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DIVISION G / WORKING GROUP Ap AND RELATED STARS

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1. Introduction

The purpose of the Working Group on Ap and Related Stars (ApWG) is to promote and facilitate research about stars in the spectral type range from mid-B to early F that exhibit surface chemical peculiarities and related phenomena. To this effect, the ApWG publishes a newsletter and distributes it to its members (Section 3), and the ApWG members actively contribute to the organization of international scientific meetings (Section 4). The Ap and related stars represents a very active field of research, which takes full advantage of the new opportunities opened by the unprecedented data delivered by the space- and ground-based instruments that came into operations in the past few years. Some of the resulting scientific highlights are presented in Section 2.

2. Scientific highlights

The past three years have seen a major increase in the number of studies of Ap and related stars based on the exploitation of large surveys, both ground- and space-based. Chojnowski et al. (2020) discovered 260 new HgMn stars in the SDSS/APOGEE survey; LAMOST spectra were used by Hümmerich et al. (2020) to identify ∼1000 new magnetic Ap stars and by Paunzen et al. (2021) to identify ∼100 new HgMn stars. Hümmerich et al. (2018) found 39 new magnetic Chemically Peculiar (mCP) stars and 5 candidates through the analysis of Kepler data; Sikora et al. (2019) discovered 60 candidate A-type rotational variables with TESS. A large number of periods of Ap stars were determined from the analysis of Kepler, ASAS-3, KELT, MASCARA and TESS rotational light curves (Hümmerich et al. 2018; Bernhard et al. 2020; Cunha et al. 2019).

Mathys et al. (2020b) used TESS photometric data to identify 23 new super-slowly rotating Ap (ssrAp) star candidates. Long-term studies of the magnetic variations of ssrAp

stars allowed three rotation periods longer than 10 years to be accurately determined for the first time (Mathys et al. 2019a; Mathys et al. 2019b, 2020a).

The TESS observations represent a formidable new resource for asteroseismological studies. Their exploitation in that field of research, together with the continued analysis of the outcome of previous space missions such as Kepler, is yielding an unprecedented wealth of results that provide us with new insight into stellar structure and the physical processes taking place inside the stars. Noteworthy works from the past three years include discoveries and studies of rapidly oscillating Ap (roAp) stars (Cunha et al. 2019; Hey et al. 2019; Holdsworth et al. 2019), δ Scuti and γ Doradus stars (Antoci et al. 2019; Li et al. 2020; Bedding et al. 2020), and λ Bootis stars (Murphy et al. 2020).

One particularly remarkable finding achieved from TESS data is that of tidally trapped pulsations in δ Scuti components of close binary systems (Handler et al. 2020; Kurtz et al. 2020; Rappaport et al. 2021; Fuller et al. 2020). TESS was also instrumental in the discovery of unusual binary systems such as HD 42659, the only known roAp star in a spectroscopic binary (Holdsworth et al. 2019), V772 Cas, only the fourth HgMn star found in an eclipsing binary (Kochukhov et al. 2021), HD 62658, a late Bp star in an eclipsing binary (Shultz et al. 2019), and τ^9 Eri, a pulsating magnetic Bp star in a double-lined spectroscopic binary (Woodcock et al. 2021). TESS data were also essential, in combination with optical interferometry and Chandra X-ray observations, to show that the companion of the ssrAp primary component of HD 94660 is more likely a pair of late F stars (Schöller et al. 2020) rather than a compact object, as had been previously proposed (Bailey et al. 2015; Oskinova et al. 2020).

A first systematic search for strongly magnetic Ap stars in the IR resulted in the discovery of resolved magnetically split lines in the H band in 154 Ap stars where such splitting had not been previously resolved in the visible (Chojnowski et al. 2019).

Other noteworthy results from the past three years include the discovery of period changes in two more Ap stars (Pyper & Adelman 2020). the confirmation of the Am peculiarity of a hot-Jupiter planet host star (Saffe et al. 2020), the exploitation of Gaia data to locate the strongly magnetic Ap stars in the Hertzsprung-Russell diagram (Scholz et al. 2019), and the demonstration of the achievable consistency between the determination of the fundamental parameters of the Ap stars through careful spectroscopic analysis and through interferometry (Romanovskaya et al. 2019).

The large number of scientific highlights reported in this incomplete list (apologies to the authors who may feel that their results have been unduly overlooked) testifies of the healthy and vigorous state of research in the field of the Ap and related stars and underlines the importance of the role that the ApWG may play to give the best support to this research.

3. A peculiar Newsletter

A peculiar Newsletter (ApN), the electronic newsletter of the ApWG, is the product of this group that is most valued by its members. Its contents include lists of recent publications in the field of Ap and related stars and announcements of interest for the scientific community working in that field (including conference announcements, job ads, and obituaries). It also serves as a forum for discussions among members of this community. In summary, since its foundation in 1978 (on paper, at the time), it has been an essential channel of communication and of reference for the scientists interested in Ap and related stars. Unfortunately, in February 2019, the server hosting the ApN developed a terminal failure. After delays due to personal and technical challenges, in April 2020, the ApN was deployed on a new server at the Leibniz Institute for Astrophysics Potsdam, under the

lead of a new Editor, Dr. Silva Järvinen. It features a modernised format, which makes it both more appealing and readable.

