

Annual Report of IAU Commission G4 Pulsating Stars 2019

Organizational news

This is the first report of the Commission with the recently elected leadership. The President of the Commission is Jaymie Matthews. Róbert Szabó was elected as vice president and he was trusted as acting president. The Organizing Committee members are Victoria Antoci, Jadwiga Daszynska-Daszkiwicz, Joyce Guzik, Daniel Huber, Hiromoto Shibahashi.

Notable scientific results

Below we present an admittedly subjective and incomplete list of the latest, most important and interesting results on pulsating and oscillating stars:

1. G. Clementini, V. Ripepi, R. Molinaro et al: *Gaia Data Release 2. Specific characterization and validation of all-sky Cepheids and RR Lyrae stars*, A&A, 622, A60, 2019

All-sky sample of selected Cepheids and RR Lyrae stars is analyzed, over 50 000 of which (1/3 of the sample) are new discoveries.

2. Gaia collaboration, L. Eyer, L. Rimoldini et al: *Gaia Data Release 2. Variable stars in the colour-absolute magnitude diagram*, A&A 623, A110, 2019

This is the most complete description of the colour-absolute magnitude diagram and its variability induced changes based on variable (including pulsating) stars using Gaia DR2.

3-4. P. Kervella, A. Gallenne, N. R. Evans et al: *Multiplicity of Galactic Cepheids and RR Lyrae stars from Gaia DR2. I & II*, A&A 623, A116-A117, 2019

Binarity established from proper motion anomaly and based on common proper motion pairs is investigated in these classical pulsating stars using Gaia DR2 data.

5. W. Chaplin, A. M. Serenelli, A. Miglio et al.: *Age dating of an early Milky Way merger via asteroseismology of the naked-eye star *nu Indi**, Nature Astronomy, 4, 382, 2020

This pioneering work demonstrates how to put constraints on an ancient galactic collision by using asteroseismic age dating of a single bright star observed by TESS.

6. L. Molnár, M. Joyce, L. Kiss: *Stellar Evolution in Real Time: Models Consistent with Direct Observation of Thermal Pulse in T Ursae Minoris*, ApJ, 879, 62, 2019

The combination of state-of-the-art modelling techniques using MESA and GYRE with data assimilated from observations collected by amateur astronomers over many decades provided, for the first time, the opportunity to establish that the rapid pulsation period change and associated reduction in radius in T UMi are caused by the recent onset of a thermal pulse. Also, the most precise mass and age determinations for a single asymptotic giant branch star ever are obtained in this work.

7. G. Handler, D. W. Kurtz, S. A. Rappaport et al: *Tidally trapped pulsations in a close binary star system discovered by TESS*, Nature Astronomy, 2020

The authors reported the discovery of tidally trapped pulsations in the ellipsoidal variable HD 74423 in Transiting Exoplanet Survey Satellite (TESS) space photometry data. The system contains a δ Scuti pulsator in a 1.6-d orbit, whose pulsation mode amplitude is strongly modulated at the orbital frequency, which can be explained if the pulsations have a much larger amplitude in one hemisphere of the star. They interpreted this as an obliquely pulsating distorted dipole oscillation with a pulsation axis aligned with the tidal axis.

In a series of TESS Asteroseismology Science Consortium 'first light' papers different types of pulsating variables are analyzed using the first TESS data:

8. M. S. Cunha, V. Antoci, D. L. Holdsworth et al: *Rotation and pulsation in Ap stars: first light results from TESS sectors 1 and 2*, MNRAS 487, 3523, 2019

9. V. Antoci, M. S. Cunha, D. M. Bowman et al: *The first view of δ Scuti and γ Doradus stars with the TESS mission*, MNRAS, 490, 4040, 2019

10. A. David-Uraz, C. Neiner, J. Sikora et al: *Magnetic OB[A] Stars with TESS: probing their Evolutionary and Rotational properties (MOBSTER) - I. First-light observations of known magnetic B and A stars* MNRAS 487, 304, 2019

11. K. J. Bell, A. H. Córscico, A. Bischoff-Kim et al: *TESS first look at evolved compact pulsators. Asteroseismology of the pulsating helium-atmosphere white dwarf TIC 257459955* A&A 632, A42, 2019

12. S. Charpinet, P. Brassard, G. Fontaine et al: *TESS first look at evolved compact pulsators. Discovery and asteroseismic probing of the g-mode hot B subdwarf pulsator EC 21494-7018257459955*, A&A 632, A90, 2019

13. V. S. Aguirre, D. Stello, A. Stockholm et al: *Detection and Characterization of Oscillating Red Giants: First Results from the TESS Satellite* ApJL, 889, L34, 2020

Conferences

- The Kepler/K2 Science Conference in Glendale CA, USA, 4-8 March 2019 had several presentations, including four invited talks highlighting asteroseismology.

- The KITP program *Better Stars, Better Planets: Exploiting the Stellar-Exoplanetary Synergy*, in Santa Barbara, CA, USA Apr-Jun 2019 featured a related conference in May (*Planet-Star Connections in the era of TESS and Gaia*), both the program and the meeting had a strong seismology component.

- The next in the Los Alamos pulsation conference series *Grand Challenges in Stellar Physics: Pulsating Stars in the Universe* was planned to be held in France, Nice, in April 2019, but it was cancelled.

- The TESS Science Conference and the yearly TASC5/KASC12 (Kepler/TESS Asteroseismic Science Consortia) conferences were held back-to-back in Boston in July 2019. While the first one had two asteroseismology sessions, the latter is by and large was dedicated to seismology and its applications.

