

COMMISSION 1

GALAXY SPECTRAL ENERGY DISTRIBUTIONS

*DISTRIBUTIONS D'ÉNERGIE SPECTRALE
DE GALAXIES*

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COMMISSION J.1 WORKING GROUPS

Div. J / Commission 1 / WG 1

**REference LIBrary of GALaxy Spectral energy distributions
(RELIGAS)**

Div. J / Commission 1 / WG 2

**From DataBases to Spectral Energy Distributions
(DB2SED)**

TRIENNIAL REPORT 2015-2018

1. Introduction

The Galaxy Spectral Energy Distribution (Galaxy SED, C.J1) commission is an Inter-Commission share between divisions D, G, H and J that was created following the IAU General Assembly held in Honolulu, HI in August 2015.

This Galaxy SED Commission is dedicated to providing a (virtual) meeting room for astronomers around the world interested in galaxy SEDs without putting limits on time or space.

Since galaxy SEDs spread over a broad range of the electromagnetic spectrum, different spectral regions of the SEDs have various physical origins. This broad range of wavelengths through which galaxies emit their SEDs is partially due to the diversity of physical conditions and to the variety of components that are involved into producing a given SED: stars, gas, AGN, dust and cosmic rays. Thus, the Galaxy SED commission aims in bridging several divisions and that is why it is an Inter-division (D-G-H-J) commission. Our primary division is Division J: Galaxies and Cosmology.

The communities related to C.J1 that would be interested in participating and sharing their efforts is large, because the information extracted from galaxy SEDs has a major impact in Astrophysics. Combining data secured by ground-based and space-based telescopes is the essence of galaxy SEDs. We absolutely need to discuss, develop and disseminate tools, models and, of course, new ideas in order to be ready for the challenges that will be brought by these instruments and others.

2. Working Groups

During this first term, the commission, in agreement with Div. J, decided to create two working groups (WG) to further focus on two specific issues that we think are important to the members of C.J1: *RELIGAS* chaired by M. Brown (Australia) and C. Gruppioni (Italy) and *DB2SED* chaired by Samir Salim (USA) and Anja Schroeder (South Africa). The members of the two WGs are listed in the appendix.

The two WGs have been created during the first term. Given that it took time to start working together, we think that it could be useful to extend the action related to these two WGs over the next triennial. However, after initiating the WGs and organize several telecons, we found out that:

- a) Even though we created two WGs with different objectives and somewhat different expertises (for instance, there are people who develop databases in *DB2SED* and people who develop galaxy models in *RELIGAS*), the global objective will finally be the same: doing the best use of whatever spectral information exists on galaxies to better understand them.
- b) Members of the two WGs, and especially the chairs, asked what happens and what conclusions could come from the other WG. This is quite understandable as they share the same global scientific objective and they are sometimes deeply involved in what is discussed in the other WG.

So, we modified the way the two WGs work by:

- 1) developing common telecons between the two WGs (mainly the chairs),
- 2) deciding that the two reports will be written separately by each WG but, ultimately merged in a single document with a common cap and common conclusions. We think that one single report will have a stronger impact on the community than having two separate ones.

3. Scientific Meetings

Since our commission was created in August 2015, its influence on the community was not very strong at the beginning of this triennial. We list below a number of IAU Symposia that are directly related to our Commission Galaxy SED. Two of them were held in 2016, among which one is certainly notable as it opens a bridge between Astrophysics and Mathematics. None in 2017. But, we are happy to notice that there three symposia related to C.J1 will take place in 2018:

- March 2016: IAUS 321: Formation and evolution of galaxy outskirts
- October 2016: IAUS 325: Astroinformatics (AstroInfo16)
- August 2018: IAUS 343: Why Galaxies Care About AGB Stars: A Continuing Challenge through Cosmic Time
- August 2018: IAUS 344: Dwarf Galaxies: From the Deep Universe to the Present
- November 2018: IAUS 341: Challenges in Panchromatic Modelling with Next Generation Facilities

This could mean that the topics related to our commission are quite interesting and relevant in a modern astrophysical context.

