

## COMMISSION H1

## THE LOCAL UNIVERSE

*L'UNIVERS LOCAL*

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Maria-Rosa Cioni, Yasuo Fukui,  
Margaret Meixner, Gang Zhao**

### TRIENNIAL REPORT 2018–2021

#### 1. Activities of IAU Commission H1 during 2018-2021

by Dante Minniti (President), Gražina Tautvaišienė (Vice-President), and Wako Aoki (Secretary)

##### 1. Introduction

The IAU Commission H1 on “The Local Universe (L’Univers Local)” is one of the three commissions of Division H, “Interstellar Matter and Local Universe”. This Commission H1 was established in mid-2015, and it was presided by Eva Grebel (Germany) during its first triennial period. IAU Commission H1 presently counts with 342 members from all over the World. Our Commission focuses on studies of the Milky Way and nearby galaxies, where we can resolve galaxies into stars, and study their properties in detail. A range of observational and theoretical research on the stellar populations, interstellar medium, dark matter of local galaxies, etc. are covered in order to understand galaxy formation, history and evolution. Many recent photometric, spectroscopic, and astrometric surveys (both ground- and space-based) contribute to the knowledge revolution that this field is experiencing.

The Commission’s main objectives are to:

- focus on “near-field cosmology”, i.e., studies of the Milky Way and its surrounding galaxies
- use this nearby laboratory to study how galaxies in different environments and across a wide range of masses formed and evolved
- foster the organization of meetings and workshops worldwide on the study of the Local Universe

##### 2. Triennial Activities

These past three years the organizing committee members contributed to the organization of various symposia and dedicated sessions at scientific conferences. They also

attended several international meetings and workshops worldwide, representing the IAU and giving invited/contributed talks and posters.

Among the major developments on the area of Milky Way and Nearby galaxies that occurred during these three last years, we can mention as examples the data releases and important publications from the following large surveys (in random order, incomplete list):

### **Astrometry**

- The Gaia mission data release 2 (DR2) in April 2018, and Gaia early data release 3 (EDR3) in December 2020, yielding a number of publications.

### **Imaging and Photometry**

- Dark Energy Survey (DES) optical imaging
- Galactic Legacy Infrared Mid-Plane Survey Extraordinaire (GLIMPSE) in the near and mid-IR
- Catalina Northern-sky Survey in the optical
- Panchromatic Hubble Andromeda Treasury (PHAT)
- The VISTA near-infrared YJKs survey of the Magellanic System (VMC)
- VISTA Hemisphere survey (VHS) in the South
- VISTA Variables in the Via Lactea (VVV) and extended (VVVX) near-IR surveys
- Wide-field Infrared Survey Explorer (ALLWISE)
- Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) all-sky optical imaging
- Galactic Legacy Infrared Mid-Plane Survey Extraordinaire (GLIMPSE) in the near and mid-IR
- SkyMapper Southern Survey
- Southern Photometric Local Universe Survey (S-PLUS)

### **Variability and Seismology**

- The Kepler satellite extended mission (K2)
- Transiting Exoplanet Survey Satellite (TESS)
- Optical Gravitational Lensing Experiment (OGLE)
- Palomar Transient Factory (PTF) and Zwicky Transient Facility (ZTF) in the North

### **Spectroscopy**

- The 15-17th release of the SDSSIV data (DR15-17) including the APO Galactic Evolution Experiment (APOGEE2) near-IR survey, and the Mapping Nearby Galaxies at Apache Point Observatory survey (MANGA).
- The Large Sky Area Multi-Object Fibre Spectroscopic Telescope (LAMOST) data release
- Release of more RAdial Velocity Experiment (RAVE) data
- Release of more Gaia-ESO Survey (GES) data
- The Galactic Archaeology with HERMES survey (GALAH)
- The Pristine Survey

### Future projects

- The Vera Rubin Observatory, formerly known as the Large Synoptic Survey Telescope (LSST) planning continued with different white papers available online at the arXiv.
- 4MOST and MOONS planning continued with papers published in The Messenger.
- William Herschel Telescope Enhanced Area Velocity Explorer (WEAVE)
- eROSITA satellite all sky X-ray data to be released
- Southern Stellar Stream Spectroscopy Survey ( $S^5$ ), that began in 2018 using the 2dF/AAOmega spectrograph on the 3.9-metre Anglo-Australian Telescope, data release planned for April 2021.
- Subaru Telescope PFS survey for Galactic Archaeology

