[포 AT-05] Development of Total Radio-Power Detector using Optical transmission for next broadband system of KVN

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한국우주전파관측망(KVN)을 이루는 각 전파망원경에는 4 주파수 동시관측 시스템을 운영하고 있다. 이 시스템에는 각 주파수별로 우주에서 오는 전파신호 세기를 모니터링하기 위한 전파세기 측정기(Total Radio-Power Detector)를 자체 기술로 설계, 제작하여 운영하고 있다. 전파세기 측정기는 수신되는 전파신호의 변화를 확인하기 위한 장치로써, KVN을 이루는 21m 전파망원경의 수신기로 천체의 전파 신호를 관측할 때 사용한다. 현재, KVN 수신 시스템은 광대역 시스템으로의 성능 향상을 위한 개발을 진행하고 있다. 이에, 개발되는 광대역 수신시스템을 지원하기 위하여, 원격지 컴퓨터에서 모니터링과 원격 제어로 자동화 운용이 가능하도록 광전송 방식의 전파세기 측정기를 새로 개발하고 있다. 이번 발표에서는 진행 중인 개발 내용과 향후 계획을 소개한다.

[포 AT-06] All-In-One Observing Software for Small Telescope

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In astronomical observation, sequential device control and real-time data processing are important to maximize observing efficiency. We have developed series of automatic observing software (KAOS, KHU Automatic Observing Software), e.g. KAOS30 for the 30 inch telescope in the McDonald Observatory and KAOS76 for the 76 cm telescope in the KHAO. The series consist of four packages: the DAP (Data Acquisition Package) for CCD Camera control, the TCP (Telescope Control Package) for telescope control, the AFP (Auto Focus Package) for focusing, and the SMP (Script Mode Package) for automation of sequences. In this poster, we introduce KAOS10 which is being developed for controlling a small telescope such as aperture size of 10 cm. The hardware components are the QHY8pro CCD, the QHY5-II CMOS, the iOptron CEM 25 mount, and the Stellarvue SV102ED telescope. The devices are controlled on ASCOM Platform. In addition to the previous packages (DAP, SMP, TCP), KAOS10 has QLP (Quick Look Package) and astrometry function in the TCP. QHY8pro CCD has RGB Bayer matrix and the QLP transforms RGB images into BVR images in real-time. The TCP includes astrometry function which adjusts the telescope position by comparing the image with a star catalog. In the future, We expect KAOS10 be used on the research of transient objects such as a variable star.

[포 AT-07] Design of the Control and Monitoring Architecture for the KVN 4 Channel Receiver System using Profibus

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KVN 수신기는 22/43/86/129GHz 주파수 대역의 우주전파를 관측할 수 있는 4채널 동시 관측 시스템의 핵심으로 다수의 제어 및 모니터 항목이 존재한다. 대표적인 예로 Synthesizer, Pcal, LO, Vacuum, Cryogenic Temperature 등이 있으며 이와 관련된 여러 인스트루먼트가 21m 전파망원경의 하부단에 위치한 수신기실 내에 분산 배치되어 있다. 이에 대한 효율적인 제어를 위해서는 사용자 컴퓨터 관점에서 두 가지 조건이 충족되어야 한다. 첫째, 물리적으로 분산된 인스트루먼트에 대한 접근 및 변경이 용이해야 하고, 둘째는 단일 인터페이스 상에서 다양한 인스트루먼트를 하나로 통합하는 확장성이 보장되어야 한다. 이러한 요건을 고려하여 KVN은 산업 분야에서 널리 쓰이고 있는 프로피버스를 수신기 시스템의 제어를 위한 기반 인터페이스로 활용 중에 있고, 추가 기능 요구에 효율적으로 대처하고 있다. 본 발표에서는 먼저 KVN 수신기 시스템을 구성하는 인스트루먼트에 대해 살펴보고자 한다. 그리고 이를 효율적으로 제어하기 위한 기반 인터페이스로서 프로피버스 구축 및 활용 현황에 대해 논하고자 한다.

태양/태양계

[포 SS-01] Simulations of the Lunar Exosphere: Initial Conditions of atomic species near the Surface of the Moon

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It is interesting to find the best exospheric model that can account for the observed characteristics of the lunar coma and tail simultaneously. Recently, the initial abundances of atomic species near surface are found to be different depending on certain local areas. We will present the influence of different initial conditions of localized sources on the characteristics of the lunar exosphere, and also present time-dependent simulations showing the distributions of atomic species around the lunar coma and the final stage of the lunar tail. Based on our updated 3-D lunar model, we will present resulted physical parameters of the lunar sodium coma and tail.

[포 SS-02] The inference of minimum temperature of the solar atmosphere from the FISS data

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In the solar atmosphere, below the region of temperature minimum, temperature decreases with height and above it, temperature increases with height. Therefore the inference of temperature minimum is a basis of the study about the solar atmosphere and heating problem. The temperature of the temperature minimum region can be inferred from acoustic cutoff frequency. According to a recent study the acoustic cutoff frequency is related to the peak frequency of the power spectrum the chromospheric three-minute velocity oscillations. Using this relationship, we infer the temperature of temperature minimum. The three minute velocity oscillation and its power spectrum are obtained for a pore observed with the Fast Imaging Solar Spectrograph (FISS) Hα band. We present the inferred temperature and compare it with the temperature of Maltby model. We also investigate the effect of the inclination of magnetic field on the temperature minimum.

[포 SS-03] The Limit of Magnetic Helicity Estimation by a Footpoint Tracking Method during a Flux Emergence

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Theoretically, the magnetic helicity transport flux through the solar surface into the upper atmosphere can be estimated indefinitely precisely by magnetic field footpoint tracking if the observational resolution is infinitely fine, even with magnetic flux emergence or submergence. In reality, the temporal and spatial resolutions of observations are limited. When magnetic flux emerging or submerging, the footpoint velocity goes to infinity and the normal magnetic field vanishes at the polarity inversion line. A finite observational resolution thus generates a blackout area in helicity flux estimation near the polarity inversion line. It is questioned how much magnetic helicity is underestimated with a footpoint tracking method due to the absence of information in the blackout area.

We adopt the analytical models of Gold-Hoyle and Lundquist force-free flux ropes and let them emerging from below the solar surface. The observation and the helicity integration can start at different emerging stages of the flux rope, i.e., the photospheric plane initially cuts the flux rope at different levels. We calculate the magnetic helicity of the flux rope below the photospheric level, which is eventually to emerge, except the helicity hidden in the region to be swept by the blackout area with different widths.

Our calculation suggests that the error in the integrated helicity flux estimate is about half of the real value or even larger when small scale magnetic structures emerge into the solar atmosphere.

[포 SS-04] Velocity oscillations in the Chromosphere above a Solar Quiet Region

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We investigate velocity oscillations in a solar quiet region by using the spectral data of the Hα and Ca II 8542Å lines. The data were acquired by the Fast Imaging Solar Spectrograph installed at the 1.6 m Goode Solar Telescope of Big Bear Solar Observatory. According to Chae & Litvinenko (2018)'s theoretical work, there is a correlation between dominant period of the oscillations and the temperature of the temperature minimum region in a non-isothermal atmosphere. In our study, we measure the temporal variations of the intensity and the line of sight Doppler velocity, and find out the relations between the intensity and