Project Details

ROSES ID: NRA-00-OSS-01
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Project Title:
Coronal Magnetic Structures Capable of Producing Coronal Mass Ejections

PI Name: Boon-Chye Low
PI Email: low@ucar.edu
Affiliation: National Center for Atmospheric Research
Summary:
Observations and recent developments in solar magnetohydrodynamics have shown that Coronal Mass Ejections (CMEs) originate from the eruption of pre-existing long-lived coronal magnetic structures interpretable in terms of failure of confinement of highly twisted magnetic fields. This proposal seeks to understand the circumstances of such confinement failures based on analytical and numerical MHD calculations, and relate the theoretical results obtained to observations made in space and from the ground. Several sets of solutions describing static MHD structures in the unbounded space outside a sphere will be constructed, both in idealized axisymmetric geometry and in fully three-dimensional geometry in order to quantitatively survey the parametric limits within which equilibrium states may exist. The proposed work will provide theoretical understanding on (i) when magnetic-field confinement may fail in the solar corona, (ii) how much magnetic energy is available to drive a CME at such a failure point, and, (iii) what plasma and magnetic structures might be observed to be characteristic of such a confinement failure. This understanding will be fundamental to interpretation of existing NASA observational data on CME eruptions, with regards, in particular, to Space Weather interest in observational signatures of an impending CME eruption on the solar disk. The several MHD modeling groups in the solar physics community will benefit from using the static MHD solutions that will be generated by the proposed work as initial states to study CME expulsion out of the corona as time-dependent MHD flows in axisymmetric and 3D geometries. The success of numerical simulation depends on both the power of the time-dependent simulation code and on the availability of suitable initial states physically capable of evolving into a CME. The proposed work includes an observational component as well as a time-dependent simulation component, represented by the Co-Investigators of the proposal. The three-year funding requested will be for (a) the support of a graduate student to be appointed in the NCAR graduate fellowship program, (b

Publication References:

no references