

representative coronal, photospheric, and chromospheric lines, respectively. Our results may be used as a secondary perspective in addition to primary scientific purposes in selecting a few channels of an UV/EUV imaging instrument for future solar satellite missions.

### [구 SS-06] Halo CME mass estimated by synthetic CMEs based on a full ice-cream cone model

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In this study, we suggest a new method to estimate the mass of a halo coronal mass ejection (CME) using synthetic CMEs. For this, we generate synthetic CMEs based on two assumptions: (1) the CME structure is a full ice-cream cone, (2) the CME electron density follows a power-law distribution ( $\rho_{\text{cme}} = \rho_0 r^{-n}$ ). The power-law exponent  $n$  is obtained by minimizing the root mean square error between the electron number density distributions of an observed CME and the corresponding synthetic CME at a position angle of the CME leading edge. By applying this methodology to 57 halo CMEs, we estimate two kinds of synthetic CME mass. One is a synthetic CME mass which considers only the observed CME region ( $M_{\text{cme1}}$ ), the other is a synthetic CME mass which includes both the observed CME region and the occulted area larger than 4 solar radii ( $M_{\text{cme2}}$ ). From these two cases, we derive conversion factors which are the ratio of a synthetic CME mass to an observed CME mass. The conversion factor for  $M_{\text{cme1}}$  ranges from 1.4 to 3.0 and its average is 2.0. For  $M_{\text{cme2}}$ , the factor ranges from 1.8 to 5.0 with the average of 3.0. These results imply that the observed halo CME mass can be underestimated by about 2 times when we consider the observed CME region, and about 3 times when we consider the region including the occulted area. Interestingly these conversion factors have a very strong negative correlation with angular widths of halo CMEs. We also compare the results with the CME mass estimated from STEREO observations.

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### [구 SS-07] Quasi-Periodic Oscillations of Off-Limb Flaring Arcade Loops observed in the SDO/HMI Continuum

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In this study, we report oscillations of the total intensity of white light loops in the off-limb solar flare observed in 2017-Sep-10 with the SDO/HMI. The total intensity oscillations are correlated with the area of the flaring loop in the plane of the sky. The oscillatory pattern is well fitted by two consecutive damped oscillations. The period and damping time of the first oscillation are 12.9 minutes and 9.9 minutes, respectively. Those of the second oscillation are 11.7 minutes and 15.4 minutes. The excitation of the oscillations coincides with two consecutive type III radio bursts observed in meter range. Assuming the oscillations are magnetoacoustic waves in the flaring loops with the loop lengths ranging from 30 to 90 Mm, the temperature of the white light emitting loops could be in the range from 0.3 MK to 2.6 MK.

### [구 SS-08] Sun-Earth Connection in Korean Historic Observations

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10세기부터 18세기까지 한국 역사서에 기록된 38개 흑점과 이와 연관된 것으로 보이는 25개의 적색 오로라를 조사하여 고대 흑점의 지구 영향성을 분석하였다. 고대 관측 시기를 1300년을 기준으로 이전의 온난기와 이후의 냉한기로 나누어 보면, 흑점의 관측 빈도는 두 기간에서 비슷하지만, 오로라는 냉한기에 집중적으로 관측된다. 특히 하계도, 크기가 큰 흑점의 경우는 냉한기보다 온난기에서 관측 빈도가 세 배 이상 높다. 또한, 흑점과 관련된 오로라의 강도를 분석해보면 크기가 큰 흑점은 작은 흑점보다 2~3배 이상 지구영향성이 높다는 것을 알 수 있다. 우리는 1185년에 관측된 흑점이 수개월에 걸쳐 여러 차례 관측되었다는 것을 확인하였으며, 그 활동성 면에서 2003년 할로윈 이벤트와 유사했을 것으로 유추하였다. 향후 현대의 흑점 관측 스케치와 국제 흑점수의 관계를 정량화할 수 있다면, 유일하게 한국 역사서에만 찾아볼 수 있는 흑점의 크기 단위는 흑점수와 같이 태양활동의 지표로 사용될 수 있을 것으로 보인다.

### [구 SS-09] Apophis Rendezvous Mission: I. Science Goals

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