PEER REVIEW

By Professor Dr. Evgeni Hristov Semkov, (IA and NAO, BAS)

on the competition for the occupation of the academic position "Associate Professor" in the professional field 4.1 Physical Sciences, scientific specialty "Heliphysics" for the needs of the "Sun and Solar System" department, on the topic "Acceleration of high-energy charged particles from solar coronal shock waves and propagation waves heliosphere - numerical modeling based on remote observations", announced by the Institute of Astronomy and National Astronomical Observatory, BAS, according to an announcement in Newspaper of State no. 47 of 14/06/2019

With a candidate, Dr. Kamen Asenov Kozarev, assistant professor at the Institute of Astronomy and NAO, BAS

Dr. Kamen Kozarev has completed his secondary education at the Plovdiv Language High School. He received his bachelor's degree in astrophysics in 2005 from Williams College, Williamstown, USA and a master's degree in 2008 from Boston University, Boston, USA. He received his doctorate in astronomy in 2013 from Boston University, USA. He worked as a teacher of physics and mathematics at the English International School of Padua, Padua, Italy during 2005-2006 and as a postdoctoral researcher in solar physics at the Harvard-Smithsonian Center for Astrophysics in Cambridge, USA in 2012-2016. From 2016 Dr. Kamen Kozarev works at the Institute of Astronomy and National Astronomical Observatory and has been consistently occupying the following positions: physicist, assistant and assistant professor. Dr. Kamen Kozarev speaks English and Italian and is an associate editor of the renowned Journal of Space Weather and Space Climate.

The main scientific contributions of Dr. Kamen Kozarev on the topic of the announced competition are in the following directions:

1. Studies on coronal mass ejection (CME) and the resulting high-energy solar particles (SEP). Dr. Kamen Kozarev is involved in the development and operation of a specialized software system for numerical modeling of cosmic radiation in the global heliosphere from Sun before and after the orbit of Mars. He has been involved in the creation of a modern, flexible and stable three-dimensional model for studying the global spread of SEP simultaneously during major solar storms, which can be used for both scientific and space weather forecasting. The model was used to study the propagation of SEP flows in large solar flares, using observations near Earth. The model results are found to be close to SEP observations near the Moon, Mars (1.5 AU) and Jupiter (5.2 AU). Models of radial gradients of SEP flows in the interplanetary space from Jupiter have been obtained, which serve to determine radiation doses for astronauts and electronic equipment in interplanetary space missions. Research results show that magnetized global shock waves can form throughout the low and medium corona (1.1-8 solar radii), and are efficient charged particle accelerators as a major source of high-energy particle fluxes observed in the interplanetary space. It has been

suggested that SEP acceleration can be triggered: 1) mainly by CME-induced shock waves and 2) occur much closer to the Sun than previously thought.

2. Observational study of phenomena associated with shock waves in the low crown. High-temporal and spatial high-resolution ultraviolet observations of solar eruptions made with the Advanced Imaging Assembly telescope, part of the Solar Dynamics Observatory (SDO), have examined over 10 different ultraviolet waves and determined their kinematic and morphological properties. The strength of these compressive edges was determined by observing plasma densities, and the simultaneous presence of shock waves at the coronal edges of the edges was detected using radio observations of the so-called type 2 radio bursts. Based on these results, it has been confirmed that CME coronal fronts for the most part are weak shock waves. The specialized software system Coronal Analysis of SHock and Waves was developed to characterize the coronal shock waves through a combination of observations and models. In some of the shock waves studied, it has been shown that protons can accelerate to energies above 50 MeV only in the first 10 minutes of eruption, while in others, no significant increase in the energies of the modeled particles occurs. In addition, the interaction of shock waves with coronal magnetic fields has been found to modulate dynamically the heliographic latitudes and propagation lengths of high-energy particles in the solar system.

Dr. Kamen Kozarev has submitted a list of 15 publications for participation in the competition, all of which are in scientific journals with an impact factor (eight in Journal of Space Weather, three in ApJ, two in Journal of Geophysical Research and one each in ApJ Lett and in Nuclear Technology). Dr. Kamen Kozarev has provided a list of exactly 30 citations of publications with the exclusion of self-citations, which is the minimum requirement of the BAS Regulations for the application of Law on the Development of Academic Staff in Bulgaria. The SCOPUS reference shows that there are 237 citations to its publications and an h-index of 10 with excluded self-citations. The number of publications and citations is sufficient to cover the requirements for registration in the NACID database and the Regulations for the application of the Law on the Development of Academic Staff in Bulgaria for the occupation of the academic position "Associate Professor".

Dr. Kamen Kozarev is the first author of four of the submitted publications to participate in the competition and of three additional publications from the supplementary list. This is a testament to his undoubted contribution to scientific results. Dr. Kamen Kozarev is a participant and leader in a number of international scientific projects, including projects with NASA, with the US Air Force Science Division, a project funded by the Bulgarian Science Fund on bilateral cooperation Bulgaria-Austria. He recently won a project funded by the European Space Agency.

Dr. Kamen Kozarev has prepared and teaches an "Introduction to Radio Astronomy" course for bachelor's and master's degrees and a course in Solar Physics for masters in masters programs in astronomy at Sofia University "Kliment Ohridski". In 2019 he lectured on "Radio Astronomy" at the Faculty of Telecommunications of the Technical University in Sofia. Participates as a lecturer in schools and doctoral seminars in radio astronomy and heliophysics. He actively participates in the presentation of IA with NAO at the annual Science Festival in Sofia. He has evaluated projects at NASA, NSF and the Polish National

Science Center, and has reviewed articles in prestigious astronomy journals. He is a member of: the American Astronomical Union, the American Geophysical Union and the European Geophysical Union.

CONCLUSION

My categorical opinion is that the scientific results, publications in reputable astronomical journals, the scientific activity of the candidate Dr. Kamen Asenov Kozarev in IA and NAO fully comply with the requirements of the Law on the Development of Academic Staff in Bulgaria, its regulations and the criteria of the Institute of Astronomy and NAO for awarding of the academic position "Associate Professor". I recommend the Scientific Council of IA and NAO to elect Dr. Kamen Asenov Kozarev in the academic position of Associate Professor in the professional field 4.1 Physical Sciences, scientific specialty "Heliophysics".

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/prof. Dr. Evgeni Semkov/