### Science and Outreach

- The Galaxy Zoo experiment involving the wider community
- IAU 100th Anniversary Online Celebration and activities

### 3. Meetings 2019-2021 (Source CADC-CCDA)

- "The Milky Way in the Gaia Era" (Saas-Fee, Valais, Switzerland, 27 Jan - 2 Feb 2019)
- "23rd International Microlensing Conference" (Center for Computational Astrophysics, New York City, NY, USA, 28-30 Jan 2019)
- "Monsters of the Universe: The Most Extreme Star Factories" (Lorentz Centre, Leiden, The Netherlands, 4-8 Feb 2019)
- "Nucleosynthesis for a Life: Symposium in honour of Prof. Roland Diehl" (MPE, Garching/Munich, Germany, 8 Feb 2019)
- "Formation of Stars and Massive clusters in Dwarf Galaxies over Cosmic Time" (Lorentz Center, Leiden, The Netherlands, 18-22 Feb 2019)
- "Dusting the Universe" (NOAO, Tucson, Arizona, USA, 4-8 Mar 2019)
- "Dynamical Models for Stars and Gas in Galaxies in the GAIA Era" (UCSB, Santa Barbara, CA, USA, 4-10 May 2019)
- "Kepler & K2 Science Conference V" (Glendale, CA, USA, 4-8 Mar 2019)
- "Large surveys with small telescopes: Past, Present, and Future" (Sternwarte, Bamberg, Germany, 10-13 Mar 2019)
- "MOSAIC 2019: Science and Surveys with the ELT Multi-Object Spectrograph" (Heidelberg, Germany, 11-15 Mar 2019)
- "II Workshop Chemical Abundances in Gaseous Nebulae: Open Problems in Nebular Astrophysics" (UNIVAP, Sao Jose dos Campos, SP, Brazil 11-14 Mar 2019)
- "Extreme Precision in Radial Velocity IV" (CERN, Grindelwald, Switzerland, 18-21 Mar 2019)
- "The La Silla Observatory - from the inauguration to the future (LS2019)" (ESO, La Serena, Chile, 25-29 Mar 2019)
- "r-process sources in the universe" (Arizona State University, AZ, USA, 27-30 Mar 2019)
- "New Quests in Stellar Astrophysics IV: Astrochemistry, Astrobiology and the Origin of Life" (Puerto Vallarta, Mexico, 31 Mar- 5 Apr 2019)
- "Grand Challenges in Stellar Physics: Pulsating Stars in the Universe" (Nice French Riviera, Nice, France, 1-5 Apr 2019)

