-	1.73	Shaw+ (2012)	fsrq	FSRQ	-	Some differences in redshift measurements: the first observation (Hook+ 1996) resulted in a featureless spectrum; then, Falco+ (1998) reported a galaxy-dominated spectrum at $z = 0.028$, on the basis of Hα and [OIII] (plus weak Hβ and Ca H&K), but there was no spectrum published. The SDSS spectrum is quite noisy, but similar to that published by Shaw+ (2012). The featureless spectrum reported by Hook+ (1996) seems to be due to low S/N rather than a real change of classification.
J0924.0 + 0534	RBS 771	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive. Piranomonte+ (2007) reported a featureless spectrum and set $z > 0.65$. Chang+ (2019) reported a firm redshift of $z = 0.57$, but no spectrum was published. It seems the value of the automatic pipeline of SDSS is DR3, which is unreliable because the spectrum is featureless and noisy.
J0924.0 + 2816	B2 0920 + 28	-	0.744	SDSS	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0925.7 + 3126	B2 0922 + 31B	-	-	-	bll	BLLAC	-	SDSS inconclusive. In the literature, $z = 0.26$ from Tinti+de Zotti (2006) is often cited, but it is a photometric value.
J0925.7 + 5959	NVSS J092542 + 595812	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0926.4 + 5412	NVSS J092638 + 541126	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0927.2 + 2454	MG2 J092720 + 2456	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J0928.1 − 2035	PKS 0925 − 203	-	0.347	Peterson+ (1979)	fsrq	FSRQ	-	6dF
J0928.2 − 3048	PKS 0926 − 306	-	-	-	bcu	UNCL	-	-
J0928.4 − 0415	PKS B0926 − 039	-	-	-	bcu	UNCL	-	-
J0928.5 + 4048	1RXS J092837.8 + 404858	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0928.7 − 3529	NVSS J092849 − 352947	-	-	-	bll	UNCL	-	-
J0929.3 + 5014	GB6 J0929 + 5013	-	-	-	bll	BLLAC	-	SDSS inconclusive. A value of $z = 0.37$ is often found in the literature, but it is one of the early measurements from the SDSS DR3: unreliable.
J0929.3 − 2414	NVSS J092928 − 241632	-	-	-	bcu	UNCL	-	-
J0929.6 + 4621	SDSS J092922.75 + 462046.4	-	-	-	bcu	UNCL	-	-
J0930.3 + 8612	S5 0916 + 864	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J0930.5 + 4951	1ES 0927 + 500	-	0.187	Perlman+ (1996)	bll	BLLAC	-	SDSS
J0930.7 + 3502	B2 0927 + 35	-	-	-	bll	BLLAC	-	Featureless, Caccianiga+ (2002).
J0930.9 + 0033	PKS 0928 + 008	-	1.77	SDSS	fsrq	FSRQ	-	Early estimation was $z = 0.505$ by Jauncey+ (1984), who identified a line at 4211 Å as MgII. The SDSS spectrum shows that instead it is CIV. Other lines in the spectrum support this finding.
J0930.9 − 1015	TXS 0928 − 099	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0931.2 − 8533	PKS 0936 − 853	-	-	-	bcu	UNCL	-	-
J0931.9 + 6737	NGC 2892	-	0.0228	Wegner+ (2003)	rdg	MIS	E	FRI with twin-jet morphology. Noel-Storr+ (2003).
J0932.6 + 5306	S4 0929 + 53	-	0.597	Stickel+Kuhr (1994)	fsrq	NLS1	-	FWHM(Hβ)∼1897 km/s (Rakshit+ (2017)). SDSS
J0932.7 + 1041	NVSS J093239 + 104231	-	0.361	SDSS	bll	BLLAC	-	-
J0934.3 + 3926	GB6 J0934 + 3926	-	-	-	bll	BLLAC	-	Featureless, SDSS.
J0934.5 − 1720	RXC J0934.4 − 1721	-	0.250	Bauer+ (2000)	bll	BLLAC	-	-
J0935.3 − 1736	NVSS J093514 − 173658	-	-	-	bll	BLLAC	-	Featureless, Desai+ 2019.
J0936.3 − 2111	TXS 0933 − 209	-	-	-	bll	UNCL	-	-
J0936.5 + 1847	GB6 J0936 + 1850	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J0937.1 + 5008	GB6 J0937 + 5008	-	0.276	Henstock+ (1997)	fsrq	SEY	-	SDSS. Rakshit+ (2017) classified it as NLS1, with FWHM(Hβ)∼1866 km/s and weak FeII. However, Henstock+ (1997) reported FWHM(Hβ)∼4105 km/s, and also Shaw+ (2012) measured a broad FWHM(Hβ)∼3400 km/s on the same SDSS spectrum. The Hβ profile is distorted at its base, and there is significant noise. It seems more an intermediate Seyfert.
J0937.9 − 1434	NVSS J093754 − 143350	-	0.287	Paiano+ (2017)	bll	BLLAC	-	-
J0939.3 − 1732	TXS 0936 − 173	-	1.831	Krogager+ (2018)	bcu	FSRQ	-	-
J0940.0 − 2828	TXS 0937 − 282	-	-	-	bcu	UNCL	-	-
J0940.4 + 6148	RX J0940.3 + 6148	-	0.211	Bauer+ (2000)	bll	BLLAC	E	SDSS
J0940.9 − 1335	TXS 0938 − 133	-	0.551	Healey+ (2008)	fsrq	FSRQ	-	-
J0941.7 + 4125	GB6 J0941 + 4121	-	0.816	White+ (2000)	bcu	FSRQ	-	SDSS

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0941.9 + 2724	GB6 J0941 + 2721	-	-	-	bll	BLLAC	-	In the 2LAC the source is identified as fsrq with $z = 1.254$, but, in the more recent version of the catalog, the source is identified as bll without redshift. SDSS spectrum is inconclusive, but at least it favors a BLLAC identification.
J0942.3 + 2842	NVSS J094223 + 284413	-	0.366	SDSS	bll	BLLAC	-	-
J0942.3 − 0800	PMN J0942 − 0800	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ 2016.
J0943.7 + 6137	FIRST J094420.3 + 613550	-	0.791	SDSS	bcu	FSRQ	-	-
J0944.2 + 5557	NVSS J094441 + 555752	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0945.2 + 5200	WISE J094452.09 + 520233.4	SBS 0941 + 522	0.563	Walsh+ (1984)	fsrq	FSRQ	-	SDSS
J0945.5 + 4635	B3 0942 + 468	-	0.639	Britzen+ (2007)	fsrq	MIS	-	SDSS. Healey+ (2008) also performed optical spectroscopy and confirmed the value of z, but they classified it as fsrq. Britzen+ (2007) also analyzed radio data (VLA), which allowed them to estimate the viewing angle $\theta \sim 66^\circ$ and $\beta_{\rm app} \sim 1.5$.
J0945.7 + 5759	GB6 J0945 + 5757	-	0.229	SDSS	bll	BLLAC	-	SDSS shows another object with the same redshift at $\sim 5''$ ($\sim$19 kpc), but with a redder spectrum and no radio counterpart. No specific publication was found in the literature. Interacting galaxies?
