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SOLAR WIND TRANSIENTS IN 3D

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Heliosphere or interplanetary space is filled with various types of solar wind transients, which may significantly influence the space environment near the Earth and cause severe space weather. Establishing the capability of monitoring solar wind in the upstream of the Earth will undoubtedly improve our level of space weather forecasting and warning. Traditionally, solar wind is learned and monitored through in-situ measurements of spacecraft at a limited number of locations, e.g., the Wind and ACE spacecraft at L1 point near the Earth, the STEREO twin spacecraft in the Earth orbit at 1 AU and the Ulysses spacecraft in the large elliptical orbit around 5 AU. This way can only obtain the in-situ solar wind properties rather than the overall distribution of solar wind in the heliosphere. Alternatively, large-scale solar wind structures in 3D may be reconstructed by using interplanetary scintillations (IPS) technique. However the spatial resolution and cadence of the reconstructed solar wind maps are quite low. In this talk, we show a newly developed method to reconstruct 3D solar wind in the inner heliosphere by using imaging data from dual views. By applying this method to real observations from STEREO twin spacecraft, which keep taking pictures with a cadence of 40 minutes, we are now able to reconstruct the small-scale and large-scale inhomogeneous solar wind transients (Fig.1). Based on the successful application of this method, we propose a new concept of a space mission to monitor and study 3D solar wind in the inner heliosphere.

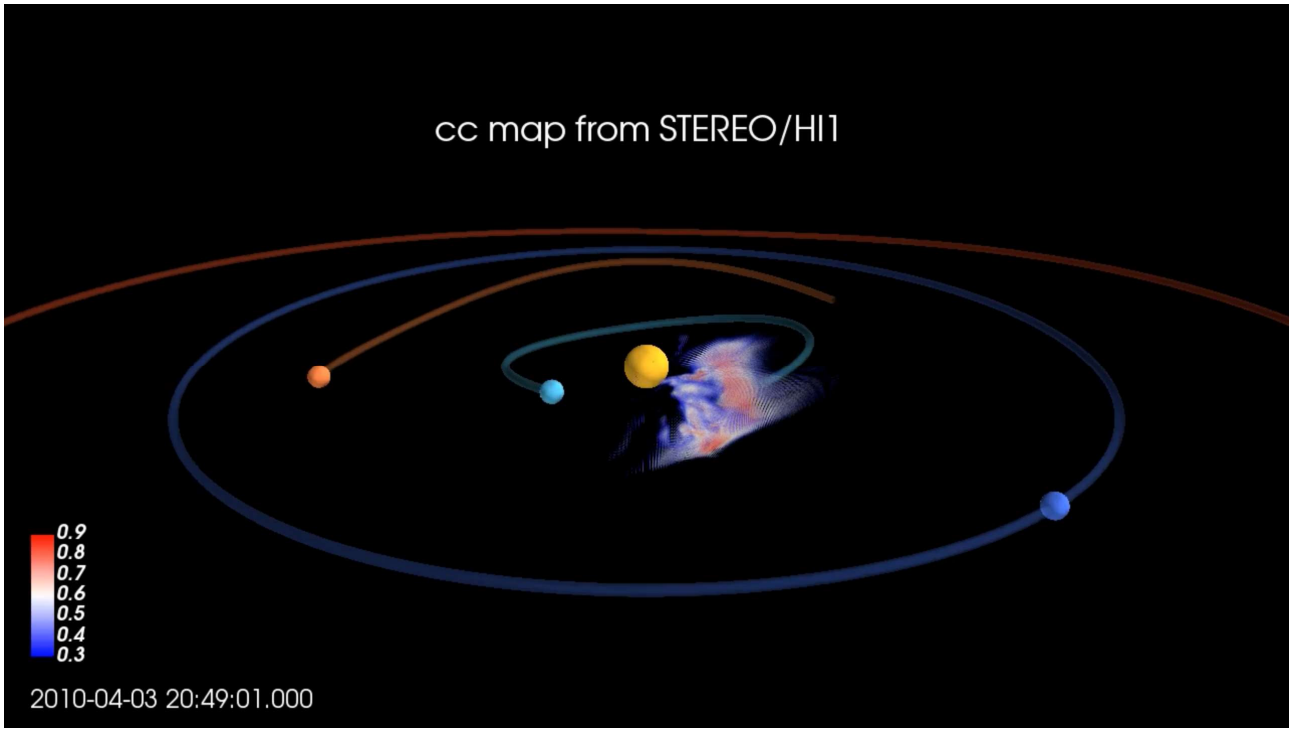

Fig.1 Reconstructed 3D solar wind transients by correlation-aided method based on the HI 1 images from STEREO-A and B twin spacecraft. The yellow ball in the center indicates the Sun, and the other balls indicates Mercury, Venus and Earth.