- "Turbulence & magnetic fields - from the early universe to late-type stars" (Helsinki, Finland, 1-5 Apr 2019)
- "The 1st Donglu Astrophysics Forum The era of large-scale sky surveys: Near field cosmology and time domain science" (Kunming, P.R. China, 1-3 Apr 2019)
- "9th Friends of Friends Meeting" (Cordoba Observatory, Cordoba, Argentina, 1-5 Apr 2019) "The Gaia Universe" (ESTEC, Noordwijk, The Netherlands, 8-12 Apr 2019)
- "IAUS 350: Laboratory Astrophysics: from Observations to Interpretation" (Cambridge, UK, 14-19 Apr 2019)
- "The Deaths and Afterlives of Stars" (STScI, Baltimore MD, USA, 22-24 Apr 2019)
- "Metals in Galaxies, Near and Far: Looking Ahead" (Lorentz Center, Leiden, The Netherlands, 6-10 May 2019)
- "Preparing for 4MOST: A community workshop introducing ESO's next-generation spectroscopic survey facility" (ESO, Garching near Munich, Germany, 6-8 May 2019)
- "Herschel ten years after launch: science and celebration" (ESAC, Villafranca del Castillo, Madrid, Spain, 13-14 May 2019)
- "Multi-messenger astronomy with SKA precursors and pathfinders, a capacity building workshop" (Aveiro, Portugal, 13-15 May 2019)
- "LXIII Meeting of the Italian Astronomical Society: 20 years of INAF, Italian Astronomy between Present and Future" (INAF, Accademia dei Lincei, Rome, Italy, 14-17 May 2019)
- "Exploring the Infrared Universe: The Promise of SPICA" (Crete, 20-23 May 2019)
- "Multi-Spin Galaxies 2019" (Asiago Astrophysical Observatory, Asiago, Italy, 20-23 May 2019)
- "LSST@Asia: Exploring the Wide, Fast, Deep Universe" (Sydney, Australia, 20-23 May 2019)
- "IAUS 351: Star Clusters: from the Milky Way to the Early Universe (MODEST 19)" (Bologna, Italy, 27-31 May 2019)
- "Zoom-In and Out: From the Interstellar Medium to the Large Scale Structure of the Universe" (NORDITA, Stockholm, Sweden, 3 May- 28 Jun 2019)
- "What matter(s) between galaxies: unraveling the knots in the Cosmic Web" (Abbazia di Spineto, Italy, 3-7 Jun 2019)
- "Space Astrometry for Astrophysics" (L'Aquila Italy, 3-7 Jun 2019)
- "Linking the Milky Way and Nearby Galaxies: The ISM and Star Formation from Cold Cores to Kpc Scales" (Helsinki, Finland, 3-7 Jun 2019)
- "IAU Symposium 352: Uncovering early galaxy evolution in the ALMA and JWST era" (Viana do Castelo, Portugal, 4-8 Jun 2019)
- "Light in the suburbs: structure and chemo-dynamics of galaxy halos" (Sexten Center for Astrophysics, Sesto, Italy, 9-14 Jun 2019)
- "New perspectives on galactic magnetism" (Newcastle upon Tyne, UK, 10-14 Jun 2019)
- "The Cosmic Web: From Galaxies to Cosmology" (Royal Observatory, Edinburgh, UK, 17- 19 Jun 2019)
- "Science in Our Own Backyard: Exploring the Galaxy and the Local Group with WFIRST" (IPAC, CALTECH, Pasadena, CA, USA, 18-20 Jun 2019)
- "Recovering an old sky: archive data at full accuracy by Gaia calibrations" (EWASS, Lyon, France, 24 Jun 2019)
- "EWASS 2019: S7 Cosmic dust (r)evolution" (EWASS, Lyon, France, 24-25 Jun 2019)
- "Future Science with Multi-Wavelength Data: North Ecliptic Pole Meeting 2019" (National Tsing Hua University, Hsinchu, Taiwan, 24-26 Jun 2019)