4. Prospects and Recommendations

During this first term of Commission J.1, interesting actions have been initiated that needs to be continued to go deeper in the analysis of the main questions. **We recommend to extend the commission at least for the next triennial.**

After the initial works and the first common report from the two WGs, we recommend to skim the list of members to keep only those that have been active and maybe to effectively merge the two WGs into a single one. Besides, the first term was more dedicated to map the landscape. We think that a second term would be useful to actually study and propose actions. **We recommend to keep at least one WG dedicated to the tasks attributed to *DB2SED* and *RELIGAS* for the next triennial.**

In addition to this, we clearly see that we are now entering a time where more and more data will be available. Beside the need to save them in easily usable databases, we identified a new challenge related to the advent of large spectroscopic databases. Our commission suggests that integrating spectroscopy in the analysis of galaxy SEDs could be an important action for the next triennial.

We think that the power of today's computers is large enough to analyse large amounts of data (big data) in reasonable times. However, this opens up a mathematical issue: how to manage un-balanced spectral datasets containing both photometric and spectroscopic data in a homogeneous way and with the most valid statistical approach? This is, of course an astrophysical issue but Astrophysics might be a test-bench to develop a new methodology. But, to carry this out, we need to develop another bridge between Astrophysics and Mathematics to enable a better use of the big quantitatively and qualitatively different data that we will have in hand in the near future.

Astronomy is truly becoming data-driven in the ways that are both quantitatively and qualitatively different from the past. The information content of the modern data sets is so high that archival research and data mining not merely profitable, but nearly mandatory; researchers who obtain the data can only extract a small fraction of the science that is enabled by it.

We recommend to organize a platform to develop inter-science (Astrophysics - Statistics) discussions to develop and implement new, efficient and statistically performant analysis algorithms. This challenge probably represents the next revolution in modern extragalactic Astrophysics.

5. Appendix

Composition of the WG *RELIGAS*:

Chairs: Michael Brown (Monash University, Australia) and Carlotta Gruppioni (INAF-OABO, Italy)

Members: Marteen Baes (Universiteit Gent, Belgium), Mederic Boquien (University of Antofagasta, Chile), Denis Burgarella (Laboratoire d'Astrophysique de Marseille, France), Laure Ciesla (CEA Saclay, France), Danny Dale, (University of Wyoming, USA), Elisabeta da Cunha (ANU, Australia), Jacopo Fritz (IRyA, UNAM, Mexico), Evanthia Hatziminaoglou (ESO, Germany), Leslie Hunt (INAF-OAAR, Italy), Akio Inoue (Osaka University, Japan), Mari Polletta (INAF-IASF, Italy), Cristina Popescu (University of Central Lancashire, UK), Daniel Schaerer, (Switzerland), Elisabeth Stanway, (University of Warwick, UK), Richard Tuffs (MPI Heidelberg, Germany)

Composition of the WG *DB2SED*:

Chairs: Samir Salim (Univ of Indiana, USA), Anja Schroeder (SAAO, South Africa)

Members: Sudhanshu Barway (SAAO, South Africa), Alessandro Boselli (Laboratoire d'Astrophysique de Marseille, France), Denis Burgarella (Laboratoire d'Astrophysique de Marseille, France), Dongwei Fan (NAO, China), Dmitry Makarov (France), Joseph Mazarella (IPAC, USA), Cristina Popescu (University of Central Lancashire, UK), Philippe Prugniel (Univ of Lyon, France), Yannick Roehlly (CRAL, Lyon, France), Yue Shen (Univ of Illinois, USA), Ani Thakar (JHU Baltimore, USA), Mattia Vaccari (Univ of Western Cape, South Africa), Kevin Vinsen (ICRAR, Australia)

Denis Burgarella
President of the Commission