Observational Test of Coronal Magnetic Field Models

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Two-dimensional line-of-sight magnetic field maps of the solar corona can now be reliably obtained from spectropolarimetric observations with the Fe XIII 1075 nm forbidden coronal emission line. Together with the linear polarization measurements that map the azimuthal direction of the coronal magnetic field projected in the plane of the sky containing Sun center, these coronal vector magnetograms have allowed for direct and quantitative observational testing of various theoretical coronal magnetic field models. We present a detailed study testing the validity of the global potential field model for coronal magnetic fields, in which the observed linear and circular polarization signals are found to be well consistent with the synthesized ones from a thin coronal layer just above a sunspot near the plane of the sky containing the Sun center, indicating the IR coronal magnetograms can reveal local coronal magnetic field structure. A linear (constant alpha factor) force-free field model is developed to further confirm this conclusion. However, significant difference is found for the synthesized results between the potential field and the linear force-free field models in the case of large-scale coronal areas. Practical global non-linear force-free field models, as well as high-precision full-disk photospherical vector magnetograms from HMI/SDO should be utilized to improve the comparison study in the near future.

Keywords: mangetic field; corona; IR; force-free field.

References

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