國立中央大學太空科學與工程學系

Department of Space Science and Engineering, National Central University

專題演講

Coronal Holes and Open Magnetic Field Regions: Properties, Differences and Long-term Behaviors

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Place： 健雄館(科四館) S4-917 教室

摘 要/Abstract：

Coronal holes are persistent and recurrent features in the solar corona. They are observationally defined as dark patches with predominantly unipolar magnetic field, or theoretically as regions with magnetic field lines extending far into the interplanetary space (``open" magnetic field regions). The two definitions, however, do not always coincide with each other.

In this study, we refer to the coronal hole as the first definition, and aims to quantify the difference between the two physical phenomena, investigate the sources of inconsistencies between the two, and study the long-term evolution of the open magnetic field regions.

We apply a procedure to extract coronal holes from the synoptic maps spanning from the Carrington Rotation (CR) number 2099 to CR2227 which are constructed from the magnetic field and extreme ultraviolet (EUV) images onboard the Solar Dynamics Observatory (SDO), and compare them with the open magnetic field regions on the basis of the potential field model, the linear force-free model, and the thermal magnetohydrodynamic (MHD) model. The comparison between the coronal holes and the open magnetic field regions is also applied to the thermal MHD data, which is used to examine our findings.

By comparing the coronal holes and the open magnetic field regions with the high-speed solar wind streams (HSSs), we found that the open magnetic field regions are more consistent with the source region of the HSSs than the coronal holes are. The inconsistency between the coronal holes and the open magnetic field regions comes from two sources: open magnetic regions with bright EUV intensities and coronal holes with closed magnetic field structures. Our analysis shows that (1) the EUV intensity has a positive correlation with the magnetic flux expansion factor under the logarithmic scale, which means that an open magnetic field region with a sufficiently large expansion factor will result in a bright EUV intensity, thereby qualified as a non-coronal-hole region; (2) the closed magnetic field lines can cross the coronal hole boundaries and connect coronal holes with non-coronal-hole regions or with distinct coronal holes, which contributes a non-negligible amount of unipolarity to the coronal holes; (3) the long-term evolution of the open magnetic field regions forms a pole-to-pole trans-equatorial migration pattern, and the speed of the migration is comparable to the measured meridional flow speed.

※歡迎聽講※

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