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Space Solar Physics in China*

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Abstract The activities of Chinese space solar physics in 2016–2018 can be divided into two categories: pre-study projects and mission-level projects. Both projects were undertaken smoothly. Especially the ASO-S, after several years' promotion, finally got formal approval at the end of 2017. This paper describes in brief the status of all related projects.

Key words Space astronomy, Solar physics

Classified index P 35

1 Pre-study Projects

As described in the last report[1], within the Strategic Priority Program on Space Science sponsored by CAS, the third batch of pre-study projects during the 12th Five-Year Plan (2010–2015) supported four solar physics projects: (i) key technique studies on a new type Bi-refraction filter; (ii) further technique studies on space-borne solar full-disc vector magnetograph; (iii) key technique studies on detection of solar energetic particles with high accuracy; (iv) key technique studies on inner coronagraph at L5. Due to the financial shortage, these 4 projects were shortened from 2 years to 1 year, and finished the work by the end of 2016.

In 2017, CAS initiated a new round of Strategic Priority Program on Space Science, corresponding to the 13th Five-Year National Plan. Although this time CAS announced in the guide for an application that the pre-study projects are still limited to institutions of CAS, different from previous, it left some room for the proposals from non-CAS institutions. A dozen proposals were received in response to this call for solar projects. After some competitive selections, a total of 7 proposals, as the first batch of pre-study projects, finally got financial support, which we listed as follows.

(1) Multi-scale Solar Spectral Observatory (MSSO) (January 2018 to December 2019): it is a concept study, which plans to propose a complete mission frame within two years. The tentative goals include scientific objectives, full spectral observation requirements, spectral coronagraph schemes, and related technique feasibilities.

(2) Dual observations at solar polar orbit (January 2018 to December 2019): it is a concept study. The primary idea is to put two identical satellites at 2 positions of solar polar orbit, so as to observe the whole Sun, especially the polar regions simultaneously. The outputs of the study include both scientific objectives and payload configurations.

(3) Solar Transition region Observation and Research Mission (STORM) (January 2018 to December 2019): it is a concept study. In terms of current problems in observing the Transition Region (TR), the project pays more attention to the upper layer of TR, that is, extending from the lower TR, upper TR, up to corona, so as to better understand the physical process happening at the TR.

(4) Close observation of solar eruptions (January 2018 to December 2019): it is a conception study. Close to the Sun to make both in-situ and remote

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sensing observations is always an exciting task. Different from Solar Orbiter and Park Solar Probe, this project tries to study the possibility to do direct measurement inside the magnetic release site, like current sheet leading to solar flares and CMEs.

(5) Spectral imager for a portion magnetic field of the Sun with high accuracy and high resolution (January 2018 to December 2019): it includes both concept study and key technology study. Focusing on the multi-layer measurement of solar magnetic field with high resolution and high sensitivity, the project tries to propose a new type of space-borne Integral Field Unit magnetograph.

(6) High-accuracy measurement for coronal magnetic field (January 2018 to December 2020): it is a key technology study. The project plans to study the main technical problems in measuring coronal magnetic field through near-infrared lines by using LCVR, like measuring polarization with a high property and measuring high brightness ratio corona.

(7) Design, simulation and experimental study on ultraviolet piezoelectric polarimeter (January 2018 to December 2020): it is a key technology study. Aiming at the observation on the magnetic field of chromosphere and transition region, this project plans to study the technology of ultraviolet polarization, like ultraviolet piezoelectric polarimeter.

In addition to the 7 pre-study projects mentioned above, there might be some other projects which are sponsored by different financial sources. Anyway, all the finished pre-study projects will pass competition if they want to go into the next phase, *i.e.*, intensive study phase.

2 Mission-level Projects

Mission-level solar projects in China have gone a long way[2−7]. In the past two years, although some of them (like DSO, Kuafu, *etc.*) did not make any progress, we have indeed seen some other projects getting the approval of going into the engineering phases. Before we introduce the ASO-S and $H\alpha$ Space Telescope, we would like to mention the status of SPORT, LASGA, and a mission possibility sponsored by National Satellite Meteorological Centre.

