Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM32-06 会場:503 時間:5 月 2 日 10:30-10:45

放射凝縮による太陽フィラメント形成の 2.5 次元 MHD シミュレーション
2.5D MHD Simulations of Solar Filament Formation by Condensation

金子 岳史 [1*] ; 横山 央明 [1]
KANEKO, Takafumi[1*] ; YOKOYAMA, Takaaki[1]

[1] 東京大学 地球惑星科学専攻
[1]Department of Earth and Planetary Science, The University of Tokyo

We investigate the formation mechanism of solar filaments by two-dimensional magnetohydrodynamic (MHD) simulations. Solar filaments are cool dense plasma clouds in the hot tenuous corona. Filaments abruptly erupt with flares, hence, they are the important objects to comprehend the explosive events in the solar atmosphere. On the other hand, their formation mechanism is still unclear as well as the mechanism for eruptions.

Filaments always appear inside the coronal arcade fields, and the cool dense plasma is sustained by the magnetic forces. Observations show that filaments are categorized as normal polarity filaments or inverse polarity filaments. The normal polarity filaments have the same polarity with the surrounding coronal magnetic fields, while the inverse polarity filaments have opposite polarity. One candidate to explain the origin of the cool dense plasma is condensation by the radiative cooling in the corona. The current condensation model can reproduce the normal polarity filaments, but not the inverse polarity filaments. We propose a new condensation model to reproduce the inverse polarity filaments, and demonstrate it by two-dimensional MHD simulations including radiative cooling, thermal conduction along the magnetic field and gravity. Our model starts from the formation of the magnetic flux rope. The relatively dense plasma at the lower corona is trapped inside the flux rope and lifted up to the upper corona. The dense plasma causes imbalance between the radiative cooling and the background heating, while the thermal conduction along the closed field line of the flux rope does not suppress the thermal imbalance. Consequently, the condensation process is triggered and the cool dense plasma is formed. We test two types of heating term (one depends on magnetic pressure and the other depends on density) and two types of formation mechanisms of the flux rope (one is the conversing motion at the footpoints of the coronal arcade field and the other is the interaction between the emerging flux and the coronal arcade field). As a result, the cool dense plasma is formed inside the flux rope in every case. We also show that our model has a possibility to reproduce the density of solar filaments, which is 10 -100 times larger than that of the surrounding corona, qualitatively.

キーワード: 太陽フィラメント, プロミネンス
Keywords: solar filament, prominence