

environment. The dewar inside the telescope is designed to operate the infrared detector at 80K stage. From the thermal analysis, we confirmed that the telescope and the dewar can be cooled down to around 200K and 80K, respectively in order to reduce the large amount of thermal noise. The stray light analysis is shown that a light outside a field of view can be reduced below 1%.

After the fabrications of the parts of engineering qualification model (EQM), the NSS EQM was successfully assembled and integrated into the satellite. To verify operations of the satellite in space, the space environment tests such as the vibration, shock and thermal-vacuum test were performed. Here, we report the results of the critical design review for the NISS.

[ㄱ SO-03] Error Compensation Algorithm for Higher Surface Accuracy of Freeform Mirrors Based On the Method of Least Squares

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Off-axis reflective optical systems have attractive advantages relative to their on-axis or refractive counterparts, for example, zero chromatic aberration, no obstruction, and a wide field of view. For the efficient operation of off-axis reflective system, the surface accuracy of freeform mirrors should be higher than the order of wavelengths at which the reflective optical systems operate. Especially for applications in shorter wavelength regions, such as visible and ultraviolet, higher surface accuracy of freeform mirrors is required to minimize the light scattering. In this work, we propose the error compensation algorithm (ECA) for the correction of wavefront errors on freeform mirrors. The ECA converts a form error pattern into polynomial expression by fitting a least square method. The error pattern is measured by using an ultra-high accurate 3-D profilometer (UA3P, Panasonic Corp.). The measured data are fitted by two fitting models: Sag (Delta Z) data model and form (Z) data model. To

evaluate fitting accuracy of these models, we compared the fitted error patterns with the measured error pattern.

항성 및 항성계

[ㄱ ST-01] The Globular Cluster NGC 6273: Another Candidate for the Milky Way Building Blocks

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In our recent investigation (Lim et al. 2015), we have shown that the combination of narrow-band Ca photometry and low-resolution spectroscopy can effectively search for globular clusters (GCs) with supernovae (SNe) enrichments. We apply this technique to the metal-poor bulge GC NGC 6273 and find two distinct subpopulations having different light and heavy element abundances. Our result suggests that NGC 6273 was massive enough to retain SNe ejecta, which would place this cluster in the growing group of GCs with Galactic building block characteristics, such as ω Centauri and M22.

[ㄱ ST-02] Simultaneous source frequency phase referencing observations of H₂O and SiO masers toward VX Sgr

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We performed simultaneous observations of H₂O and SiO masers toward VX Sgr using the Korean VLBI Network (KVN) and Source Frequency Phase Referencing (SFPR) method. The observations were carried out at 5 epochs from 2014 February to 2015 June. The relative locations of the SiO with respect to the H₂O maser emission were determined at two epochs by SFPR for the first time. The H₂O masers show well developed asymmetric outflow features which are spread up to ~300 mas in diameter. On the other hand, the SiO masers show a ring-like structure close to the central star with ~ 30 mas diameter. The SFPR observational results at two epochs ($\phi=0.83$ and 0.99) provide similar relative locations of H₂O and SiO maser features. These superposed maps of H₂O and SiO masers lead us to investigate the

development of outflow motions from relatively spherical SiO maser regions close to central star to aspherical H₂O maser regions according to optical phase of stellar pulsation together with the prediction of the position of central star.

[구 ST-03] Discovery of White Dwarfs in the Globular Clusters M13 and M22 Using the HST ACS Photometric Data

(허블우주망원경 ACS 측광 자료를 이용한 구상성단 M13과 M22에서의 백색왜성 발견)

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허블우주망원경에 장착된 ACS/WFC로 획득한 Anderson 등과 Sarajedini 등의 깊고 균질한 VI 측광 목록을 이용하여 우리은하 구상성단 M13(NGC 6205)과 M22(NGC 6656)의 뜨겁고 밝은 백색왜성 탐사를 수행하였다. 허블우주망원경 VI 측광 목록으로부터 M13과 M22의 V 대 V-I 색-등급도를 작성하였고 여기에서 많은 항성으로 잘못 검출된 대상(spurious detection)을 측광 질매개변수 qfit(V)와 qfit(I)에 따라서 제거하였다. 그리고 M13의 경우에는 중심의 높은 밀집도에 기인한 높은 측광 오차를 가진 중심영역 별을 제거하기 위하여 성단 중심으로부터의 추가적인 반경 제한을 실시하였다. 이렇게 도출한 M13과 M22의 각각의 V 대 V-I 색-등급도에서 십여개 정도의 백색왜성 후보를 동정하였다. 이들은 동반되어 제공되는 ACS/WFC 각각의 영상에서 항성체로 동정되었으며, M13과 M22의 성단 중심부 영역에 임의적으로 분포하고 있으며, 색-등급도상의 위치가 DA 백색왜성 냉각계열의 밝은 부분에 위치하고 있어서 이들이 M13과 M22의 진짜 백색왜성임을 나타내고 있다. 이들에 대해 추가적으로 분광학적인 관측 연구를 수행한다면 이들의 백색왜성 진위 여부와 다양한 물리량을 밝혀낼 것이다. 또한 가까운 구상성단에 대해서 같은 방법으로 조사를 수행하면 더 많은 구상성단에서 갓 태어난 뜨겁고 밝은 백색왜성을 찾아낼 것으로 기대한다.

별 생성

[구 SF-01] A Photometric Study of the Young Open Cluster IC 1805

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We have performed deep wide-field CCD photometry of the young open cluster IC 1805 in the famous star forming region W4, and obtained

photometric data for more than 91,000 stars in the field of IC 1805 based on observations with the 3.6m CFHT and the AZT-22 1.5m telescope at Maidanak Astronomical Observatory in Uzbekistan. The photometric data cover an area 43' × 45' which is far larger and far deeper than any other optical observations made for the cluster. In order to select the young stellar objects with mid-IR excess emission, we have performed mid-IR photometry of the cluster using the archival images obtained with the Spitzer Space Telescope IRAC and MIPS instruments.

From a preliminary analysis of the data, we determined the reddening law ($R_V = 3.02 \pm 0.05$), distance modulus ($V_0 - M_V = 11.9 \pm 0.2$), and the spatial distribution of members.

[구 SF-02] Warm Dust and Gas of Massive YSOs Revealed by Herschel PACS Spectroscopy

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As part of the Herschel key program “Water in Star-forming Regions with Herschel (WISH)”, PACS imaging spectroscopy data have been taken toward ten massive young stellar objects (YSOs): four high mass protostellar objects (HMPOs), two hot molecular cores (HMCs), and four ultracompact HII regions (UCHIIs). The spectra cover a broad range of wavelengths (55 to 210 micron) presenting various atomic and molecular lines as well as excellent dust thermal continua. By fitting the continua utilizing a modified black-body formula we estimate mass-weighted temperature and column density distributions of warm dust and find that UCHII regions are warmer and HMCs are more deeply embedded than the other types. We also estimate rotational temperature and column density distributions of warm CO gas using the rotational diagram analysis. In addition, based on the comparison of high J CO line fluxes to the RATRAN estimates of central heating envelope models, we find that majority of warm CO is originated from bipolar outflow shocks.

[구 SF-03] Molecular Hydrogen Outflow in