- *Stars and their Variability, Observed from Space – Celebrating the 5th Anniversary of BRITe-Constellation*; held in 19-23 August 2019, Vienna was well-attended, and it was a huge success.

- The *Dynamics of the Sun & Stars: Honoring the Life & Work of Michel Thompson* conference was held at NCAR, Boulder CO, USA featured several helio- and asteroseismology talks.

- RRL/CEP2019 conference – *Frontiers of Classical Pulsators: Theory and Observations* – was held in Cloudcroft, NM, USA 13-18 October 2019. This is a series of biannual meetings dedicated to RR Lyrae and Cepheid science in a broad sense.

- The AAS#235 meeting was held in Honolulu, HI between 4-8 January 2020. The diverse program had a Pulsating Variable Stars session with six talks and a plenary talk on stellar physics and seismology by Jennifer van Saders.

Due to the COVID-19 pandemic situation many upcoming meetings concerning pulsating variable stars are cancelled, postponed or went online (e.g. the Liège pulsation conference *The Rising stars of Asteroseismology*, the LSST@Europe4 conference in Rome, the TASC6/KASC13 meeting in Leuven *Asteroseismology in the Era of Surveys from Space and the Ground: Stars, Planets, and the Milky Way*, EAS 2020). It is expected that this situation will basically change our attitude towards traveling and face-to-face meetings.

Two IAU symposium proposals related to pulsating stars have been submitted:

- *At the cross-roads of astrophysics and cosmology: Period–luminosity relations in the 2020s* April 2021 in Budapest, Hungary (Richard de Grijs)

- *Winds from close-in exoplanet to massive stars* August 2021 Busan, South Korea (Aline Vidotto)

Ongoing and future projects

In space

The highly successful Canadian MOST satellite was decommissioned in March 2019 after more than 15 years of operations. NASA's revolutionary Kepler/K2 missions also stopped operations in late 2019. The BRITe-Constellation nanosatellite fleet in Austrian-Polish-Canadian cooperation continues to observe bright stars. Launched two years ago, NASA's Transiting Exoplanet Survey Satellite (TESS) mission is currently observing the northern ecliptic hemisphere and an extended mission was approved by the NASA Senior Review. ESA's M4 mission, PLATO with a strong seismology component is on track for its launch scheduled for the year 2026.

On the ground

The Danish-led Stellar Observations Network Group (SONG) is installing a new node with two telescopes in Mt. Kent, Australia to obtain spectroscopic time-series data of pulsating and oscillating stars. The US-led Vera C. Rubin Observatory in Chile will start its 10-yr multi-color Legacy Survey of Space and Time survey in early 2023. The multi-object spectrograph of the WEAVE survey to be installed on the 4.2m William Herschel Telescope on La Palma, Canary Islands will have its first light sometime early next year according to the current plans. The WEAVE survey will observe Cepheids and RR Lyrae stars as part of its SCIP (Stellar, Circumstellar and Interstellar Physics) and Galactic Archeology programs, respectively.

Awards and Prizes

The American Astronomical Society instituted a new type of fellowships among its senior members. The following IAU members associated with Commission G4 were honored (in alphabetic order): Anne Cowley, Nancy R. Evans, Arne Henden, Steven Kawaler, Arlo Landolt. We congratulate to all of them for their outstanding work and exemplary careers.

Journals

Starting from 10 March 2019 **IBVS (International Bulletin on Variable Stars)** is no longer accepting new submissions. There are multiple reasons behind the decision to discontinue the journal. Konkoly Observatory maintained and edited IBVS since its conception in 1961.

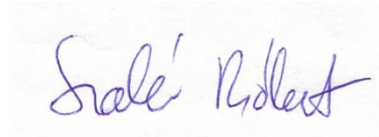
The number of the submitted manuscripts have steadily declined since the heydays in the 1990s and early 2000s. New possibilities arose to publish short papers and notes regarding variable stars. And, while quality of the papers is much more subjective to assess than quantity, editors felt that the overall level of the journal has also lowered. The Discovery and Observation reports formats started to get outdated, as we have entered the era of big, time-resolved surveys with hundreds of thousands of new variable detections, and these reports presented extra work for the editorial staff with diminishing returns. The journal also run into human resources issues. IBVS was too little to employ dedicated staff, so editorial work was distributed among a few post-docs (on temporary contracts), and IT personnel at the observatory. This was not a sustainable path on the long term. At this point, Konkoly Observatory management felt that resuscitating the journal would require expensive investments that are not justified by the number and quality of recently published papers. Instead, the objectives become to:

- provide an archived version of the journal,
- deposit all pdf versions to ADS, and
- deposit the data files at CDS.

The Editorial Board and all recent authors were notified about the closure, and the latter were pointed towards similar options elsewhere (e.g., JAAVSO, OEJV and RNAAS for papers, the AAVSO VSX and AID databases for observation data and reports). During the almost 60 years of operations more than 6200 IBVS issues were published.

Open European Journal on Variable Stars (OEJV, Czech Republic) also stopped operations in October 2019. On their website one reads that 'Submission of new manuscript to OEJV is temporarily stopped.' The main reason is the lack of manpower. However, it seems that OEJV will be reborn at some point because colleagues at Masaryk University have started thinking about how to reorganize the journal. Hopefully within a few months they will renew OEJV (priv. comm. M. Skarka).

Budapest, 17 April 2020



Róbert Szabó
acting president
on behalf of the Commission G4 Organizing Committee