J0946.0 + 4735	RX J0946.0 + 4735	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0946.2 + 0104	1RXS J094620.5 + 010459	-	0.577	SDSS	bll	BLLAC	-	-
J0946.2 + 1016	TXS 0943 + 105	-	1.004	Afanas'ev+ (2003)	fsrq	FSRQ	-	SDSS
J0947.1 − 2541	1RXS J094709.2 − 254056	-	-	-	bll	UNCL	-	-
J0947.6 + 2215	TXS 0944 + 225	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J0947.9 + 1121	NVSS J094746 + 112020	-	0.187	SDSS	bll	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0948.6 − 0338	PMN J0948 − 0338	-	-	-	bcu	UNCL	-	-
J0948.9 + 0022	PMN J0948 + 0022	-	0.584	Williams+ (2002)	NLSY1	NLS1	-	SDSS
J0949.0 + 4038	4C +40.24	-	1.25	Wills+Wills (1976)	fsrq	FSRQ	-	SDSS
J0949.2 + 1749	TXS 0946 + 181	-	0.693	SDSS	fsrq	FSRQ	-	-
J0949.7 + 5819	87GB 094609.3 + 583301	-	1.42	SDSS	bcu	FSRQ	-	-
J0950.2 + 0615	GB6 J0950 + 0615	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0950.2 + 4553	RX J0950.2 + 4553	-	-	-	bll	BLLAC	-	SDSS and LAMOST (2) inconclusive.
J0952.1 + 3932	RX J0952.2 + 3936	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0952.2 + 7503	RBS 804	-	0.181	Bauer+ (2000)	bll	BLLAC	-	-
J0952.8 + 0712	SDSS J095249.57 + 071329.9	-	0.574	Paiano+ (2017)	bll	BLLAC	-	-
J0953.0 − 0840	PMN J0953 − 0840	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J0953.4 − 7659	RX J0953.1 − 7657	-	-	-	bcu	UNCL	-	-
J0954.2 + 4913	1ES 0950 + 495	-	-	-	bll	BLLAC	-	SDSS inconclusive. Several papers reported $z = 0.207$, which was indicated as possible by Morris+ (1991) on the basis of the redshift of a nearby galaxy.
J0955.1 + 3551	1RXS J095508.2 + 355054	-	0.557	Paiano+ (2020)	bll	BLLAC	-	Possible neutrino source.
J0955.2 + 0835	NVSS J095501 + 083342	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J0956.0 + 3936	WISE J095608.57 + 393515.8	-	1.173	Vigotti+ (1997)	fsrq	FSRQ	-	SDSS
J0956.5 − 0958	1RXS J095627.2 − 095720	-	0.161	Grazian+ (2002)	bll	BLLAC	-	-
J0956.7 + 2516	OK 290	-	0.708	Burbidge+Strittmatter (1972)	fsrq	FSRQ	-	SDSS. Calderone+ (2012) suggested it might be a NLS1 on the basis of an asymmetric profile of Hβ.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0957.3 − 1348	PMN J0957 − 1350	-	1.32	Healey+ (2008)	fsrq	FSRQ	-	-
J0957.6 + 5523	4C +55.17	-	0.903	Wills+Wills (1974)	fsrq	FSRQ	-	SDSS. Double peaked Hβ and other lines with evident red wings.
J0957.8 + 3423	B2 0954 + 34	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J0958.0 + 3222	3C 232	-	0.531	Wills (1966)	fsrq	NLS1	-	SDSS. Phillips (1978) reported the typical NLS1 spectrum (FWHM(Hβ)$\sim$1360 km/s, bump FeII), but, at that epoch, the classification was not yet invented. Boksenberg+Sargent (1978) reported Ca H&K absorption features in the spectrum of 3C 232, which are due to the nearby ($\sim 2'$) spiral galaxy NGC 3067.
J0958.0 + 4728	OK 492	-	1.88	Burbidge+ (1977)	fsrq	FSRQ	-	SDSS
J0958.0 − 0319	1RXS J095806.4 − 031729	-	-	-	bll	BLLAC	-	Featureless, Piranomonte+ (2007).
J0958.1 − 6753	1RXS J095812.8 − 675241	-	-	-	bcu	UNCL	-	-
J0958.3 − 2656	NGC 3078	-	0.00828	Humason+ (1956)	rdg	AMB	E	Compact radio core, flat radio spectrum. It is indicated as radiogalaxy in the 4FGL, but the radio properties are not those of a radiogalaxy. No optical spectrum was published.
J0958.4 + 5042	7C 0955 + 5054	-	1.15	Hook+ (1996)	fsrq	FSRQ	-	SDSS
J0958.4 − 2441	TXS 0956 − 244	-	-	-	bcu	UNCL	-	-
J0958.7 + 6534	S4 0954 + 65	-	0.368	Lawrence+ (1986)	BLL	BLLAC	-	-
J0958.8 + 7039	GB6 J0958 + 7039	-	-	-	bcu	UNCL	-	-
J0959.4 + 2120	RX J0959.4 + 2123	-	0.365	Bauer+ (2000)	bll	BLLAC	-	SDSS

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J0959.6 + 4606	2MASX J09591976 + 4603515	-	-	-	bcu	UNCL	-	There is almost nothing in the literature. SIMBAD has no sources within 5″, while NED reports only infrared photometry and no radio data. However, the FIRST catalog reported a detection with a flux density of ∼4.1 mJy (not recognized by both SIMBAD and NED). SDSS displays only photometry and the image shows a likely edge-on spiral galaxy. Perhaps MIS?
J1001.1 + 2911	GB6 J1001 + 2911	-	0.556	Shaw+ (2012)	bll	FSRQ	-	The SDSS-DR13 shows a spectrum bluer than SDSS-DR16, but, in both cases, there is an evident emission line at ∼4400 Å, which was incorrectly identified as [OIII] in the DR13, resulting in a zero-value redshift. In the DR16, the line is correctly identified as MgII.
J1002.5 + 2215	1RXS J100235.8 + 221609	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1003.4 + 0205	SDSS J100326.63 + 020455.6	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J1003.6 + 2605	PKS 1000 + 26	-	-	-	bll	BLLAC	-	SDSS inconclusive
J1003.6 − 2137	1RXS J100342.0 − 213752	-	-	-	bcu	UNCL	-	-
J1006.5 + 6440	RX J1006.1 + 6440	-	-	-	bll	UNCL	-	SDSS inconclusive.
J1006.7 − 2159	PKS 1004 − 217	-	0.330	Bolton+Savage (1977)	fsrq	FSRQ	-	-
J1007.0 + 3455	EXO 1004.0 + 3509	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1007.6 − 3332	PKS 1005 − 333	-	1.84	Hook+ (2003)	fsrq	FSRQ	-	-
J1008.0 + 0028	PKS 1005 + 007	-	0.0977	Grandi (1983)	bcu	MIS	-	Classified as FRI by Owen+ (1995) (redshift refinement and emission line properties) and Owen+ (1996) (radio morphology). Yuan+ (2016) reported $z = 0.176$, but it is not clear the origin of this measurement.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1008.0 + 0620	MG1 J100800 + 0621	PMN J1008 + 0621	-	-	bll	BLLAC	-	Urrutia+ (2009) reported $z = 1.72$ from Keck observations, but Shaw+ (2013) found a featureless spectrum still at Keck. Although it could be a change of the spectral properties due to the jet variability, the former did not publish any spectrum, and thus it is not possible to check the measured value. The SDSS is inconclusive.
