

DIVISION B **COMMISSION 14**

ATOMIC AND MOLECULAR DATA

*DONNÉES ATOMIQUES ET
MOLECULAIRES*

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COMMISSION 14 WORKING GROUPS

Div. B / Commission 14 WG	Atomic Data
Div. B / Commission 14 WG	Collision Processes
Div. B / Commission 14 WG	Molecular Data
Div. B / Commission 14 WG	Solids and Their Surfaces

TRIENNIAL REPORT 2012-2015

1. Introduction

The main purpose of Commission 14 is to foster interactions between the astronomical community and those conducting research on atoms, molecules, and solid state particles to provide data vital to reducing and analysing astronomical observations and performing theoretical investigations.

Commission 14 supports a website at <http://www.inasan.ru/iau14/>. It informs the astronomical community of the meetings of interest, provides links to the relevant databases, contains Triennial Reports of Commission 14 and Working Groups (WGs) for the past triennia, and includes the history of the Commission 14 officers, Organizing Committee (OC), and Working Groups.

2. Historical background

Commission 14 has been operating for almost a century. It was one of the 32 Standing IAU Commissions (Blaauw 1994) and established in 1919, with the name Wavelength Standards and Spectral Tables for the Sun. The first President was C. E. St. John. In 1961 at the IAU General Assembly (GA) XI in Berkeley it was renamed as Commission 14 Fundamental Spectroscopic Data and in 1979 at the IAU GA XVII in Montreal as Commission 14 Atomic and Molecular Data.

Before 2003 in recognition of its special interdisciplinary character, Commission 14 was linked directly to the IAU Executive Committee. It was included in a newly created Division XII at the IAU GA XXV in Sydney, July 2003. In 2012 the IAU GA XXVIII in

Beijing approved the new Divisional restructuring, and Commission 14 became a part of Division B.

In the past twenty years Commission 14 was led by Presidents W. H. Parkinson (1994-1997), F. Rostas (1997-2000), P. L. Smith (2000-2003), S. Johansson (2003-2006), S. R. Federman (2006-2009), G. M. Wahlgren (2009-2012), and L. Mashonkina (2012-2015). In different triennia, the Organising Committee included seven to twelve members, and the usual practice was for a member to serve for six years.

Up to eight WGs operated successfully within Commission 14 during each triennium. They were chaired by recognised experts, i.e. WG Atomic Spectra and Wavelengths (S. Johansson, G. Nave), WG Atomic Transition Probabilities (J. Fuhr, G. M. Wahlgren, W. L. Wiese), WG Atomic Data (J. Fuhr, G. Nave, G. M. Wahlgren), WG Collision Processes (P. S. Barklem, M. S. Dimitrijevic, G. Peach, D. R. Schultz, P. C. Stancil), WG Line Broadening (G. Peach, C. Stehle), WG Molecular Structure (E. F. Van Dishoeck), WG Molecular Reactions on Solid Surfaces (W. Schutte), WG Molecular Data (P. Bernath, J. Black, S. Federman, H. Müller), WG Gas Phase Reactions (T. J. Millar), and WG Solids and Their Surfaces (T. Henning, H. Linnartz, G. Vidalì).

3. Activity

One way that the Commission accomplishes its goal is through triennial compilations on recent relevant research in atomic, molecular and solid state physics, and chemical analysis, and their application to astronomy. The most recent compilations appear in the accompanying set of Commission 14 WG Triennial Reports, which were produced by members of the WGs and the OC (Federman *et al.* 2015; Nave *et al.* 2015; Peach *et al.* 2015; Vidalì *et al.* 2015). Triennial Reports for the past triennia, starting from 2000-2003, were published in Transactions IAU (Smith 2003; Johansson *et al.* 2007; Federman *et al.* 2009; Wahlgren *et al.* 2012; Federman *et al.* 2012; Nave *et al.* 2012; Peach & Dimitrijevic 2012; Vidalì 2012).

During 2012-2015, members of Commission 14 have also been active in organizing and participating in meetings of various types. The following meetings were sponsored by Commission 14.

- IAU Symposium No. 297 'The Diffuse Interstellar Bands', May 2013, Noordwijkerhout, The Netherlands
- International conference 'Putting A Stars into Context: Evolution, Environment, and Related Stars', June 2013, Moscow, Russia
- IAU GA XXIX Focus Meeting 12 (FM12) 'Bridging Laboratory Astrophysics and Astronomy: From Provider to User', August 3-5, 2015, Honolulu, United States

The latter meeting was organised by Commission 14 together with the American Astronomical Society Laboratory Astrophysics Division (AAS LAD). Farid Salama, Lyudmila Mashonkina, and Steven Federman co-chaired the SOC. FM12 involved atomic and molecular data, plasma physics, nuclear physics, and particle physics and their application to various fields, such as interplanetary, interstellar, and intergalactic matter, planetary and stellar atmospheres.

