

leaves periodic tool marks on machined mirror surfaces, leading to undesirable diffraction effect, as well as the deviation of input beam. In order to solve this problem, we propose new SPDT machining conditions to minimize tool marks. We will also show the results from optical measurement and Power Spectral Density (PSD) analysis to evaluate the expectable performance for applications in wide field infrared telescopes.

**[포 AT-05] BVRI Filter Standardization of DOAO 1m Telescope**

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National Youth Space Center has recently founded the Deokheung Optical Astronomy Observatory (DOAO) 1m Telescope, which accepts community observing applications since 2016. Standardization and calibration of the new observing facility are essential for astronomical research. In this poster, we present standardization processes and preliminary results for photometry of the Johnson-Cousins BVRI filter system. We selected sample data from a night in stable weather condition. After bias, dark, and flat corrections and photometry using ccdred and daophot package of IRAF, we derived standardized band pass parameters including color terms. The corrected photometry results of the BVRI filter system show reduced deviations from the standard magnitudes in the literature. In addition, we calculated atmospheric extinction coefficients and limiting magnitudes of the telescope system. We plan to extend these standardizing processes to flux calibration of narrow band filters, e.g. H $\alpha$  filter.

**[포 AT-06] The Development of The Observing System for Goheung Radio Telescope (고흥전파망원경 관측시스템 개발)**

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2013년 청소년 교육목적으로 개발된 고흥전파간섭계시

스템을 활용하여 청소년으로 하여금 전파관측을 체험케 하고, 전파천문학 연구 기회를 제공하고자 한다. 안정된 단일경 전파관측과 간섭계모드 전파관측을 위해 현 시스템이 갖추어야 할 기능을 개선하고 있다. 보다 정밀하게 관측대상을 추적하고, 전파 점광원을 관측할 수 있도록 새로운 전파관측시스템을 개발한다. 정밀한 관측대상 추적과 함께 데이터 취득 시간을 확장하여 점광원 관측이 가능하게 되면, 청소년에게 전파관측 및 전파간섭원리와 관측 방법을 실험체험 프로그램으로 전해 줄 수 있다.

**KMTNet**

**[포 KMT-01] Progress report of the deep and wide-field imaging survey of nearby galaxies with KMTNet**

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In a  $\Lambda$ CDM universe, galaxies are believed to evolve by mergers and accretions. The debris resulting from such processes remains as diffuse, low-surface brightness structures, such as outer disks, stellar halos, and faint companions. These structures will give us fruitful insight into the recent mass assembly history of galaxies, but it is challenging to observe them due to their low surface brightness. In order to explore the structural properties of outskirts of nearby galaxies, we conduct deep wide-field imaging survey with KMTNet. Here we present a progress report of data reduction for the images of NGC 1291, a lenticular barred galaxy with outer rings. To achieve accurate flat fielding, we use dark sky flat and remove the sky gradient of each exposure with a polynomial fit. As a result, we are able to reach 1 sigma depth of  $\mu_R \sim 29.6$  mag arcsec<sup>-2</sup>. We expect to investigate the surface brightness profile of NGC 1291 in 1-D profile, and color-gradient in the outer part of the galaxy using the B- and R-band images.

**항성 및 항성계**

**[포 ST-01] Raman O VI Profile Analysis of**

## Accretion and Bipolar Outflow in Sanduleak's Star

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Sanduleak's star is a suspected symbiotic binary located in the Large Magellanic Cloud. It is known that it has a giant jet with physical size  $\sim 14$ pc. Its spectrum shows two strong emission bands at 6825Å and 7082Å, which are originated from Raman-scattering of O VI by neutral hydrogen atoms. We present the high-resolution spectrum of Sanduleak's star obtained with MIKE at the Magellan-Caly telescope to investigate the O VI emission region based on the profiles of the two Raman features. In this spectrum, it is noted that the Raman 6825Å feature exhibits a single broad peak profile, which is in high contrast with a clear triple peak profile of the Raman 7082Å feature. In our analysis we suggest that the O VI emission region consist of three main emission parts: an accretion disk, a bipolar outflow and an optically thick, compact component surrounding the white dwarf. By performing Monte Carlo simulation we constrain the representative column density of the H I scattering region  $N_{\text{HI}} \sim 1 \times 10^{23} \text{ cm}^{-2}$ , which is in accordance with the observed flux ratio in the two Raman features  $F(6825)/F(7082) \sim 4.5$ .

## [포 ST-02] Formation of short-period black hole binary systems from Population III stars as gravitational wave radiation sources

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Massive Population III black hole binary systems are one of the suggested candidate sources of the recently detected gravitational wave radiation (GWR). GWR detection from a black hole binary system requires a sufficiently short orbital separation at the time of their formation, such that they would undergo coalescence within the Hubble time. This condition cannot be simply fulfilled by a short initial period, because binary interactions such as mass transfer and common envelope evolution can largely change the orbital

parameters and the masses of stellar components. Here, we discuss the possibility of black hole binary mergers from massive Pop III binary systems, using a new grid of Pop III binary evolutionary models with various initial primary masses ( $20 M_{\odot} \leq M \leq 100 M_{\odot}$ ) and initial separations, for different initial mass ratios ( $q = 0.5 - 0.9$ ).

## [포 ST-03] Photometric Observations for $\delta$ Sct and SX Phe Variables

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변광성은 거리를 결정하기 위한 중요한 천체이며, 대표적으로 RR Lyr형 변광성을 사용하여 성단까지의 거리를 결정해왔다. 하지만 성단의 거리를 결정함에 있어 성단 구성원의 multi-population을 고려해야 한다는 의견이 최근 제시되어 왔으며, 이를 위해 RR Lyr형 외에 새로운 지표가 필요한 실정이다. 변광성 중에서  $\delta$  Sct와 SX Phe형의 경우 짧은 변광 주기를 가지기 때문에, RR Lyr형을 대신할 새로운 지표로 대두되고 있다. 따라서 본 연구에서는 국립고흥청소년우주체험센터(NYSC)에서 주최하는 천문실습 과정에 참여하여 각각 2개의  $\delta$  Sct와 SX Phe형 변광성을 NYSC 1m 망원경을 사용하여 관측하였다. 실습과정에서 진행된 관측 및 자료처리 과정에 대한 검증을 위해, 관측 대상의 광도곡선을 얻고 문헌의 결과와 비교하고자 한다.