4. Scientific meetings

Several conferences took place since September 2018 that were organized in large part by members of the ApWG: *What physics can we learn from oscillating stars?* (Banyuls, France, September 2018), *Physics of Magnetic Stars* (Nizhniy Arkhyz, Russia, October 2018), *Stellar Magnetism* (London, Ontario, Canada, July 2019), *Stars and their Variability observed from space* (Vienna, Austria, August 2019), *MOBSTER-1: Stellar variability as a probe of magnetic fields in massive stars* (virtual conference, July 2020), and *OBA Stars: Variability and Magnetic Fields* (virtual conference, April 2021). Another meeting to the organization of which members of the ApWG actively contributed is the *TASC5/KASC12 workshop* (Cambridge, Mass., USA, July 2019).

5. Closing remarks

The scientific activity in the field of Ap and related stars has strongly benefited from the TESS observations, which have opened unprecedented prospects not only for asteroseismology but also for other areas of study, such as rotation, binarity, etc. Other recent missions, projects, and instruments, such as Kepler, Gaia, the APOGEE survey and modern spectropolarimeters, have opened new possibilities to gain insight into many aspects of the physics of these stars that had been largely unexplored until now. Within this context, the recently overhauled newsletter of the WG on Ap and Related Stars (*A peculiar Newsletter*) represents a much valued communication channel between the WG members. The WG members also play leading roles in the organisation of scientific meetings in their area of research. In summary, the WG on Ap and Related Stars plays an important role in facilitating scientific research in a very active and expanding field, so that we strongly believe that its continuation is highly desirable and beneficial.

Gautier Mathys
chair of Working Group

References

Antoci, V., Cunha, M. S., Bowman, D. M., et al. 2019, MNRAS, 490, 4040
Bailey, J. D., Grunhut, J., & Landstreet, J. D. 2015, A&A, 575, A115
Bedding, T. R., Murphy, S. J., Hey, D. R., et al. 2020, Nature, 581, 147
Bernhard, K., Hümmerich, S., & Paunzen, E. 2020, MNRAS, 493, 3293
Chojnowski, S. D., Hubrig, S., Hasselquist, S., et al. 2020, MNRAS, 496, 832
Chojnowski, S. D., Hubrig, S., Hasselquist, S., et al. 2019, ApJ, 873, L5
Cunha, M. S., Antoci, V., Holdsworth, D. L., et al. 2019, MNRAS, 487, 3523
Fuller, J., Kurtz, D. W., Handler, G., & Rappaport, S. 2020, MNRAS, 498, 5730
Handler, G., Kurtz, D. W., Rappaport, S. A., et al. 2020, Nature Astronomy, 4, 684
Hey, D. R., Holdsworth, D. L., Bedding, T. R., et al. 2019, MNRAS, 488, 18
Holdsworth, D. L., Saio, H., & Kurtz, D. W. 2019, MNRAS, 489, 4063
Hümmerich, S., Mikulášek, Z., Paunzen, E., et al. 2018, A&A, 619, A98
Hümmerich, S., Paunzen, E., & Bernhard, K. 2020, A&A, 640, A40
Kochukhov, O., Johnston, C., Labadie-Bartz, J., et al. 2021, MNRAS, 500, 2577
Kurtz, D. W., Handler, G., Rappaport, S. A., et al. 2020, MNRAS, 494, 5118
Li, G., Van Reeth, T., Bedding, T. R., et al. 2020, MNRAS, 491, 3586
Mathys, G., Khalack, V., & Landstreet, J. D. 2020a, A&A, 636, A6

Mathys, G., Kurtz, D. W., & Holdsworth, D. L. 2020b, A&A, 639, A31
Mathys, G., Romanyuk, I. I., Hubrig, S., et al. 2019a, Astronomy and Astrophysics, 624, A32
Mathys, G., Romanyuk, I. I., Hubrig, S., et al. 2019b, A&A, 629, A39
Murphy, S. J., Paunzen, E., Bedding, T. R., Walczak, P., & Huber, D. 2020, MNRAS, 495, 1888
Oskinova, L. M., Ignace, R., Leto, P., & Postnov, K. A. 2020, A&A, 641, L8
Paunzen, E., Hümmerich, S., & Bernhard, K. 2021, A&A, 645, A34
Pyper, D. M. & Adelman, S. J. 2020, PASP, 132, 024201
Rappaport, S. A., Kurtz, D. W., Handler, G., et al. 2021, MNRAS, 503, 254
Romanovskaya, A., Ryabchikova, T., Shulyak, D., et al. 2019, MNRAS, 488, 2343
Saffe, C., Miquelarena, P., Alacoria, J., et al. 2020, A&A, 641, A145
Schöller, M., Hummel, C. A., Hubrig, S., et al. 2020, A&A, 642, A188
Scholz, R. D., Chojnowski, S. D., & Hubrig, S. 2019, A&A, 628, A81
Shultz, M. E., Johnston, C., Labadie-Bartz, J., et al. 2019, MNRAS, 490, 4154
Sikora, J., David-Uraz, A., Chowdhury, S., et al. 2019, MNRAS, 487, 4695
Woodcock, K., Wade, G. A., Kochukhov, O., Sikora, J., & Pigulski, A. 2021, MNRAS, 502, 5200