Through these meetings the astronomical community can communicate their needs to data producers, while data producers provide the results of their studies. Input from the astronomical community is critical to maintaining the vitality of the data producing community, fostering collaboration on proposals and projects that can lead to funding opportunities for data producers. We are witnessing a rapid growth in quantity and quality of astronomical measurements that is driven by a combination of new and larger telescopes equipped with more sensitive detectors, and with capabilities to acquire high

spectral and spatial resolution data at wavelengths spanning the X-ray, ultraviolet, infrared, sub-millimeter and very long radio wavelength regimes. Interpreting these superb astronomical observations requires an understanding of the fundamental properties and processes of atoms and particles, molecules, ions and solids to an unprecedented precision. This need has attracted the attention and the interest of laboratory and theoretical scientists from different disciplines who have brought new or improved laboratory techniques, large-scale theoretical calculations and simulations to astronomy. Modern computers also allow detailed modeling of astrophysical phenomena, with the possibility to include chemical reactions, atomic, molecular, plasma, nuclear and particle processes and their coupling to astrophysical environments.

4. Looking forward to the next triennial period

Commission 14 terminated at the Honolulu General Assembly. However, the field covered by Commission 14 remains with the IAU. By call of the IAU, the Commission 14 OC initiated a proposal for a new Commission on Laboratory Astrophysics that would be a natural evolution of Commission 14. The Vice-President of Commission 14 Farid Salama, with the active help of the co-proposers Paul Barklem, Helen Fraser, Thomas Henning, and Gianfranco Vidali, was leading this effort. The proposed Commission was accepted in April, 2015 as the IAU Commission B5 Laboratory Astrophysics, with President Farid Salama. Helen Fraser was elected by the commission membership at large as Vice-President and Harold Linnartz and Gianfranco Vidali as OC members, in addition to the ex-officio ones.

The goal of the new Laboratory Astrophysics Commission is better understanding of the Universe through the promotion of fundamental theoretical and experimental research into the underlying processes that drive the cosmos. To achieve this goal, the Commission intends to facilitate interactions between the international astronomical community (user community) and the experimentalists and theorists who provide the necessary atomic, molecular, solid-state, nuclear and particle astrophysics data. The Commission will adopt a strategy to promote the field of laboratory astrophysics, particularly with reference to ground-based and space-born astronomy missions. To increase the visibility of this initiative the two new mailing lists, namely the American LAD list and the European labastro list, have been initiated.

Lyudmila Mashonkina
President of the Commission

References

- Blaauw, A. 1994, *History of the IAU*, Kluwer Academic Publishers
- Federman, S. R., Bernath, P. F., & Müller, H. S. P. 2012, *Transactions IAU*, T28A, p. 355-370
- Federman, S. R., Bernath, P. F., & Müller, H. S. P. 2015, *Transactions IAU* (submitted)
- Federman, S. R., Wahlgren, G. M., Johansson, S., Dimitrijevic, M., Jorissen, A., Mashonkina, L. I., Salama, F., Tennyson, J., & van Dishoeck, E. F. 2009, *Transactions IAU*, 27A, Reports on Astronomy 2006-2009. Edited by Karel van der Hucht. Cambridge: Cambridge University Press, p. 374-374
- Johansson, S., Federman, S. R., Wahlgren, G. M., Adelman, S. J., Biémont, E., Lawler, J., Mickelson, M., Morton, D., Ryabchikova, T., Smith, P. L., & Stehle, C. 2007, *IAU Transactions*, 26A, Reports on Astronomy 2002-2005. Edited by O. Engvold. Cambridge: Cambridge University Press, p. 337-375
- Nave, G., Wahlgren, G. M., & Fuhr, J. R. 2012, *Transactions IAU*, T28A, p. 341-354
- Nave, G., Nahar, S., & Zhao, G. 2015, *Transactions IAU* (submitted)

- Peach, G. & Dimitrijevic, M. S. 2012, *Transactions IAU*, T28A, p. 371-384
- Peach, G., Dimitrijevic, M. S., & Barklem P. S. 2015, *Transactions IAU* (submitted)
- Smith, P. L. 2003, *Transactions IAU*, 25A, p. 381-419
- Vidali, G. 2012, *Transactions IAU*, T28A, p. 385-393
- Vidali, G., Linnartz, H., & Henning, T. 2015, *Transactions IAU* (submitted)
- Wahlgren, G. M., van Dishoeck, E. F., Federman, S. R., Beiersdorfer, P., Dimitrijevic, M. S., Jorissen, A., Mashonkina, L. I., Nilsson, H., Salama, F., & Tennyson, J. 2012, *Transactions IAU*, 28A, p. 339-340