

by the evolution of the fine-scale magnetic discontinuity in the photosphere

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We report a small-scale EUV bright loop associated with the evolution of the fine-scale magnetic discontinuity in the photosphere. Our analysis was carried out by using the high spatial resolution data taken with InfraRed Imaging Magnetograph (IRIM) and the Fast Imaging Solar Spectrograph (FISS). As a result, an extremely narrow dark lane of the intense horizontal magnetic field (width ~ 300 km) is detected parallel to the boundary of the magnetic pore, which is one of the footpoints of the small-scale bright coronal loop. We find that the variation of the net linear polarization inside the dark lane is closely related to the intensity variations of the coronal loop. Based on our results, we suggest that small-scale atmospheric heating such as bright coronal loop seen above the complex pore group may be strongly affected by the evolution of the fine-scale magnetic discontinuity in the photosphere. This is a nice example of solar atmospheric heatings associated with the fine-scale magnetic discontinuity in the photosphere.

[ㄹ SS-06] Mass and energy of erupting plasma associated with a coronal mass ejection in X-rays and EUV

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We investigate the mass and energy of erupting plasma observed in X-rays and EUV, which is associated with a coronal mass ejection (CME) and an X-class flare. The erupting plasma was observed by both the X-ray telescope (XRT) on Hinode and the Atmospheric Imaging Assembly (AIA) on Solar Dynamic Observatory (SDO). We estimate the emission measures of the erupting

plasma using a differential emission measure method. The plasma erupts with a loop-like structure in X-ray and EUV. We estimate the mass of erupting plasma assuming a cylinder structure. In addition, we estimate the radiative loss, thermal conduction, thermal, and kinetic energies of the eruptive hot plasma. We find that the thermal conduction timescale is much shorter than the duration of the eruption. This result implies that additional heating during the eruption may be required to explain the hot plasma observations in X-rays.

[ㄹ SS-07] Spin and shape analysis for the Mars-crossing asteroid 2078 Nanking

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The YORP effect is non-gravitational force that changes the spin-status of asteroid. So far this effect has been directly detected only from the Near-Earth asteroids (Taylor et al. 2007; Lowry et al. 2007, 2014; Breiter et al. 2011; Durech et al. 2008, 2012). Pravec et al. 2008 found the evidences for changing spin rate of small asteroids (3 - 15 km) by the YORP effect in the Main-Belt and Mars-crossing asteroids. The Mars-crossing asteroids ($1.3 < q < 1.66$ AU) are objects that cross orbit of the Mars. The Mars-crossing asteroids are regarded as one of the main sources for the Near-Earth asteroids. We expect that rotation of Mars-crossing asteroids would be influenced by the YORP effect. We try to search observational evidence of the YORP effect for the Mars-crossing asteroid. Our target 2078 Nanking is a population of the Mars-crossing asteroid. First light-curve of 2078 Nanking was obtained from Mohamed et al. 1994, and Warner et al. 2015 recently published new observational data. We observed this asteroid on 26th Nov. 2014 and 17th Jan. 2015 using SOAO (Sobaeksan Optical Astronomy Observatory) 0.61 m telescope with 4K CCD. Using light-curve inversion method (Kaasalainen & Torppa 2001; Kaasalainen et al. 2001), we try to determine the pole orientation and shape model of this asteroid based on the combination of our light-curve and literature photometric data. Knowing spin parameters, such as rotational period and spin axis, are essential for studying the YORP effect. In this presentation, we provide some preliminary results of our recent study: light-curve and processing of shape modeling of 2078 Nanking. We

plan to find observational clue for the YORP effect on the Mars-crossing asteroids.

