channel data

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We demonstrate that a deep learning classifier that only uses to gravitational wave (GW) detectors auxiliary channel data can distinguish various types of non-Gaussian noise transients (glitches) with significant accuracy, i.e., $\gtrsim$ 80%. The classifier is implemented using the multi-scale neural networks (MSNN) with PyTorch. The glitches appearing in the GW strain data have been one of the main obstacles that degrade the sensitivity of the gravitational detectors, consequently hindering the detection and parameterization of the GW signals. Numerous efforts have been devoted to tracking down their origins and to mitigating them. However, there remain many glitches of which origins are not unveiled. We apply the MSNN classifier to the auxiliary channel data corresponding to publicly available GravitySpy glitch samples of LIGO O1 run without using GW strain data. Investigation of the auxiliary channel data of the segments that coincide to the glitches in the GW strain channel is particularly useful for finding the noise sources, because they record physical and environmental conditions and the status of each part of the detector. By only using the auxiliary channel data, this classifier can provide us with the independent view on the data quality and potentially gives us hints to the origins of the glitches, when using the explainable AI technique such as Layer-wise Relevance Propagation or GradCAM.

[포 AT-02] Development progress in the Maunakea Spectroscopic Explorer's Exposure Time Calculator (MSE-ETC)

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MSE (Maunakea Spectroscopic Explorer)는 11.25m 구경의 망원경과 최대 4,000 개의 천체를 한 번에 관측할 수 있는 분광기를 통해 다천체 분광학 연구를 이끌 차세대 관측기기이다. 경희대학교는 망원경에 장착되는 다천체 분광기의 성능 요구사항을 바탕으로 노출 시간 소프트웨어 ETC (Exposure Time Calculator)를 개발하고 있다. ETC는 대기에 의한 연속선 소광, 방출선과 흡수선, 망원경 및 광학 기기의 투과율, 검출기의 암전류와 읽기 잡음을 바탕으로 신호 대 잡음비 S/N (Signal to Noise)을 도출하여 천체를 분광 관측하기 위한 적절한 노출 시간을 계산한다. MSE-ETC는 저분산 LR (Low Resolution, R=3,000), 중분산 MR (Moderate Resolution, R =6,000) 및 고분산 HR (High Resolution, R=40,000)의 관측 모드로 가시광선과 근적외선 영역의 S/N과 파장, 그리고 S/N과 AB등급 간의 상관관계를 보여준다. 본 포스터에서는 개발 중인 MSE-ETC 프로그램의 구조와 작동 알고리즘 및 사용 예를 발표한다.

[포 AT-03] Confocal off-axis optical system with freeform mirror, application to Photon Simulator (PhoSim)

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MESSIER is a science satellite project to observe the Low Surface Brightness (LSB) sky at UV and optical wavelengths. The wide-field, optical system of MESSIER is optimized minimizing optical aberrations through the use of a Linear Astigmatism Free - Three Mirror System (LAF-TMS) combined with freeform mirrors.

One of the key factors in observations of the LSB is the shape and spatial variability of the Point

Spread Function (PSF) produced by scatterings and diffraction effects within the optical system and beyond (baffle). To assess the various factors affecting the PSF in this design, we use PhoSim, the Photon simulator, which is a fast photon Monte Carlo code designed to include all these effects, and also atmospheric effects (for ground-based telescopes) and phenomena occurring inside of the sensor. PhoSim provides very realistic simulations results and is suitable for simulations of very weak signals.

Before the application to the MESSIER optics system, PhoSim had not been validated for confocal off-axis reflective optics (LAF-TMS). As a verification study for the LAF-TMS design, we apply Phosim sequentially.

First, we use a single parabolic mirror system and compare the PSF results of the central field with the results from Zemax, CODE V, and the theoretical Airy pattern. We then test a confocal off-axis Cassegrain system and check PhoSim through cross-validation with CODE V.

At the same time, we describe the shapes of the freeform mirrors with XY and Zernike polynomials. Finally, we will analyze the LAF-TMS design for the MESSIER optical system.

[포 AT-04] Standard Calibration for Broadband and Narrowband Filters of KHAO 0.4 m Telescope

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Maemi Dual Field Telescope System (MDFTS) is a dual telescope system located at Kyung Hee University. The system consists of 0.4 m telescope and 0.1 m telescope for wide-field observation. The 0.4 m telescope provides photometric observation which covers a field of view of 21'×16'. It has been used for various purposes with Johnson-Cousins UBVRI broadband filter system, e.g., SomangNet and Intensive Monitoring Survey of Nearby Galaxies. In this poster, we present the standard calibration result for our broadband filter system. Also, we suggest a new usage of the KHAO 0.4m telescope which is narrowband photometry by demonstrating the standard calibration of H-alpha filter. For flux calibration, not only R filter but also V filter is used for compensating the central wavelength discrepancy between R filter and H-alpha filter.

[포 AT-05] Characterization of the performance of the next-generation controller for the BOES CCD

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We present the characterization of the performance of the next-generation controller (SDSU Gen III) for BOAO Echelle Spectrograph CCD (BOES CCD) at the Bohyunsan Optical Astronomy Observatory. The current controller (SDSU Gen II) of the BOES CCD will be upgraded to SDSU Gen III to provide a more stabilized operation. To assess the performance of the new controller (e.g., conversion gain, full well capacity, S/N), we obtain various types of calibration images (e.g., bias, flat, science images of standard stars). Based on those datasets, we find that the overall performance of the new controller is somewhat comparable to that of the old controller if the slow mode is adopted for the readout. This may demonstrate that the new controller can be successfully substituted for the old controller without a substantial loss of performance. However, further analysis with a large dataset obtained in various observational conditions is necessary to confirm our results.

[포 AT-06] Development Plan for the First GMT ASM Reference Body

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GMT secondary mirror system consists of 7 segmented adaptive mirrors. Each segment consists of a thin shell mirror, actuators and a reference body. The thin shell has a few millimeters of thickness so that it can be easily bent by push and pull force of actuators to compensate the wavefront disturbance of light due to air turbulence. The one end of actuator is supported by the reference body and the other end is adapted to this thin shell. One of critical role of the reference body is to provide the reference surface for the thin shell actuators. Therefore, the reference body is one of key components to succeed in development of GMT ASM. Recently,