
The 3-D NLFFF reconstruction of Active Region NOAA 11158

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Abstract

A 3-D coronal magnetic field is reconstructed in NOAA 11158 on 2011 February 14 by a GPU-accelerated direct boundary integral equation method (GPU-DBIE), which is about 1000 times faster than the original DBIE for solar nonlinear force-free field modelling, with the SDO/HMI vector magnetogram as the bottom boundary condition. The reconstructed magnetic field lines are compared with the projected EUV loop structures as observed by SDO/AIA at line-of-sight and the STEREO A/B spacecraft at side views. They show very good agreement three-dimensionally so that the topology configurations of the magnetic field can be analyzed, and the role in the flare/CME process of the active region can be better understood. It is found that the observed coronal loop structures can be grouped into a number closed and open field structures with some central bright loop features across the polarity inversion line which may have played a key role. A group of electric current lines co-aligned with the central bright loops along the polarity inversion line has been obtained, which confirms its important role in the flare/CME process.

Keywords: Solar magnetic fields, extrapolation, NLFFF

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