- "Astrochemistry: From nanometers to megaparsecs - A symposium in honour of John H. Black" (Gothenburg, Sweden, 24-28 jun 2019)
- "Feedback and its Role in Galaxy Formation" (Spetses, Greece, 25-29 Jun 2019)
- "EWASS 2019: S1 - Exploring the time-domain phase space from current surveys to LSST" (Lyon, France, 26-27 Jun 2019)
- "EWASS 2019: SS12 Stellar populations in the era of ELTs: advances over the next decade and beyond" (Lyon, France, 28 Jun 2019)
- "EWASS 2019 SS7 : Dual Nuclei in Late Stage Galaxy Mergers and their Effect on Galaxy Evolution" (Lyon, France, 28 Jun 2019)
- "IAU Symposium 353: Galactic Dynamics in the Era of Large Surveys" (Shanghai Astronomical Observatory, Shanghai, China, 30 Jun- 5 Jul 2019)
- "15th International Symposium on Origin of Matter and Evolution of Galaxies (OMEG15)" (Kyoto University, Kyoto, Japan, 2-5 Jul 2019)
- "IAU Symposium 355: The Realm of the Low Surface Brightness Universe" (La Laguna, Tenerife, Spain, 8-12 Jul 2019)
- "Advancing Theoretical Astrophysics" (University of Amsterdam, Netherlands, 15-26 Jul 2019)
- "BASIS Foundation Summer School 2019: Evolution of Galaxies and Stars", (SIRIUS Education Centre, Sochi, Russia, 15-27 Jul 2019)
- "High Spatial Resolution Spectroscopy in the era of ALMA, JWST and ELT" (Sixten Center for Astrophysics, Sesto, Italy, 22-26 Jul 2019)
- "Small Galaxies, Cosmic Questions" (Durham, UK, 29 jul- 2 Aug 2019)
- "Understanding Dust 30 Years After CCM: (A Symposium in Honor of Geoff Clayton's 65th Birthday)" (Boulder, Colorado, 4-6 Aug 2019)
- "Cosmic Dust" (Chiba Institute of Technology, Narashino, Japan, 12-16 Aug 2019)
- "LSST 2019 Project and Community Workshop" (Tucson, AZ, USA, 12-16 Aug 2019)
- "VISTA Variables in Via Lactea (VVV) 10th Science meeting" (Hilo, Hawai'i, USA, 19-22 Aug 2019)
- "Understanding the Nearby Star Forming Universe with JWST" (Courmayeur, Aosta Valley, Italy, 26-30 Aug 2019)
- "4th OBSPM/LAM Summer School Galaxy Formation and Evolution in a Cosmological Context" (Spetses, Greece, 28 Aug- 5 Sep 2019)
- "Celebrating the first 40 years of Alexander Tielens' contribution to science: the physics and chemistry of the ISM" (Palais des Papes in Avignon, France, 2-6 Sep 2019)
- "Views on the Interstellar Medium in galaxies in the ALMA era" (Bologna, Italy, 2-6 Sep 2019)
- "Astrophysics with GW detections" (Warsaw, Poland, 6-7 Sep 2019)
- "A synoptic view of the Magellanic Clouds: VMC, Gaia and beyond" (ESO-Garching, Germany, 9-13 Sep 2019)
- "CEMP Stars as Probes of First-Star Nucleosynthesis, the IMF, and Galactic Assembly" (University of Geneva, Geneva, Switzerland, 9-13 Sep 2019)
- "KIAA Forum on Gas in Galaxies: Multiple-phase Interstellar medium: Probing the Activities and Power Engines from Local to Distant Universe" (KIAA, Peking University, Beijing, China, 9-13 Sep 2019)
- "From Gas to Stars: The Links between Massive Star and Star Cluster Formation" (York, UK, 16-20 Sep 2019)
- "The extragalactic explosive Universe: the new era of transient surveys and data-driven discovery" (ESO, Garching, Germany, 16-19 Sep 2019)
- "The functioning of galaxies: challenges for Newtonian and Milgromian dynamics:

A workshop at the University of Bonn” (Bonn University, Bonn, Germany, 23-27 Sep 2019)

