



演 講

Physical Forces Acting on Solar Coronal Mass Ejections (CMEs): Propagation Through Interplanetary Space

Speaker : **James Chen**

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Time : 107 年 5 月 11 日 星期五 14:00

Place : 健雄館(科四館) S4-811 教室

摘 要 / Abstract :

"Space weather" refers to the global condition in the geoplasma environment encompassing the near-Earth solar wind, magnetosphere, and ionosphere. Severe space weather disturbances can adversely affect space-borne as well as ground-based technological systems. The most severe form and the most wide-spread of these disturbances result from major geomagnetic storms, which are invariably driven by the magnetic field of CME structures propagating to the Earth. The physical mechanisms responsible for these closely associated processes have been a major unanswered question in modern solar physics for

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nearly a century. Model concepts have evolved with improving observations. The recent STEREO mission has yielded data on CME dynamics from the Sun to 1 AU, providing much more stringent constraints on CME models than previously available. The prevailing paradigm envisions releasing magnetic energy stored in the coronal magnetic arcades via reconnection, and several large-scale numerical simulation models have been developed to model CMEs and EPs in which reconnection is accomplished by specified and/or numerical dissipations. They have not yet produced quantitative agreement with the observed CME acceleration and propagation to 1 AU. In this talk, I will present a new theoretical concept that yields model CME-EP dynamics in good quantitative agreement with data. The basic driving force is the toroidal Lorentz hoop force acting on a flux rope anchored in the Sun. This force is affected by others including magnetic tension force and drag arising from the momentum coupling of expanding CMEs and the ambient interplanetary plasma medium. The hoop force is similar and scalable to toroidal laboratory plasma structures such as tokamaks and the drag force is similar to aerodynamic drag. New testable answers to the long-standing questions are emerging. These theoretical answers, when fully verified, will help define effective means to predict the onset, severity, and duration of major geomagnetic storms.

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