J1008.1 + 4706	RX J1008.1 + 4705	-	0.343	Bade+ (1998)	bll	BLLAC	-	SDSS
J1008.7 − 2909	PMN J1008 − 2912	-	-	-	bcu	UNCL	-	-
J1008.8 − 3139	PKS 1006 − 313	-	0.534	Landoni+ (2020)	bll	BLLAC	-	-
J1010.2 − 3119	1RXS J101015.9 − 311909	-	0.143	Piranomonte+ (2007)	bll	BLLAC	-	-
J1010.8 − 0158	PKS 1008 − 01	-	0.887	Drinkwater+ (1997)	fsrq	FSRQ	-	2dF
J1011.3 − 0427	PKS B1008 − 041	-	1.59	Perlman+ (1998)	fsrq	FSRQ	-	-
J1012.3 + 0629	NRAO 350	-	0.727	Sbarufatti+ (2005)	bll	AMB	-	The source displays ambiguous characteristics of both BL Lac Objects and FRII radio galaxies (Landt+Bignall (2008)). The SDSS clearly shows forbidden [OII] and [OIII] lines, but Sbarufatti+ (2005) also reported the detection of MgII. The radio spectrum is flat above 1.4 GHz, but steep below this frequency.
J1012.3 − 1232	PKS B1009 − 123	-	-	-	bcu	UNCL	-	-
J1012.7 + 2439	MG2 J101241 + 2439	-	1.81	Shaw+ (2009)	fsrq	FSRQ	-	SDSS
J1012.7 + 4228	B3 1009 + 427	-	0.365	Cao+ (1999)	agn	BLLAC	-	SDSS
J1013.3 − 2551	PKS B1010 − 255	-	-	-	bcu	UNCL	-	-
J1013.4 − 4006	NVSS J101319 − 400549	-	-	-	bll	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1013.7 + 3444	OL 318	-	1.41	Wills+Wills (1976)	fsrq	FSRQ	-	SDSS
J1014.3 + 4112	GB6 J1014 + 4112	-	-	-	bcu	UNCL	-	-
J1014.8 + 2257	OL 220	-	0.566	Schmidt (1974)	fsrq	FSRQ	-	SDSS. ADS scanned the first printing of Schmidt's paper, which did not include the table with the redshifts because of an error, and ADS did not upload the Errata Corrige, where the table is printed. It was necessary to retrieve the correct paper from our local library.
J1014.8 − 0537	AT20G J101446 − 054049	-	-	-	bcu	UNCL	-	-
J1015.0 + 4926	1H 1013 + 498	1ES 1011 + 496	0.212	Albert+ (2007)	bll	BLLAC	-	A value of $z = 0.2$ appeared in Lin+ (1996): they referred to Hewitt+Burbidge (1993), but that paper referred to Wisniewski+ (1986), which, in turn, reported a featureless spectrum and no redshift. SDSS spectrum is inconclusive, but with a strange blue tail.
J1015.6 + 5553	TXS 1012 + 560	-	0.678	SDSS	fsrq	FSRQ	-	-
J1016.0 + 0512	TXS 1013 + 054	-	1.70	SDSS	fsrq	FSRQ	-	-
J1016.4 + 7703	1RXS J101647.6 + 770239	-	-	-	bcu	UNCL	-	-
J1016.5 − 2650	NVSS J101634 − 265057	-	-	-	bcu	UNCL	-	-
J1017.3 + 5204	7C 1013 + 5217	-	0.379	Galbiati+ (2005)	bcu	BLLAC	-	SDSS
J1017.4 + 2538	NVSS J101724 + 253955	-	0.417	SDSS	bcu	BLLAC	-	-
J1017.8 + 0715	GB6 J1018 + 0715	-	1.54	SDSS	bcu	FSRQ	-	-
J1018.1 + 1905	NVSS J101808 + 190614	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1018.3 − 3124	PKS 1016 − 311	-	0.794	Drinkwater+ (1997)	fsrq	FSRQ	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1018.4 + 0528	TXS 1015 + 057	-	1.95	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	SDSS
J1018.4 + 3540	B2 1015 + 35B	-	1.23	Peterson+ (1978)	fsrq	FSRQ	-	Kraus+Gearhart (1975) reported $z = 1.6$, and this value remained in the literature for a while; it is not clear the reason of the mismatch. SDSS confirms Peterson's redshift.
J1018.8 + 5913	TXS 1015 + 594	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1018.9 + 1043	SDSS J101857.97 + 103625.6	-	0.660	SDSS	bcu	AMB	-	The SDSS spectrum is galaxy-dominated, with strong [OII] and other weak lines. The LAT spectrum is quite soft ($\Gamma \sim 3$), suggesting a misaligned AGN, rather than a BLLAC, but the radio spectrum is flat, although there are no measurements below 1.4 GHz.
J1019.7 + 6321	GB6 J1019 + 6319	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1021.1 + 1626	SDSS J102100.35 + 162554.0	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1021.4 + 8021	NVSS J102201 + 802350	-	-	-	bcu	UNCL	-	-
J1021.9 + 5123	MS 1019.0 + 5139	-	0.142	Stocke+ (1991)	bll	AMB	-	SDSS. The optical spectrum is more FRI-like than BL Lac (Rector+ (1999)), while the remaining MW characteristics are of a BL Lac Object.
J1022.4 − 4231	PMN J1022 − 4232	-	-	-	bll	UNCL	-	-
J1022.7 − 0112	RX J1022.7 − 0112	-	-	-	bll	BLLAC	-	Featureless, Landoni+ (2013).
J1023.1 + 3949	4C +40.25	-	1.25	Hewitt+Burbidge (1993)	fsrq	FSRQ	-	SDSS
J1023.2 + 2859	TXS 1020 + 292	-	-	-	fsrq	UNCL	-	SDSS inconclusive.
J1023.8 + 3002	RX J1023.6 + 3001	-	0.433	SDSS	bll	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1023.8 − 4335	RX J1023.9 − 4336	-	0.534*	Stadnik+Romani (2014)	bll	BLLAC	-	Featureless, Landoni+ (2013).
J1023.9 − 3236	PKS 1021 − 323	-	1.57	Hook+ (2003)	fsrq	FSRQ	-	-
J1024.8 + 2332	MG2 J102456 + 2332	RX J1024.9+2332	0.165	SDSS	bll	BLLAC	-	Strong Hα, flat radio spectrum, steep γ-ray spectrum ($\Gamma\sim$2.4).
J1026.9 + 0608	NVSS J102703 + 060934	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1026.9 − 1749	1RXS J102658.5 − 174905	-	-	-	bll	BLLAC	-	Bauer+ (2000) reported an uncertain $z = 0.114$, while Jones+ (2009) reported $z = 0.267$ with $q = 3$. No high quality spectra are available to verify one or the other value.
