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Editorial to the Topical Collection: Oscillatory Processes in Solar and Stellar Coronae

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In 2019 the solar physics research community celebrated the 50th anniversary of the first detection of oscillatory processes in the solar corona as a quasi-periodic pulsation (QPP) of an X-ray and radio emission produced by a solar flare (Parks, G.K. & Winckler, J.R., *Astrophys. J.* **155**, L117, 1969). Nowadays, the study of oscillatory phenomena in coronal plasmas has reached its maturity with several dedicated sessions at major international conferences each year. Oscillations of coronal plasma structures are detected and analysed in all observational bands, from radio to gamma-rays, and with ground-based and spaceborne instruments. The study of oscillatory phenomena is now considered as an intrinsic aim in almost every upcoming space mission dedicated to solar physics. A striking success has been reached in the interpretation of coronal wave process in terms of magnetohydrodynamic (MHD) wave theory. Analysis and modelling of coronal oscillations resulted in the successful implementation of the wave-based plasma diagnostic techniques (MHD seismology), contributed to the solution of the enigmatic problems of solar coronal heating and fast solar wind acceleration, and created a solid ground for the exploitation of solar-stellar and coronal-magnetospheric analogies.

The successful exploitation of the abundant observational information about oscillatory processes in the solar corona, obtained with the current generation of spaceborne and

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ground-based instruments and with the recently commissioned solar telescope DKIST, the radioheliograph e-OVSA, and space missions Parker Solar Probe and Solar Orbiter, requires consolidated efforts of the international research community. Likewise, an important challenge is the link of the high-precision observations with results of state-of-the-art theoretical numerical and analytical modelling. A timely task is also the need for the identification of the future research avenues. This will be opened up by the upcoming new generation of the solar instruments (Aditya, ASO-S, InterHelioProbe, MUSER, Proba-3/ASPIICS, SRH). Addressing these challenges, the International Space Science Institute in Beijing (ISSI-BJ) hosted a one week international workshop "Oscillatory processes in solar and stellar coronae" on 14–19 October 2019. This event was attended by more than forty specialists from more than ten countries. The workshop became a long-awaited forum gathering the most active researchers and promising young fellows in the field. The participants discussed and summarised the main research achievements reached in the last decade, identified important gaps in our knowledge and discrepancies between observations and theory and the ways for their resolution, assessed existing data analysis and modelling tools and approaches, and identified the most promising future research avenues in our research field. The solar-stellar analogy in the study of solar and stellar coronal oscillations, based on the recent detections of quasi-periodic patterns in stellar flaring energy releases with Kepler and XMM-Newton, was fruitfully discussed, and the striking similarity of the properties of those oscillatory patterns in solar and stellar flares was identified. The exploitation of the solar-stellar analogy is especially timely now in the context of the TESS space mission.

Outcomes of the workshop resulted in this Topical Collection which consists of seven comprehensive review papers. The reviews cover cutting-edge recent results obtained on the analysis and theoretical modelling of several most intensively studied coronal MHD wave phenomena, namely, kink and sausage oscillations, and running and standing slow waves. A dedicated review assesses the consistency of proposed theoretical mechanisms for heating of the coronal plasma by various MHD waves. Another review summarises the current state of the physical mechanisms and observational properties of QPPs in solar flares and considers their analogy with QPPs in stellar flares. An important discussion of novel data analysis techniques designed recently for MHD seismology applications is subject to a special paper.

The editors would like to thank all authors and coordinators for their hard work in creating this collection, the staff at ISSI-BJ for their friendly and very effective assistance, and for the financial support in organizing the workshop and for the publication of the book, and the future readers of this topical collection who will no doubt answer many of puzzles connected with the research topics highlighted by the collection, which so far remain unresolved.