- ”Multi-Messenger Astrophysics in the Gravitational Wave Era” (Yukawa Institute for Theoretical Physics (YITP), Kyoto University, Kyoto, Japan, 24-25 Sep 2019)
- ”GES2019. The Legacy of the Gaia-ESO Survey” (Florence, Italy, 24-27 Sep 2019)
- ”Diversity of the Local Universe” (Nizhnij Arkhyz, Russia, 30 Sep- 4 Oct 2019)
- ”Managing Follow-up Observations in the Era of ZTF and LSST” (Carnegie Observatories, Pasadena, CA, 30 Sep- 4 Oct 2019)
- ”IAU symposium 356: Nuclear Activity in Galaxies Across Cosmic Time” (Addis Ababa, Ethiopia, 7-11 Oct 2019)
- ”The RR Lyrae and Cepheid Conference 2019: Frontiers of Classical Pulsators - Theory and Observations” (Cloudcroft, New Mexico, USA, 13-18 Oct 2019)
- ”The Milky Way 2019: LAMOST and Other Leading Surveys” (Yichang, Hubei, China, 14- 18 Oct 2019)
- ”Galaxy Angular Momentum Alignment 2019” (Shanghai Jiao Tong University, Shanghai, China, 21-25 Oct 2019)
- ”New Horizons in Galactic Center Astronomy and Beyond” (Yokohama, Japan, 21-24 Oct 2019)
- ”Modelling Galaxies: the Synergies of Chemical and Panchromatic Models” (Antofagasta, Chile, 28 Oct- 1 Nov 2019)
- ”The XVI Latin American Regional IAU Meeting” (Antofagasta, Chile, 3-8 Nov 2019)
- ”Subaru Telescope 20th Anniversary
- ”Optical & Infrared Astronomy for the Next Decade” (Waikoloa Beach Marriott, The Big Island of Hawaii, HI, USA, 17-22 Nov 2019)
- ”Lithium in the Universe: to Be or not to Be?” (Roma, Italy, 18-22 Nov 2019)
- ”The Art of Measuring Galaxy Physical Properties” (Milan, Italy, 18-22 Nov 2019)
- ”Twenty Years of Science with Chandra” (Boston, Massachusetts, USA, 3-6 Dec 2019)
- ”WorkPlaNS II: Workshop for Planetary Nebula observations” (Lorentz Center @Oort, The Netherlands, 16-20 Dec 2019)
- ”10th OPTICON Gaia Science Alerts Workshop” (Catania, Sicily, Italy, 18-20 Dec 2019)
- ”The Cosmic Web in the Local Universe” (Lorentz Center @Oort, The Netherlands, 27-31 Jan 2020)
- ”MODEST 20: Dense Star Clusters in the Era of Large Surveys”, (Tata Institute of Fundamental Research, Mumbai, India, 2-7 Feb 2020)
- ”Celebrating the Legacy of the Spitzer Space Telescope”, (Caltech, Pasadena, California, 11-13 Feb 2020)
- ”The build up of galaxies through multiple tracers and facilities”, (Univ. of Western Australia, Perth, Australia, 17-19 Feb 2020)
- ”24th international Microlensing Conference”, (Beijing, China, 17-19 Feb 2020)
- ”IAU Symposium 359 - Galaxy Evolution and Feedback across Different Environments”, (Bento Goncalves, RS, Brazil, 2-8 Mar 2020)
- ”Star clusters and their role in the build-up of galaxies”, (Gemini Obs, La Serena, Chile, 9-11 Mar 2020)
- ”Globular Clusters at the Nexus of Star and Galaxy Formation”, (Santa Barbara, California, 30 Mar-12 Jun 2020)
- ”Multi-line Diagnostics of the Interstellar Medium in Galaxies”, (Nice, France, 30 Mar- 1 Apr 2020)
- ”H0 2020: Assessing uncertainties in Hubble’s constant across the Universe”, (ESO Garching, Germany, 22-26 Jun 2020)

- "The Magellanic Clouds in the 2020s: a spectroscopic perspective (Symposium S7 at EAS 2020)", (Leiden, The Netherlands, 1-2 Jul 2020)
- "The Local Group in Context: Galaxies in the Local Volume as a Testbed of Cosmology (Symposium S11 at EAS 2020)", (Leiden, The Netherlands, 2-3 Jul 2020)
- "The Local Group. Assembly and Evolution (Virtual Meeting)", (STScI, Baltimore, MD, 31 Aug- 4 Sep 2020)
- "Galaxy Formation and Evolution in the Era of the Nancy Grace Roman Space Telescope", (STScI, Baltimore, MD, 5-9 Oct 2020)
- "Linking the Galactic and Extragalactic: stellar dynamics and stellar populations of the Milky Way and its siblings", (Wollongong, NSW, Australia, 3-4 Dec 2020)
- "MW-Gaia Workshop: Galactic Centre and Inner Galaxy", (Heidelberg, Germany, 10-12 Feb 2021)
- "STREAMS 21: Constraints on Dark Matter", (Flatiron Institute, New York City, 22-26 Feb 2021)

#### 4. Final Remarks

The year 2019 was the memorable 100th Anniversary of the IAU, and our Commission H1 members celebrated and participated enthusiastically on the different activities celebrating this historic event.

Then the year 2020 brought unexpected changes because of the world-wide COVID-19 pandemia, posing new challenges to the IAU ways. Suddenly we were not able to meet in person at all, all activities migrated to the virtual environment, and the General Assembly had to be cancelled. Many workshops and meetings were initially cancelled as well, others then were adapted to being on-line. Now we have to contemplate that this pandemia probably might have changed our meetings forever. In the rest of the year 2021 it would also be impossible to meet in person, and most workshops and meetings will continue with the on-line format.

Finally, based on the positive evaluation of the Commission's application for continuation by the IAU Executive Committee, Commission H1 The Local Universe (L'Univers Local) will continue its work during the upcoming term 2021-2024. The future is promising indeed, as a number of forthcoming facilities will yield an even deeper understanding of our Local Universe.

Dante Minniti  
*President of the Commission*