J1027.0 − 8542	PKS 1029 − 85	-	-	-	bll	BLLAC	-	Featureless, Titov+ (2017).
J1027.2 + 7427	GB6 J1027 + 7428	-	0.879	Falco+ (1998)	bcu	FSRQ	-	-
J1027.6 + 1828	GB6 J1027 + 1831	-	-	-	bcu	UNCL	-	-
J1027.6 + 6317	RX J1027.4 + 6317	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1027.6 + 8251	2MASS J10284195 + 8253398	-	-	-	bcu	UNCL	-	-
J1027.9 + 0252	TXS 1025 + 031	-	0.715	Healey+ (2008)	fsrq	FSRQ	-	-
J1028.3 + 3108	TXS 1025 + 313	-	0.240	Falco+ (1998)	bll	BLLAC	-	SDSS
J1028.4 − 0234	PMN J1028 − 0237	-	0.471	Landt+ (2001)	fsrq	FSRQ	-	SDSS
J1030.3 − 8403	PMN J1030 − 8402	-	-	-	bcu	UNCL	-	-
J1030.4 − 3001	PMN J1030 − 3004	-	-	-	bcu	UNCL	-	-
J1030.6 − 2028	NVSS J103040 − 203032	-	-	-	bll	BLLAC	-	Featureless, Desai+ (2019).
J1031.1 + 7442	S5 1027 + 74	-	0.123	Stickel+Kühr (1993)	bll	FSRQ	-	-
J1031.3 + 5053	1ES 1028 + 511	-	0.361	Polomski+ (1997)	bll	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1031.6 + 6019	TXS 1028 + 605	-	1.23	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	SDSS
J1031.8 − 2609	NVSS J103137 − 260715	-	-	-	bcu	UNCL	-	It seems to be the dominant galaxy in a cluster; Pierre+ (1994) and Bauer+ (2000) reported an uncertain $z = 0.247$ of unknown origin.
J1032.6 + 3737	B3 1029 + 378	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013). SDSS and LAMOST inconclusive.
J1032.7 + 6624	2MASS J10323905 + 6623234	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1033.1 + 4115	S4 1030 + 41	-	1.12	Walsh+ (1979)	fsrq	FSRQ	-	SDSS
J1033.5 + 4221	GB6 J1033 + 4222	-	0.211	SDSS	bll	BLLAC	E	-
J1033.7 + 3708	RX J1033.8 + 3708	-	0.448	SDSS	bcu	BLLAC	-	Noisy spectrum, caveat.
J1033.9 + 6050	S4 1030 + 61	-	1.41	SDSS	FSRQ	FSRQ	-	Stickel+Kuhr (1994) reported $z = 0.336$ on the basis of one individual emission line identified as MgII.
J1034.0 − 2547	PMN J1033 − 2544	-	-	-	bcu	UNCL	-	-
J1035.3 + 5541	GB6 J1035 + 5542	-	-	-	bcu	UNCL	-	SDSS spectrum is rather odd: almost featureless and flat, with huge noise in the violet.
J1035.3 − 2050	2MASS J10351532 − 2050261	-	-	-	bcu	UNCL	-	-
J1036.2 + 2202	OL 256	-	0.595	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	SDSS
J1036.5 + 1231	TXS 1034 + 128	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1036.6 − 3741	PKS 1034 − 374	-	1.82	Jauncey+ (1984)	fsrq	FSRQ	-	-
J1037.0 − 1954	1RXS J103657.5 − 195432	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1037.4 − 2933	PKS 1034 − 293	-	0.312	Stickel+Kühr (1989)	fsrq	CLAGN	-	Jauncey+ (1979) reported a featureless continuum with $EW < 0.2$, while Stickel & Kühr's (1989) spectrum showed lines with $EW > 3.6$.
J1037.7 + 5711	GB6 J1037 + 5711	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020). SDSS and LAMOST spectra inconclusive.
J1037.7 − 2822	PKS B1035 − 281	-	1.07	Shaw+ (2012)	fsrq	FSRQ	-	-
J1038.2 − 2425	NVSS J103824 − 242355	-	-	-	bcu	UNCL	-	-
J1038.5 + 3926	NVSS J103845 + 392736	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1039.6 + 0535	NVSS J103940 + 053608	-	-	-	bcu	UNCL	-	SDSS spectrum is quite bizarre and unreliable.
J1039.7 − 1540	PKS B1036 − 154	-	0.525	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J1039.9 + 7326	GB6 J1039 + 7326	-	-	-	bcu	UNCL	-	-
J1040.5 + 0617	GB6 J1040 + 0617	-	-	-	bll	UNCL	-	SDSS inconclusive.
J1041.0 + 1342	1RXS J104057.7 + 134216	-	-	-	bll	UNCL	-	-
J1041.1 − 1201	NVSS J104108 − 120332	-	-	-	bcu	UNCL	-	-
J1041.7 + 3902	B3 1038 + 392	-	0.208	Bauer+ (2000)	bll	BLLAC	E	SDSS
J1041.9 − 0557	PMN J1042 − 0558	-	0.390	Álvarez Crespo+ (2016)	bll	BLLAC	-	-
J1042.1 − 4128	1RXS J104204.1 − 412936	-	-	-	bll	UNCL	-	-
J1042.9 + 0054	RBS 895	-	-	-	bcu	BLLAC	-	Boyle+ (1990) suggested an uncertain $z = 0.73$ on the basis of a single feature identified as Mg II. Croom+ (2004) found no reliable features in the 2dF spectra. Desai+ (2019) found a featureless spectrum in the COSMOS survey.
J1043.2 + 2408	B2 1040 + 24A	-	0.559	White+ (2000)	fsrq	BLLAC	-	Hook+ (1996) reported a featureless spectrum with an upper limit to the lines $EW < 3$ Å. White+ (2000) reported $EW \sim 5$ Å. SDSS

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1043.6 + 0654	NVSS J104323 + 065307	-	-	-	bll	UNCL	-	SDSS inconclusive.
J1044.6 + 8053	S5 1039 + 81	-	1.26	Eckart+ (1986)	fsrq	FSRQ	-	-
J1045.3 + 2751	NVSS J104516 + 275136	-	-	-	bll	UNCL	-	SDSS and LAMOST inconclusive.
J1045.3 − 2928	PKS B1043 − 291	-	2.13	Baker+ (1999)	fsrq	FSRQ	-	-
J1046.0 + 5448	7C 1043 + 5505	-	0.249	Caccianiga+ (2002)	bcu	AMB	-	SDSS. Caccianiga+ (2002) classified it as Type 2, which are objects with only narrow emission lines (Seyfert 2, Narrow-Emission Line Radio Galaxies, LINERS, starburst), but Caccianiga+ (2004) reported a core dominance parameter ∼13.6. The steep gamma-ray spectrum (Γ∼2.4) favors a radio galaxy.
J1046.8 − 2534	NVSS J104651 − 253547	-	0.254	Piranomonte+ (2007)	bll	BLLAC	-	-
J1047.7 + 7238	GB6 J1047 + 7238	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J1047.9 + 0055	TXS 1045 + 011	-	0.643	Zhou+ (2004)	bcu	AMB	-	Zhou+ (2004) also proposed that the source could be a binary black hole on the basis of double-peaked lines, but Jaiswal+ (2019) suggested that the line profiles are due to the interaction of the jet with the NLR. SDSS: please note an error in the redshift evaluation from the automatic pipeline, where the Hβ+[OIII] complex is incorrectly identified as a Hα+[NII] complex, with a clear mismatch of the frequencies of many other lines.
