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**A new approach to modeling three-dimensional non-force free coronal magnetic field**

We propose to develop and test a new approach to deriving the three-dimensional nonforce free coronal magnetic field structure from photospheric vector magnetograph measurements. The local structure in approximate magnetohydrostatic equilibrium above the photosphere is to be reconstructed, utilizing high-quality vector magnetogram which provides boundary conditions within its field-of-view.

Based on the Principle of Minimum Dissipation Rate, a general non-force free magnetic field can be expressed as the superposition of two linear (constant-$\alpha$) force free field. The parameter, $\alpha$, for each of the two linear force free field, can be determined by optimizing the requirement that the recovered transverse magnetic field components as the superposition of the corresponding components of the two linear force free field agree with the observed ones at the photospheric level. Further studies on optimizing such an agreement is proposed. Therefore, an optimal solution without the common force-free assumption is obtained by solving two linear force free extrapolation problems, in which only the normal component of the magnetic field at the lower boundary is known. The difficulties associated with such an extrapolation is well known. We will revisit these problems and propose alternative means to overcome them.
The proposed research has significant impact on LWS program and Heliophysics science, since studying solar coronal magnetic field is the key element in the understanding of solar magnetic activity. It is the driving force of the space weather effect, that is a key issue to NASA's new vision for space exploration. At the present time, new high-quality and high-resolution magnetograph data from both ground-based and space-borne instrumentations are becoming available. It is imperative to develop such a tool to meet the demands for quantitative analysis of solar coronal magnetic field.