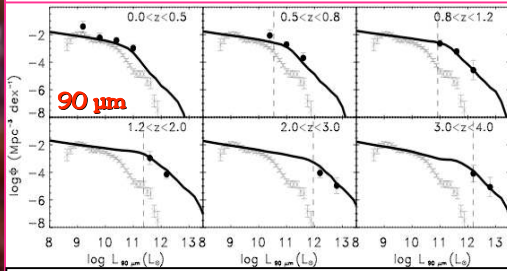
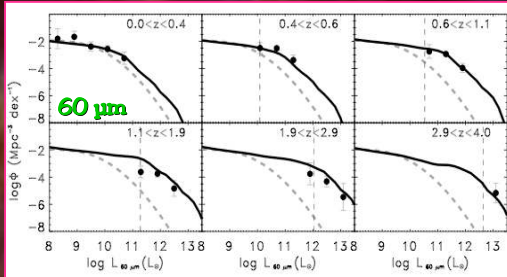


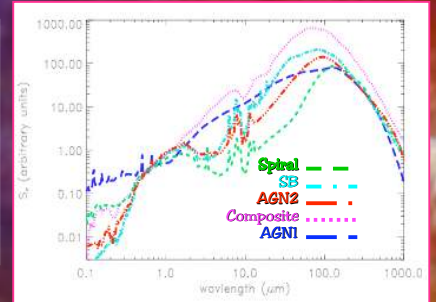
# PEP: FIRST HERSCHEL PROBE OF DUSTY GALAXY EVOLUTION UP TO $z \sim 3$

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Rest-frame LF at 60  $\mu\text{m}$  (top) and 90  $\mu\text{m}$  (bottom). Black solid line: GP2010 model; grey dashed line: Saunders'90 60- $\mu\text{m}$  LLF; diagonal crosses: Serjeant'04 90- $\mu\text{m}$  LLF.

**ABSTRACT:** We exploit the deepest existing 100- and 160- $\mu\text{m}$  data obtained by PEP in the GOODS-N to derive for the first time the evolution of the rest-frame 60- $\mu\text{m}$ , 90- $\mu\text{m}$  and total IR Luminosity Function (LF) up to unprecedented high redshifts ( $z \sim 3$ ).

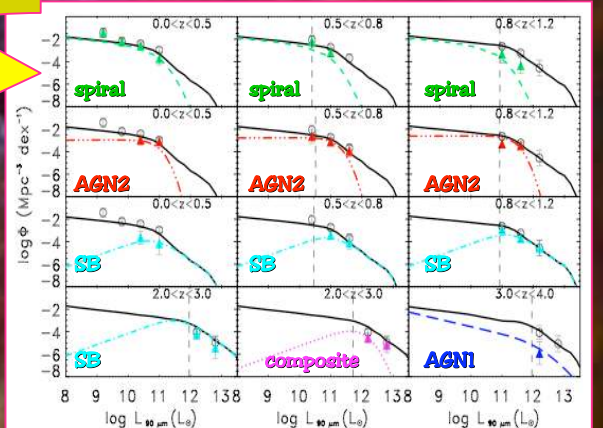
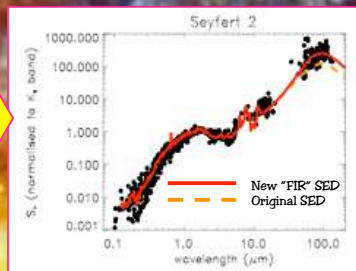


Prototypical template SEDs (from the library of Polletta'07) for the five populations.