J1048.0 − 1912	PKS 1045 − 18	-	0.595	Murdoch+ (1984)	fsrq	NLS1	-	FWHM(Hβ)∼ 1700 km/s, [OIII]/Hβ∼0.7.
J1048.4 + 7143	S5 1044 + 71	-	1.15	Stickel+ (1996)	FSRQ	FSRQ	-	-
J1049.5 + 1548	GB6 J1049 + 1548	-	0.327	Paggi+ (2014)	bll	BLLAC	-	SDSS
J1049.7 + 5011	NVSS J104857 + 500943	-	0.402	SDSS	bll	BLLAC	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1049.8 + 1429	MG1 J104945 + 1429	IVS B1047 + 147	-	-	bcu	UNCL	-	-
J1050.1 + 0432	MG1 J105009 + 0433	PMN J1050 + 0432	1.22	Clowes+ Campusano (1994)	fsrq	FSRQ	-	SDSS
J1051.4 + 3942	RBS 909	-	0.498	Beckmann+ (2003)	bll	BLLAC	-	SDSS
J1051.4 − 3139	PKS 1048 − 313	-	1.43	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J1051.6 + 2109	OL 282	4C +21.28	1.30	Wills+Wills (1976)	fsrq	FSRQ	-	SDSS
J1051.9 + 0103	NVSS J105151 + 010312	-	0.265	Shaw+ (2013)	bll	BLLAC	-	SDSS
J1052.3 + 0818	2MASX J10522451 + 0814095	-	0.223	SDSS	bcu	BLLAC	E	-
J1052.9 − 3743	PMN J1053 − 3743	-	-	-	bll	UNCL	-	-
J1053.7 + 4930	GB6 J1053 + 4930	-	0.140	Gioia+ (1990)	bll	MIS	E	SDSS. Capetti+ (2017) display an image of radio structure showing a clear bipolar large scale jet (>30 kpc).
J1053.9 + 8628	WN B1046.1 + 8645	-	-	-	bcu	UNCL	-	-
J1054.2 + 3926	CRATES J105433 + 392803	-	2.64	SDSS	bcu	FSRQ	-	-
J1054.5 + 2211	87GB 105148.6 + 222705	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J1055.5 − 0125	RX J1055.5 − 0126	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020)
J1056.0 + 0253	RX J1056.1 + 0252	-	0.236	Appenzeller+ (1998)	bll	BLLAC	-	SDSS
J1056.8 + 7012	S5 1053 + 70	-	2.49	Xu+ (1994)	fsrq	FSRQ	-	-
J1057.2 + 5510	SDSS J105707.47 + 551032.2	-	-	-	bcu	UNCL	-	SDSS and LAMOST inconclusive.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1057.3 − 2341	PKS B1054 − 234	-	1.13	Healey+ (2008)	fsrq	FSRQ	-	-
J1057.8 − 2754	RX J1057.8 − 2753	-	0.092	Bade+ (1994)	bll	BLLAC	-	-
J1058.0 + 4305	B3 1055 + 433	-	1.31	SDSS	bll	BLLAC	-	-
J1058.4 + 0133	4C +01.28	-	0.892	Kraus+Gearhart (1975)	BLL	FSRQ	-	SDSS
J1058.5 + 8115	S5 1053 + 81	-	0.706	Xu+ (1994)	fsrq	FSRQ	-	-
J1058.6 + 2817	GB6 J1058 + 2817	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1058.6 + 5627	TXS 1055 + 567	-	0.143	Bade+ (1998)	BLL	BLLAC	-	SDSS. Marcha+ (1996) reported $z = 0.410$ by identifying as [OIII] complex two strong lines at ∼7000 Å (observation done in 1992). These lines were never confirmed. Laurent-Muehleisen+ (1998) observed the source in 1994–1995 and found a featureless spectrum. Bade's observation was done in 1997, but no lines were found around ∼7000 Å (the same in SDSS spectrum).
J1058.6 − 8003	PKS 1057 − 79	-	0.581	Sbarufatti+ (2009)	bll	BLLAC	-	-
J1059.2 − 1134	PKS B1056 − 113	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2020).
J1059.5 + 2057	MG2 J105938 + 2057	IVS B1056 + 212	0.393	Hook+ (1996)	fsrq	FSRQ	-	SDSS
J1100.3 + 4020	RX J1100.3 + 4019	-	0.225	Beckmann+ (2003)	bll	BLLAC	-	SDSS inconclusive.
J1101.4 + 4108	RX J1101.3 + 4108	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1101.5 + 3904	CRATES J110130 + 390434	B3 1058 + 393	-	-	bcu	UNCL	-	-
J1102.1 + 2249	CLASS J1102 + 2241	-	-	-	fsrq	UNCL	-	-
J1102.6 + 5251	GB6 J1102 + 5249	-	0.690	SDSS	fsrq	NLS1	-	FWHM(Hβ)∼2005 km/s, Rakshit+ (2017).
J1102.8 − 0148	RX J1102.8 − 0148	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1102.9 + 3014	B2 1100 + 30B	-	0.384	Everett+Wagner (1995)	fsrq	FSRQ	-	SDSS
J1103.0 + 1157	TXS 1100 + 122	-	0.913	Afanas'ev+ (2003)	fsrq	FSRQ	-	SDSS
J1103.6 − 2329	1ES 1101 − 232	-	0.186	Remillard+ (1989)	bll	BLLAC	-	Kirhakos+Steiner (1990) proposed $z = 0.0038$ and associated it to NGC 3513, which, in turn, is $\sim 15'$ distant. This seems clearly to be an error. Remillard's redshift was later confirmed by Falomo+ (1993) and many others studies.
J1104.0 + 0020	NVSS J110356 + 002238	-	0.275	Colless+ (2001)	bll	BLLAC	-	SDSS shows a nearby object, but without a spectrum. Might be an interacting system. To be checked.
J1104.0 + 2611	SDSS J110357.29 + 261119.1	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J1104.4 + 0730	MG1 J110424 + 0730	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1104.4 + 3812	Mkn 421	-	0.0308	Ulrich+ (1975)	BLL	BLLAC	E	-
J1104.9 + 5748	7C 1101 + 5808	-	-	-	bcu	UNCL	-	-
J1105.8 + 3944	GB6 J1105 + 3946	-	0.099	SDSS	bll	BLLAC	-	In the compact group of galaxies Shakhbazian 7 (Shakhbazian 1973).
