INTERNATIONAL ASTRONOMICAL UNION, Commission G-1

Binary & Multiple Systems of Stars, a sort of annual report

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We have both happy and sad news to report from our community, our research, and our attempts to gather, starting with come of the cheerful news.

First and foremost, the 2018 Ambartsumyan Prize was earned by Alexander V. Tutukov, Lev R. Yungelson, and Edward P.J. van den Heuvel for their pioneering study of the evolution of massive close binaries, especially those leading to relativistic systems and sources of gravitational waves. We raise virtual glasses of champagne to them!

Second, the American Astronomical Society has instituted its first-ever class of fellowships among (mostly senior) long-term members. The innaugural legacy fellow was E. Margaret Burbidge (who sadly left us in April 2020). The group includes nine members of Comm. G-1:

Helmut Abt	Howard Bond	Anne Cowley
Nancy Evans	Suzanne Hawley	Arlo Landolt
Terry Oswalt	Keivan Stassun	Virginia Trimble

Note that there are 4 women among the 9. Indeed the total group of Legacy Fellows is about 36% women

Third, the History of Science Society has established a new prize directed specifically at "indepndent scholars." This normally means oeople who have done important work in the field without being employed as historians or scientists. The award is expected to be presented for the first time at a fall, 2020 meeting in New Orleans. The G-1 connection is that its name, the Gerjuoy-Michell Award, honors John Michell the clergyman scholar who first reported, on statistical grounds, that many of the close pairs of stars in the sky must be physically associated.

Now on to less cheerful news
First, the series of papers by Roger F. Griffin in Observatory Magazine reporting orbits of spectroscopic binaries obatined with radial velocity spectrometers seems to have come to and end with paper 265 and something like 559 orbits,
having extended at bi-monthly intervals from 1975 to 2019.

Second, a couple of conferences we were looking forward to as relevant to G-1 will almos certainly have to be cancelled, recheduled, or virtualized. These are
IAU S361, Massive Stars Near & Far, May 2020, Ireland
Stars, honoring the 80th birthday of Peter Eggleton, August 2020, Cambridge UK

An interesting conference that did take place, recorded at http://binaries.physics.muni.c .physics.muni.cz/ at which the main themes were automatic light curves and radial velocity fitting as the rate of data production has been increasing enormously.

And a one-day meeting at Warwick 2019/09/18, run by Elizabeth Stanway and JJ. Eldridge, whose main aim was to discuss how the presence of binary stars affects the observed properties of unresolved stallar populations, and how the BRASS population synthesis code can be used to tackle this problem

One being rescheduled from July 2020 to July 2021 at Keele University on binary stars in the space-photometry era, organizer J. Southworth

This brings us to three important, relevant catalogues, which continue to expand, followed by a small group of new, interesting publications

Since the last General Assembly, the database of measures comprising the Washington Double Star Catalog has grown by almost 20%. Most of the growth is from matching of known pairs with deep astrometric surveys such as Gaia (2016A&A...595A...1G) or URAT (2015AJ....150..101Z).

- The ASAS-SN variable star catalog continues to be a rich source of variable stars of all types, including eclipsing binaries. Jayasinghe et al. 2019, MNRAS provides 1.3 million light curves in the direction of the TESS Southern Continuous Viewing Zone, identifying 11,700 variable objects (7,000 of which are new). Some 35% of the 7,000 new variables are binaries, including some in the LMC. The ASAS-SN V-band light curves are available through the ASAS-SN database (https://asas-sn.osu.edu/variables)

The Detached Eclipsing Binary Catalogue (DEBCat) can be found at www.astro.keele.ac.uk/jkt/debcat/
As of 2020/04/04 it contains the properties of 242 systems, ranging in mass from EPIC 203710387 B (0.106 Msun) to V3903 Sgr A (27.3 Msun). Most of these objects now have light curves from the TESS satellite, and these data represent a huge opportunity to measure these systems to even better precision.

1. Schneider et al., Nature, 2019, https://ui.adsabs.harvard.edu/abs/2019Natur.574..211S

In this paper (which made the cover of Nature) Fabian Schneider and collaborators report on 3-D MHD simulations that show that stellar mergers can give rise to stars with significant magnetic fields. This explains a number of existing observations and may have important implications, e.g. for magnetars and fast radio bursts.

2. Thompson et al., Science, 2019, https://ui.adsabs.harvard.edu/abs/2019Sci...366..637T

3. Liu et al., Nature, 2019, https://ui.adsabs.harvard.edu/abs/2019Natur.575..618L

Thompson et al. and Liu et al. report the discovery of two massive non-interacting binaries involving compact objects — among the first such systems to be observed. While the Liu et al. inferred black hole mass of 70 solar masses in the Galaxy is surprising and may not stand future tests (see, e.g., dissenting interpretations by Eldridge et al. and El-Badry & Quataert), such non-interacting binaries are certain to be a growing class, important for understanding binary evolution and compact-object formation.

4 Burdge et al. 2019, Nature, https://ui.adsabs.harvard.edu/abs/2019Natur.571..528B/abstract. This paper announces the discovery of an eclipsing WD-WD binary with an oribtal period of just 6.91 minutes. The system is detected as a double-lined spectroscopic binary, and significant orbital decay is detected (orbital decay timescale estimated at 210,000 years). The system's expected gravitation radiation signature is close to LISA's peak, and thus this system is currently one of the best targets for early detection of gravitation wave signatures by that upcoming mission.

5 Important paper: Maxted et al (arXiv:2003.09295, MNRAS submitted): The TESS light curve of AI Phoenicis. This paper presents multiple independent analyses on a single light curve of a well-detached eclipsing binary, performed by different people in order to check how well the light cuvre parameters agree. The main result is that it is possible to measure masses and radii of stars to at least 0.2% with space-based light curves and high-resolution spectroscopy from stablised echelle spectrographs. It is important to perform careful error analyses when working at this level of precision.

6 While the highest angular resolution work continues to be performed by dilute aperture interferometry (VLBI, CHARA, NPOI), the work by Scott & Howell (2018SPIE101701E..0GS) in constructing facility speckle interferometry cameras for both Gemini telescopes enables filled aperture high angular resolution work to be done at a high cadence on significantly fainter pairs enabling pointed observation of large datasets.

7 : The first paper from the SDSS-HET Survey of Eclipsing Binaries is published, Mahadevan et al. 2019, ApJ https://ui.adsabs.harvard.edu/abs/2019ApJ...884..126M/abstract. Using the SDSS APOGEE high resolution, NIR APOGEE spectrograph and (for some targets) the HET HRS spectrograph, we are obtaining radial velocitiy measurements of Kepler and K2 eclipsing binaires to derive masses and radii to better than 3%. Of special interest are EBs with high-contrast flux ratios, such as F/G stars that have M dwarf secondaries. Using TODCOR, we are able to extract the faint secondary spectral signatures and derive double-line RV solutions for systems with optical flux ratios of just a few percent. The first two systems presented here are F+M and G+M binaries. The secondaries have masses of 0.5 and 0.2 solar masses, respectively. The latter falls in a particularly under-populated region of parameter space for high-precision mass-radius realtionship measurements.

8 One of the most interesting things I have come across recently is the way in which GAIA astrometric errors can be used to identify binary stars. When orbital motion is superimposed on the parallax measurements it can be revealed by the apparent errors. This has enabled the identification of large populations of binary stars within the right rage of apparent separation. We have a preprint on this at

https://ui.adsabs.harvard.edu/abs/2020arXiv200305467B/abstract