As described in the previous report[1], Solar Polar Orbit Telescope (SPORT) was on schedule finished the so-called background study (intensive study phase). But SPORT was not adopted as a project for implementation in the period of China's 13th Five-Year Plan (2016–2020). Another project, LASGA (Large Area Solar GAmma-ray spectrometer), as introduced in Ref.[1], was indeed be accepted as a payload on board the future Chinese space station. But due to the budget difference between the expected and the approved, the project proposer ultimately gave up the proposal. National Satellite Meteorological Center recently got a chance to implement a space weather mission, which includes certainly observation of the Sun. But no more information has been released so far.

2.1 ASO-S

ASO-S (Advanced Space-based Solar Observatory) is a mission proposed for the 25th solar maximum by the Chinese solar community[8,9]. The scientific objectives are to study the relationships among solar magnetic field, solar flares, and Coronal Mass Ejections (CMEs). Three payloads include Full-disk Magnetograph (FMG), Lyman-α Solar Telescope (LST), and Hard X-ray Imager (HXI), to observe respectively solar magnetic field, CMEs, and solar flares. ASO-S has a solar synchronous orbit at an altitude of 720 km with an inclination angle around 98.2°. In 2016, ASO-S finished on time the so-called background study and got a good evaluation result from a top committee set up by CAS, which led directly to a green light to start the formal kick-off procedure of ASO-S. In the whole year of 2017, following on a more formal format, ASO-S underwent the official Phase-0, Phase-A, and funds evaluation. By the end of 2017, CAS issued a formal document to approve ASO-S project. It is really a great news for the whole Chinese solar community since it is the only solar mission which gets formal approval to start the engineering phases. Now ASO-S is intensively undertaking the Phase-B study. According to the timeline, ASO-S should finish all the work by the end of 2021. The first Chinese solar satellite, ASO-S, is expected to be launched in early 2022.

2.2 $H\alpha$ Space Solar Telescope

In about two years ago, a solar research team at Nanjing University got a chance to cooperate with Shanghai Institute of Microsatellite Engineering. The latter would then develop a new platform and could accommodate some instrument on it. $H\alpha$ Space Solar Telescope (HSST) was therefore proposed as the pay-

load. Recently the mission including the telescope and the new platform is ready to be adopted by the authority as a mission in the Practice-series. HSST is designed to spectrally image the whole Sun at lines of $H\alpha$ (6562.8 Å) and FeI (6569.2 Å). The optical system will use a scheme of grating spectrometer plus scanning mirrors. Total weight of the telescope is about 35 kg. Now the mission is under engineering study. If everything goes smoothly, HSST could be launched into space in 2019.

References

[1] GAN W Q. Space solar physics in 2014–2016 [J]. *Chin. J. Space Sci.*, 2016, **36**(5): 636-638

[2] GAN W Q, XUE S J. Space astronomy in China: 2002–2004 [J]. *Chin. J. Space Sci.*, 2004, **22**: (Sppl.): 99-101

[3] GAN W Q. Space astronomy in China during 2004–2006 [J]. *Chin. J. Space Sci.*, 2006, **26**: (Sppl.): 76-78

[4] GAN W Q. Space astronomy in China: 2006–2008 [J]. *Chin. J. Space Sci.*, 2008, **28**(5): 424-425

[5] GAN W Q, ZHANG S N, YAN Y H, *et al.* Space astronomy in China: 2008–2010 [J]. *Chin. J. Space Sci.*, 2010, **30**(5): 424-426

[6] ZHANG S N, YAN Y H, GAN W Q. China's space astronomy and solar physics in 2011–2012 [J]. *Chin. J. Space Sci.*, 2012, **32**(5): 605-617

[7] GAN W Q. Space solar physics in 2012–2014 [J]. *Chin. J. Space Sci.*, 2014, **34**(5): 563-564

[8] GAN W Q, Deng Y Y, Li H, *et al.* ASO-S: advanced space-based solar observatory [J]. *Proc. SPIE*, 2015, **9604**: 96040T

[9] GAN W Q, FENG L. Exploring Solar Eruptions and their Origins [J]. Beijing: ISSI-BJ Magazine, 2015, (5): 1-11