J1106.0 + 2813	MG2 J110606 + 2812	IVS B1103 + 284	0.842	Glickman+ (2007)	fsrq	FSRQ	-	SDSS
J1106.2 − 1048	PMN J1106 − 1048	-	-	-	bcu	UNCL	-	-
J1106.5 − 3646	PMN J1106 − 3647	-	-	-	bll	UNCL	-	-
J1107.0 − 4449	PKS 1104 − 445	-	1.60	Peterson+ (1979)	fsrq	FSRQ	-	-
J1107.6 + 0222	NVSS J110735 + 022225	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017). SDSS and LAMOST inconclusive.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1107.7 − 3042	PKS 1105 − 304	-	0.740	Caccianiga+ (2000)	fsrq	FSRQ	-	-
J1107.8 + 1501	RX J1107.7 + 1502	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive. Bauer+ (2000) reported $z = 0.259$ with the flag "uncertain" and never confirmed.
J1108.7 − 1844	NVSS J110845 − 184505	-	-	-	bcu	UNCL	-	-
J1109.3 + 2411	1ES 1106 + 244	-	0.46*	Sbarufatti+ (2005)	bll	BLLAC	-	Sbarufatti+ (2009) reported in an ATel, a spectroscopic $z = 0.482$ based on the detection of the Ca H&K break, but the value was not confirmed in a subsequent paper (Landoni+ (2013)). Paiano+ (2017) still found a featureless spectrum. SDSS inconclusive.
J1109.6 + 3735	NVSS J110938 + 373609	-	0.398	SDSS	bll	BLLAC	-	-
J1109.7 − 4814	PMN J1109 − 4815	-	-	-	bcu	UNCL	-	-
J1110.2 + 7135	RX J1110.5 + 7133	-	-	-	bll	BLLAC	-	Featureless, Laurent-Muehleisen+ (1998).
J1110.5 − 1836	CRATES J111027.78 − 183552.6	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J1111.0 + 3542	FBQS J111056.8 + 353907	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1111.4 − 4624	WISE J111127.39 − 462504.0	-	-	-	bcu	UNCL	-	-
J1111.5 + 3455	RX J1111.5 + 3452	-	0.212	Bade+ (1998)	bll	BLLAC	-	SDSS inconclusive.
J1111.8 + 4858	SDSS J111158.89 + 485701.4	-	-	-	bcu	BLLAC	-	SDSS inconclusive.
J1112.4 + 1751	1RXS J111224.2 + 175131	-	0.421	SDSS	bll	BLLAC	-	-
J1112.5 + 3448	TXS 1109 + 350	-	1.95	Hewitt+Burbidge (1993)	fsrq	FSRQ	-	SDSS
J1113.6 − 1920	NVSS J111348 − 192252	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1114.5 − 0819	PKS B1112 − 080	-	2.08	Healey+ (2008)	fsrq	FSRQ	-	-
J1114.7 − 0248	PMN J1114 − 0248	-	1.04	Croom+ (2004)	fsrq	FSRQ	-	-
J1115.2 − 0703	NVSS J111511 − 070238	-	-	-	bcu	UNCL	-	-
J1116.6 + 2915	B2 1113 + 29	4C +29.41B	0.049	Burbidge+ Strittmatter (1972)	rdg	MIS	-	SDSS. Dumbbell, FRI (Liuzzo+ (2009), Liuzzo+ (2010)).
J1117.0 + 2013	RBS 958	-	0.138	Schwope+ (2000)	bll	BLLAC	-	SDSS
J1117.2 + 0008	RX J1117.2 + 0006	-	0.451	SDSS	bll	BLLAC	-	-
J1117.6 + 0217	PMN J1117 + 0216	-	-	-	bcu	UNCL	-	-
J1117.6 + 2550	RX J1117.6 + 2548	-	0.360	White+ (2000)	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1117.7 − 3650	NVSS J111758 − 364918	-	-	-	bcu	UNCL	-	-
J1118.0 + 5356	NVSS J111757 + 535553	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1118.2 − 0415	PMN J1118 − 0413	-	-	-	agn	UNCL	-	-
J1118.2 − 4634	PKS 1116 − 46	-	0.713	Tritton (1971)	fsrq	FSRQ	-	-
J1118.6 − 1235	PKS 1115 − 12	-	1.74	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J1119.0 + 1235	OM 127	-	2.12	Schmidt (1966)	fsrq	FSRQ	-	SDSS
J1119.6 − 3047	1RXS J111941.0 − 304652	-	0.412	Piranomonte+ (2007)	bll	BLLAC	-	-
J1120.6 + 0713	1RXS J112041.6 + 071335	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1120.8 + 4212	RBS 970	-	-	-	bll	BLLAC	-	Perlman+ (1996) reported an uncertain $z = 0.124$ on the basis of Ca H&K break, but this value was challenged by Falomo+Kotilainen (1999), on the basis of the imaging of the host galaxy (not resolved). No further observation confirmed Perlman's value. The latest observation by Paiano+ (2017) still found a featureless spectrum. SDSS inconclusive.
J1121.3 − 0011	MGC 0019706	-	0.0993	Liske+ (2003)	bcu	MIS	-	Sadler+ (2014) classified it as FRI Wide-Angle-Tail radio galaxy.
J1121.4 − 0553	PKS 1118 − 05	-	1.30	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J1123.1 − 3233	1RXS J112318.0 − 323219	-	-	-	bll	BLLAC	-	6dF inconclusive.
J1123.4 − 2529	NVSS J112325 − 252858	-	0.146	Jones+ (2009)	fsrq	FSRQ	-	6dF
J1123.6 + 8028	WN B1120.0 + 8046	-	-	-	bcu	UNCL	-	-
J1123.8 + 7230	RX J1123.8 + 7230	-	-	-	bll	BLLAC	-	Featureless, Massaro+(2015)
J1124.0 + 2045	SDSS J112405.35 + 204553.7	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive.
J1124.0 + 2336	OM 235	-	1.55	Shaw+ (2012)	fsrq	CLAGN	-	SDSS confirms Shaw's value. Sowards-Emmerd+ (2005) and Healey+ (2008) reported a featureless spectrum. Mahabal+ (2009) reported $z = 2.14$ on a likely wrong identification of Lyα and CIV lines.
J1124.4 + 2308	CRATES J112431 + 230745	SDSS J112431.58 + 230755.9	0.795	SDSS	bcu	BLLAC	-	There is a mismatch ($\sim$14″) between the CRATES coordinates and the columns `RA_counterpart` and `DEC_counterpart` in the 4FGL. The former have no entries both in SIMBAD and NED, while the latter are coincident with the SDSS source. Hook+ (1996) reported a featureless spectrum.
J1124.6 − 0809	AT20G J112437 − 080643	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1124.9 + 2143	SDSS J112503.64 + 214300.1	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1124.9 + 4934	GB6 J1124 + 4933	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1125.1 − 2101	PMN J1125 − 2100	-	-	-	bll	UNCL	-	-
J1125.5 − 3557	PMN J1125 − 3556	-	0.284	Shaw+ (2013)	bll	BLLAC	-	-
J1125.9 + 2005	4C +20.25	-	0.133	Sargent (1973)	fsrq	AMB	-	SDSS with strong narrow forbidden lines and weak Hβ. Marchã+ (1996) suggested a candidate BL Lac; Zirbel+Baum (1995) suggested a FRII radiogalaxy. The radio spectrum is flat, but the gamma-ray spectrum is on the borderline between a BL Lac and a FSRQ.