The PEP sources (216 and 237 to  $S(3\sigma) \sim 3$  and 5.7 mJy at 100 and 160  $\mu\text{m}$  respectively) have been fully characterised through a SED-fitting analysis and divided into five main classes:

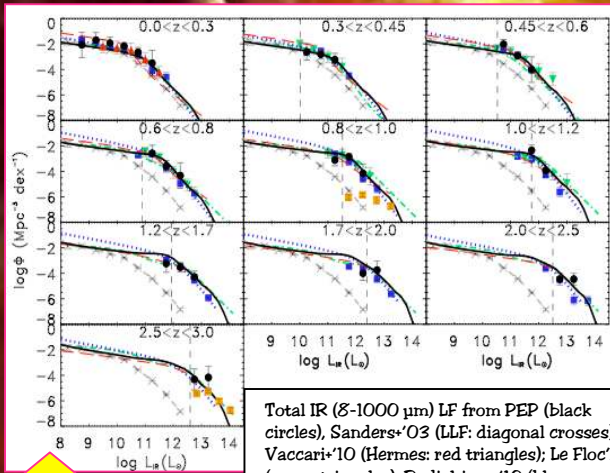
spiral galaxies, starbursts (SB), composite AGN+SB, AGN2, AGN1 (several templates for each class). Their LFs have been computed separately and compared to the Gruppioni & Pozzi (2010, in preparation; GP2010) backward evolution model predictions.

In some cases (10-12%, mainly for the AGN2) the considered local templates underestimate the PEP data points: it is therefore necessary to construct "more FIR" templates to fit our observed SEDs.



Rest-frame LF at 90  $\mu\text{m}$  from PEP (coloured triangles) and from GP2010 model at the most representative  $z$ -bins for the different populations (green: spirals; red: AGN2; cyan: SB; magenta: composite; blue: AGN1).

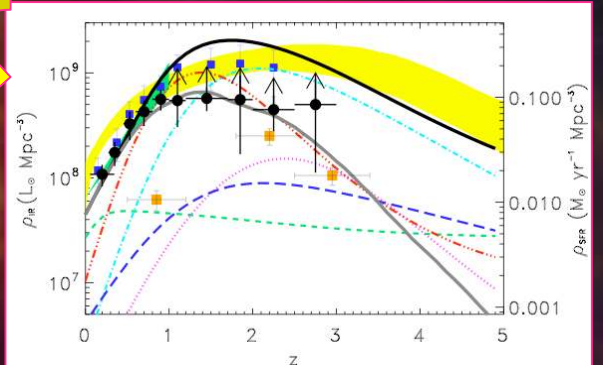
Spiral galaxies dominate the LF and the Star-formation Density (SFD) only at low redshifts ( $z \leq 0.3$ ), when moderate SF galaxies with AGN2 SEDs start to prevail up to  $z \sim 1.5$ . Then SB galaxies, dominating the bright end of the LF at any  $z$ , become the prevalent population up to the highest redshifts.



Total IR ( $8-1000 \mu\text{m}$ ) LF from PEP (black circles), Sanders'03 (LLF: diagonal crosses), Vaccari'10 (Hermes: red triangles), Le Floc'h'05 (green triangles), Rodighiero'10 (blue squares), Chapman'05 (orange squares). Models are from GP2010 (black solid), Lagache'04 (green dot-dashed), Le Borgne'09 (red dashed) and Valiante'09 (blue dotted).

Our PEP total IR LF agrees well with previous determinations (from either data or models). We find luminosity evolution as  $\sim (1+z)^{4.1 \pm 0.3}$  up to  $z = 1.5 \pm 0.3$  (though degeneracy is found between luminosity evolution and both density and luminosity). At  $1.5 \leq z \leq 2.5-3$  the evolution rate appears to keep  $\sim$  constant.

**CONCLUSIONS:** We make use of the deepest Herschel PEP 100- and 160- $\mu\text{m}$  data in the GOODS-N to characterise the evolution of the galaxy and AGN FIR LF and SFD at  $0 \leq z \leq 3$ , finding that strong evolution is required at least up to  $z \sim 2$ , with the different IR populations showing different evolutionary behaviours.



Total IR LD (or SFD) versus  $z$  from PEP (black circles) and GP2010 model (black line: total SFD, grey line: SFD integrating to the PEP completeness limit only, coloured lines: different populations, as above). SFD measurements from different optical/UV surveys (Hopkins&Beacom'06: yellow area), 24- $\mu\text{m}$  surveys (Le Floc'h'05: green area; Rodighiero'10: blue squares) and sub-mm surveys (Chapman'05: orange squares) are also reported.