고천문학 / 교육홍보 / 기타

[포 AE-01] Advaned Change of the Armillary Size of Chinese Astronomical Instruments

(중국 천체관측기기의 환의 크기의 발전적 변천)

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고대 천문학의 대표적인 관측기기로 혼의가 있다. 중국도 일찍 혼의가 도입되어 천체 관측에 활용된 것으로 보인다. 중국 고대의 선기유행이라는 기기가 한(漢)대에 접어들어 서양에서 도입된 혼천설의 영향을 받아 혼의로 발전하였다. 초창기 혼의에는 주천도수와 24방위의 눈금을 새겼고, 원주율을 3으로 적용하였다. 한말(漢末)에 혼천설에 따라 혼의 안에 지구를 만들고 혼천의 또는 혼천상이라고 불렀다. 혼천설의 구조를 적용하기 위해 비교적 자세한 원주율의 값이 알려지면서 혼의의 정밀한 눈금을 제작하는 계기를 마련하였다. 더불어 수 개의 환을 혼의에 추가하여 2층 구조의 혼의를 개발하였다. 당(唐)대에 이르러 육합의, 삼신의, 사유의로 구성된 혼의의 3층 구조가 완성되었다. 송(宋)대에는 혼의와 혼상에 수격식 자동운행장치를 도입하여 혼천이라고 하고, 이전의 관측용 혼의를 동후의(銅候儀)라고 불렀다. 조선 세종대에 제작한 혼천의는 송(宋)대의 자동운행이 결합된 혼의였고, 동후의의 관측기능을 대신하여 간의를 사용하였다. 그 재원은 각각 오징의 『서찬언』과 『원사』에서 빌려왔고, 이를 『제가역상집』에 정리하였다. 혼의의 환에는 한 개의 원주에 주천도수, 12시백각, 24방위 중 한 종류의 눈금을 그렸다. 그러나 간의에서는 한 개의 원주에 두 개의 눈금을 그리는 방법이 시작되었다. 이러한 눈금제작 방식은 조선에서 새롭게 개발된 일성정시시에 적용되었다.

[포 AE-02] A Study on the Operation Mechanism of Celestial Movement Apparatus of ChoiYuJl's Armillary Sphere(渾天儀)

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17세기 최유지가 제작한 혼천의는 수격식 동력으로 움직이는 자동 천문시계이다. 이 혼천의는 수격식 동력장치와 시간을 알려주는 시보장치, 태양과 달의 운동을 나타내는 천체운행장치로 구성되어 있다. 이 연구는 최유지 혼천의의 천체운행장치의 작동 메카니즘에 대한 것이다. 최유

지 혼천의의 천체운행장치는 태양의 연주운동과 일주운동을 재현하는 태양운행장치와 달의 공전운동과 위상변화를 재현하는 달운행장치로 구성되어 있다. 이 장치들은 조선 초기의 수격식 천문시계에 설치되었던 천체운행장치보다는 발전된 양상을 보인다. 조선 초기에 실로 매어서 운행하던 태양운행장치는 차전(叉箭)과 경각(梗角), 소축(小軸)이라는 장치들이 혼천의에 추가로 설치되어 실과 함께 태양장치를 운행하였다. 또한 조선 초기에는 설치되지 않았던 달운행장치가 새롭게 설치되어 방각(方角), 차전(叉箭), 백각환에 13도 간격으로 박힌 대나무못과 실을 활용하여 달장치를 운행하게 하였다. 우리는 최유지 혼천의의 천체운행장치 작동 메카니즘에 대하여 분석하고 개념모델을 제시했다.

[포 AE-03] The emission spectrum from isolated black holes

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There could be significant numbers of isolated stellar mass black holes in our Galaxy. The detection of these black holes will provide important clues on the origin of supermassive black holes. Interstellar gas will be accreted to these isolated black holes in nearly spherical flow. The gas and the interstellar magnetic field will be compressed and emit bremsstrahlung and magnetic bremsstrahlung. We calculate the density, temperature, magnetic field of the accretion flow onto a 10 solar mass black hole as well as its radiative emission; special attention is given to cyclotron radiation and synchrotron radiation, which covers from microwave to X-ray. We consider the possibility to detect these radiation from isolated Galactic black holes with current instruments and surveys.

[포 AE-04] Introduction to 1M telescope of Deokheung Optical Astronomy Observatory, National Youth Science Center (NYSC)

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We will soon complete the installation of 1m telescope at Deokheung Optical Astronomy Observatory (DOAO), National Youth Space Center (NYSC). Before the test observation with NYSC 1m telescope, we present the specs of the 1M telescope and observational conditions of the DOAO site, such as the seeing data at DOAO and the atmospheric extinction coefficients obtained from the observations of standard stars and stellar