J1125.9 − 0742	1RXS J112551.6 − 074219	-	0.279	Bauer+ (2000)	bll	BLLAC	-	-
J1126.8 − 3829	PKS 1124 − 382	-	-	-	bcu	UNCL	-	-
J1127.0 − 1857	PKS 1124 − 186	-	1.05	Drinkwater+ (1997)	fsrq	FSRQ	-	-
J1127.4 + 5648	S4 1124 + 57	-	2.89	Walsh+ (1984)	fsrq	FSRQ	-	SDSS
J1127.6 − 4920	MRC 1125 − 490	-	-	-	bcu	UNCL	-	-
J1127.8 + 3618	MG2 J112758 + 3620	IVS B1125 + 366	0.884	Healey+ (2008)	fsrq	FSRQ	-	SDSS
J1128.0 + 5924	TXS 1125 + 596	-	1.80	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	SDSS
J1128.8 + 3757	NVSS J112903 + 375655	-	-	-	bll	BLLAC	-	Featureless, Paiano+ (2017)
J1129.1 + 3703	CRATES J112916 + 370317	-	-	-	bll	BLLAC	-	Featureless, Hook+ (1998). SDSS inconclusive.
J1129.2 − 0529	NVSS J112914 − 052856	-	-	-	bcu	UNCL	-	-
J1129.2 − 1014	NVSS J112912 − 101349	-	-	-	bcu	UNCL	-	-
J1129.5 + 3034	87GB 112657.9 + 305242	-	-	-	bcu	UNCL	-	SDSS and LAMOST inconclusive.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1129.8 − 1447	PKS 1127 − 14	-	1.19	Burbidge+ Kinman (1966)	fsrq	FSRQ	-	6dF. Classified as GPS by Stanghellini+ (1998).
J1129.8 − 4217	LEDA 566417	PMN J1130 − 4214	-	-	bll	UNCL	-	Jones+ (2009) reported $z = 0.156$ with quality flag 3 (6dF).
J1130.5 − 3137	NVSS J113046 − 313805	-	0.151	Jones+ (2009)	bll	BLLAC	-	-
J1130.5 − 7801	SUMSS J113032 − 780105	-	-	-	bll	BLLAC	-	Featureless, Desai+ (2019).
J1131.0 + 3815	B2 1128 + 38	-	1.74	Xu+ (1994)	fsrq	FSRQ	-	SDSS
J1131.1 − 0944	1RXS J113104.6 − 094353	-	-	-	bcu	UNCL	-	Grazian+ (2002) classified it as a star. Radio: there is only the NVSS detection (∼22 mJy at 1.4 GHz)
J1131.4 + 5809	1RXS J113117.8 + 580911	-	0.360	SDSS	bll	BLLAC	-	-
J1131.4 − 0504	PKS 1128 − 047	-	0.266	Drinkwater+ (1997)	bcu	MIS	-	Classified as radiogalaxy by Angioni+ (2019) and Homan+ (2021, subm.)
J1132.2 − 4736	SUMSS J113209 − 473856	-	-	-	bcu	UNCL	-	-
J1132.7 + 0034	PKS B1130 + 008	-	0.678	Shaw+ (2013)	bll	BLLAC	-	SDSS inconclusive.
J1133.8 − 2048	NVSS J113350 − 204852	-	0.0587	Jones+ (2009)	bll	BLLAC	-	-
J1134.8 − 1729	1RXS J113443.6 − 172853	-	0.571	Piranomonte+ (2007)	bll	BLLAC	-	-
J1135.1 + 3014	CRATES J113514 + 301001	NVSS J113514 + 301005	-	-	bll	BLLAC	-	SDSS inconclusive
J1135.7 − 0427	PMN J1135 − 0428	-	0.273	Sadler+ (2002)	fsrq	FSRQ	-	-
J1136.2 + 3407	MG2 J113627 + 3408	IVS B1133 + 344	1.34	Sowards-Emmerd+ (2005)	fsrq	FSRQ	-	SDSS
J1136.3 − 0501	NVSS J113607 − 050156	-	-	-	bcu	UNCL	-	-
J1136.4 + 6736	RX J1136.5 + 6737	-	0.134	Bade+ (1994)	bll	BLLAC	E	SDSS
J1136.4 + 7009	Mkn 180	-	0.0458	Ulrich (1978)	bll	BLLAC	E	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1136.8 + 2550	RX J1136.8 + 2551	-	0.154	White+ (2000)	bll	BLLAC	-	SDSS. One doubt: Hα too strong for a BL Lac.
J1136.8 − 7413	PKS 1133 − 739	-	-	-	bcu	UNCL	-	-
J1137.9 − 1708	NVSS J113755 − 171031	-	0.600	Piranomonte+ (2007)	bll	BLLAC	-	-
J1138.2 + 4115	NVSS J113812 + 411353	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1138.4 + 4857	GB6 J1138 + 4858	-	1.30	SDSS	fsrq	FSRQ	-	-
J1139.0 + 4033	CRATES J113903 + 403303	TXS 1136 + 408	2.36	SDSS	bcu	FSRQ	-	-
J1139.0 + 5530	RX J1138.9 + 5530	-	-	-	bll	UNCL	-	-
J1140.5 + 1528	NVSS J114023 + 152808	-	0.244	Bauer+ (2000)	bll	BLLAC	-	SDSS
J1141.4 + 6805	1RXS J114118.3 + 680433	-	-	-	bcu	UNCL	-	-
J1141.5 − 1408	NVSS J114141 − 140753	-	-	-	bll	BLLAC	-	Featureless, Álvarez Crespo+ (2016).
J1142.0 + 1548	MG1 J114208 + 1547	TXS 1139 + 160	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J1143.1 + 6122	GB6 J1143 + 6122	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1144.9 + 1937	3C 264	-	0.022	Schmidt (1965)	rdg	MIS	E	SDSS, classified as FRI by Balmaverde+ (2021)
J1145.5 + 4423	B3 1143 + 446A	-	0.300	Hook+ (1996)	fsrq	SEY	-	SDSS, optical spectrum with strong narrow lines, flat radio spectrum.
J1145.5 − 0340	RBS 1029	-	0.168	Machalski+ Condon (1999)	bll	BLLAC	-	SDSS
J1145.6 + 5552	87GB 114248.3 + 560915	-	-	-	bcu	UNCL	-	-
J1145.7 + 0453	PKS 1142 + 052	-	1.34	White+ (1988)	fsrq	FSRQ	-	SDSS
J1146.4 − 3327	PKS 1143 − 331	-	-	-	bcu	UNCL	-	Gattano+ (2018) reported $z = 0.294$, but the origin is unknown. Photometric?
J1146.6 − 2902	PKS 1143 − 287	-	-	-	fsrq	UNCL	-	Wilkes+ (1983) reported $z = 0.45$ flagged as uncertain. It was never confirmed; nonetheless, it propagated into the literature as a certain value.

