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In this poster, we present a relation between the Galactic foregrounds and Galactic latitude to study the structure of the Galactic foregrounds. We propose that the standard deviation of observed values along a line of sight with Galactic latitude b ('$\sigma_{l.o.s}$') is inversely proportional to $\sqrt{\sin|b|}$. To confirm this, we use synchrotron intensity data from the Planck archive and rotation measure (RM) data from the NVSS. We divided the sphere of the Galactic coordinate into bins with a constant surface area and calculated the average of standard deviation along Galactic latitude ('σ_{lat}'). We compared $\sigma_{lat}\sqrt{\sin|b|}$ with σ_{lat} along Galactic latitude and found that $\sigma_{lat}\sqrt{\sin|b|}$ is the most constant. These results support that the relation is reasonable.

태양/태양계

[포 SS-01] Evolution of Coronal Magnetic Fields Consisting of Flux Ropes and Overlying Fields

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A series of numerical MHD simulations are performed to investigate the evolution of coronal magnetic fields consisting of two flux ropes and an overlying field. Depending on the directions of the axial current and the axial field, two co-helicity cases and two counter-helicity cases are addressed. In Case 1, in which both the axial currents and the axial fields are parallel, flux rope merging bears a huge flux rope with a large winding number. This flux rope naturally erupts, but the whole evolutionary process is rather slow. In Case 2, in which the axial currents are parallel while the axial fields are antiparallel, a self-closed structure is formed and it drives eruption. In Case 3, in which the axial currents are antiparallel and the axial fields are parallel, each flux rope erupts independently and the presence of the other flux rope does not affect the eruption of one flux rope. In Case 4, in which both the axial currents and the axial fields are antiparallel, interaction of the flux ropes and the overlying field effects a breakout reconnection creating an apple-like CME configuration. Our study tells what kind of eruption mechanisms are involved for different eruption features observed.

[포 SS-02] How to Impose the Boundary Conditions Operatively in Force-Free Field Solvers

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To construct a coronal force-free magnetic field, we must impose the boundary normal current density (or three components of magnetic field) as well as the boundary normal field at the photosphere as boundary conditions. The only method that is known to implement these boundary conditions exactly is the method devised by Grad and Rubin (1958). However, the Grad-Rubin method and all its variations (including the fluxon method) suffer from convergence problems. The magnetofrictional method and its variations are more robust than the Grad-Rubin method in that they at least produce a certain solution irrespective of whether the global solution is compatible with the imposed boundary conditions. More than often, the influence of the boundary conditions does not reach beyond one or two grid planes next to the boundary. We have found that the 2D solenoidal gauge condition for vector potentials allows us to implement the required boundary conditions easily and effectively. The 2D solenoidal condition is translated into one scalar function. Thus, we need two scalar functions to describe the magnetic field. This description is quite similar to the Chandrasekhar-Kendall representation, but there is a significant difference between them. In the latter, the toroidal field has both Laplacian and divergence terms while in ours, it has only a 2D Laplacian term. The toroidal current density is also expressed by a 2D Laplacian. Thus, the implementation of boundary normal field and current are straightforward and their effect can permeate through the whole computational domain. In this paper, we will give detailed math involved in this formulation and discuss possible lateral and top boundary conditions and their meanings.