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1146.9 + 3958	S4 1144 + 40	-	1.09	Vigotti+ (1990)	fsrq	FSRQ	-	SDSS
J1147.0 − 3812	PKS 1144 − 379	-	1.05	Stickel+ (1989)	bll	BLLAC	-	-
J1147.2 − 2627	PMN J1147 − 2625	-	-	-	bcu	UNCL	-	-
J1147.8 − 0724	PKS 1145 − 071	-	1.34	Wilkes+ (1983)	fsrq	FSRQ	-	Binary? Djorgovski+ (1987)
J1148.5 + 2629	TXS 1145 + 268	-	0.866	Bade+ (1995)	fsrq	FSRQ	-	SDSS
J1148.6 + 1841	TXS 1146 + 189	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1149.0 + 5924	NGC 3894	-	0.0108	Kelton (1980)	rdg	MIS	E/S0	LAMOST. Twin jets, CSO? Taylor+ (1998)
J1149.1 + 2819	7C 1146 + 2841	-	-	-	bcu	UNCL	-	-
J1149.2 + 6246	NVSS J114926 + 624333	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1149.4 + 2441	RX J1149.5 + 2439	-	0.402	Beckmann+ (2003)	bll	BLLAC	-	SDSS
J1149.5 − 4029	PMN J1149 − 4029	-	-	-	bcu	UNCL	-	-
J1150.4 + 2418	OM 280	-	-	-	bll	BLLAC	-	Featureless, Truebenbach+Darling (2017). SDSS inconclusive.
J1150.6 + 4154	RBS 1040	-	-	-	bll	BLLAC	-	There is one measurement by White+ (2000): $z = 1.02$ based on a single weak line identified as MgII. This line was never confirmed by newer observations (Shaw+ 2013; Paiano+ 2020). The positions are consistent each others as well as the optical magnitudes, indicating that the source was observed at the same flux level. Curiously, the SDSS spectrum shows a feature flagged as an artifact more or less at the same wavelength. Both White's spectrum and the SDSS one were taken at the Apache Point Observatory (11 years difference): perhaps it is a local artifact.
J1150.6 − 4823	PKS 1149 − 480	-	-	-	bcu	UNCL	-	-

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1151.3 + 0957	NVSS J115117 + 095826	-	-	-	bcu	UNCL	-	SDSS and LAMOST inconclusive.
J1151.5 + 5859	TXS 1148 + 592	-	-	-	bll	BLLAC	-	SDSS and LAMOST inconclusive
J1151.5 − 1347	PMN J1151 − 1347	-	-	-	bll	BLLAC	-	Featureless, Shaw+ (2013).
J1151.6 − 2115	NVSS J115140 − 211345	-	-	-	bcu	UNCL	-	-
J1152.1 + 2837	GB6 J1152 + 2837	-	0.441	SDSS	bll	BLLAC	-	-
J1152.3 − 0839	PKS B1149 − 084	-	2.37	Hook+ (2003)	fsrq	FSRQ	-	-
J1152.8 + 3308	B2 1150 + 33A	7C 1150 + 3324	1.39	White+ (2000)	fsrq	FSRQ	-	SDSS.
J1153.0 + 8056	S5 1150 + 81	-	1.25	Kühr+ (1981)	fsrq	FSRQ	-	-
J1153.3 − 1104	PKS B1150 − 108	-	0.269	Osmer+Hewett (1991)	bcu	FSRQ	-	-
J1153.4 + 4931	4C +49.22	-	0.334	Lynds+Wills (1968)	FSRQ	FSRQ	-	SDSS
J1153.6 − 2553	NVSS J115338 − 255412	-	-	-	bcu	UNCL	-	-
J1153.7 + 3822	B3 1151 + 386	-	0.410	SDSS	bll	BLLAC	-	Strong narrow forbidden lines (but also too much noise), radio spectral index at borderline, SEY?
J1154.0 + 4037	B3 1151 + 408	-	0.923	Hook+ (1996)	fsrq	NLS1	-	Henstock+ (1997) measured FWHM(Hβ) ∼1900 km/s. They had a spectrum with better S/N than SDSS at $\lambda \gtrsim 8000$ Å.
J1154.0 + 6018	RX J1154.0 + 6022	-	1.12	Shaw+ (2012)	fsrq	FSRQ	-	SDSS
J1154.0 − 0010	1RXS J115404.9 − 001008	-	0.254	Bauer+ (2000)	bll	BLLAC	-	SDSS
J1154.1 − 3243	PKS 1151 − 324	-	-	-	bll	UNCL	-	SIMBAD gives $z = 0.2$ from Mahony+ (2010), which, in turn, refer to a paper in preparation. However, nothing published was found in the following years.
J1155.5 − 3418	NVSS J115520 − 341718	-	-	-	bll	BLLAC	-	Featureless, Desai+ (2019).

4FGL Name	4FGL Counterpart	Alias	z	Reference for z	Class	R-Cl	HG	Notes
J1155.8 + 6137	SDSS J115548.40 + 613553.8	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1156.6 + 0640	TXS 1154 + 069	-	-	-	bcu	UNCL	-	-
J1156.6 − 2248	NVSS J115633 − 225004	-	-	-	bll	UNCL	-	-
J1158.5 + 4824	GB1 1155 + 486	TXS 1155 + 486	2.04	Henstock+ (1997)	fsrq	FSRQ	-	SDSS
J1158.9 + 0818	RX J1158.8 + 0819	-	-	-	bcu	AMB	-	The ambiguity derives from two nearby (∼3″) optical counterparts: SDSS-1 at $z = 0.291$ and SDSS-2 at $z = 0.338$. There is only one radio counterpart from FIRST (∼25 mJy), which could be of one of the two galaxies or both (resolution 5″).
J1159.0 + 0939	GB6 J1158 + 0937	-	-	-	bll	BLLAC	-	SDSS inconclusive.
J1159.2 − 2227	PKS 1156 − 221	-	0.565	Wright+ (1979)	bcu	FSRQ	-	-
J1159.3 − 2142	PMN J1159 − 2142	-	0.617	Healey+ (2008)	fsrq	FSRQ	-	-
J1159.5 + 2914	Ton 599	-	0.725	Burbidge (1968)	fsrq	FSRQ	-	SDSS
J1159.5 − 0723	PMN J1159 − 0723	-	-	-	bll	UNCL	-	-

Notes

1 The FITS file can be downloaded here: https://fermi.gsfc.nasa.gov/ssc/data/access/lat/10yr_catalog/ (accessed on 4 October 2021).
2 http://skyserver.sdss.org/DR16/en/home.aspx (accessed on 4 October 2021).
3 http://dr6.lamost.org/v2/ (accessed on 4 October 2021).
4 http://simbad.u-strasbg.fr/simbad/ (accessed on 4 October 2021).
5 http://ned.ipac.caltech.edu/ (accessed on 4 October 2021).
6 https://ui.adsabs.harvard.edu/ (accessed on 4 October 2021).
7 http://skyserver.sdss.org/DR16//en/tools/explore/summary.aspx?ra=0.384875&dec=21.226739 (accessed on 4 October 2021).
8 It is worth mentioning that the definition of BCU/bcu has been extended in the 4LAC, by including the reference to a flat radio spectrum and/or the typical double-humped spectral energy distribution [6].
9 This specific object is taken as an example, but currently no gamma-ray emission has been detected.
10 This difference is not completely explained by the fact that 4LAC contains only sources with `FLAGS = 0`, while 4FGL includes all the gamma-ray sources, independently of their `FLAGS` value.

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