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)

Dong-Hwan Cho[1] (조동환), Tae Seog Yoon[1] (윤태석), Sang-Gak Lee[2,3] (이상각), Hyun-Il Sung[1,4] (성현일)
[1]Kyungpook National University, [2]Seoul National University, [3]National Youth Space Center, [4]Korea Astronomy and Space Science Institute

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 질 매개변수 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.

별생성

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

Hwankyung Sung[1], Beomdu Lim[2], M. S. Bessell[3], Hyeonoh Hur[1], Jonghyuk Yi[4], & Moo-Young Chun[2]
[1]Sejong University, [2]KASI, [3]RSAA, ANU, & [4]SE Lab

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 $43' \times 45'$ 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

Woojin Kwon (권우진)[1,2], Floris F. S. van der Tak[2,3], Agata Karska[4,5,6], Gregory J. Herczeg[7], Luis Chavarria[8], Fabrice Herpin[9,10], Friedrich Wyrowski[11], Jonathan Braine[9,10], Ewine F. van Dishoeck[5,6]
[1]KASI (한국천문연구원), [2]SRON, [3]Univ. of Groningen, [4]Adam Mickiewicz Univ., [5]MPE, [6]Leiden Univ., [7]Peking Univ., [8]Univ. de Chile, [9]Univ. de Bordeaux, [10]CNRS, [11]MPIfR

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

Infrared Dark Cloud Core MSXDC G53.11+00.05

Hyun-Jeong Kim[1], Bon-Chul Koo[1], Tae-Soo Pyo[2], and Christopher J. Davis[3]
[1]Seoul National University, Korea, [2]Subaru Telescope, National Astronomical Observatory of Japan, USA, [3]National Science Foundation, USA

Outflows and jets from young stellar objects (YSOs) are prominent observational phenomena in star formation process. Indicating currently ongoing star formation and directly tracing mass accretion, they provide clues about the accretion processes and accretion history of YSOs. While outflows of low-mass YSOs are commonly observed and well studied, such studies for high-mass YSOs have been so far rather limited owing to their large distances and high visual extinction. Recently, we have found a number of molecular hydrogen (H2 1-0 S(1) at 2.12 micron) outflows in the long, filamentary infrared dark cloud (IRDC) G53.2 located at 1.7 kpc from UWISH2, the unbiased, narrow-band imaging survey centered at 2.12 micron using WFCAM/UKIRT. In IRDC G53.2 which is an active star-forming region with ~300 YSOs, H2 outflows are ubiquitously distributed around YSOs along dark filaments. In this study, we present the most prominent H2 outflow among them identified in one of the IRDC cores MSXDC G53.11+00.05. The outflow shows a remarkable bipolar morphology and has complex structures with several flows and knots. The outflow size of ~1 pc and H2 luminosity about ~1.2 Lsol as well as spectral energy distributions of the Class I YSOs at the center suggest that the outflow is likely associated with a high-mass YSO. We report the physical properties of H2 outflow and characteristics of central YSOs that show variability between several years using the H2 and [Fe II] images obtained from UWISH2, UWIFE and Subaru/IRCS+AO188 observations. Based on the results, we discuss the possible origin of the outflow and accretion processes in terms of massive star formation occurring in IRDC core.

[구 SF-04] SED MODELING FOR CLASS 0 PROTOSTAR L1527 IRS

Giseon Baek, Jeong-Eun Lee, and Seokho Lee
School of Space Research, Kyung Hee University, 1 Seocheon-dong, Giheung-gu, Yongin, Gyeonggi-do 446-701, Korea

We model the Spectral Energy Distribution (SED) of Class 0 protostar L1527 IRS using a radiative transfer code RADMC-3D. In addition to the photometry data from literatures, we include the Herschel/PACS data which well covers the far-infrared SED peak of L1527 IRS, providing precise constraints to the density structure and other physical properties of its circumstellar envelope. Previously, Tobin et al. (2013) presented a dust continuum modeling results using a rotating and infalling envelope (Terebey and Shu, & Cassen 1984 ; TSC envelope), which originally describes a power-law density profile ($\rho \propto r^{-\alpha}$) with the power-law index (α) of 1.5. However, we find that Herschel/PACS data are better fitted with a shallower power-law density profile. This smaller power-law might be attributed to a inner envelope. Thus, we fit the SED of L1527 IRS with a Bonnor-Ebert sphere, which is a combination of the inner flat-topped and the outer power-law (α =2) density profiles. This Bonnor-Ebert sphere is often used to explain the density profile of prestellar cores, which is considered the earliest stages of star formation. The well-fitted SED with a Bonnor-Ebert sphere suggests that L1527 IRS might have collapsed from a Bonnor-Ebert sphere rather than a singular isothermal sphere.

[박 SF-05] Water vapor in high-mass star-forming regions and PDRs: the Herschel/HIFI view

Yunhee Choi[1,2,3], Floris F. S. van der Tak[3,2], Ewine F. van Dishoeck[4,5], and Edwin A. Bergin[6]
[1]Kyung Hee University, Korea, [2]Kapteyn Astronomical Institute, University of Groningen, The Netherlands, [3]SRON Netherlands Institute for Space Research, The Netherlands, [4]Leiden Observatory, Leiden University, The Netherlands, [5]Max Planck Institut für Extraterrestrische Physik, Germany, [6]Dept. of Astronomy, University of Michigan, USA

Massive stars play a major role in the interstellar energy budget and the shaping of the galactic environment. The water molecule is thought to be a sensitive tracer of physical conditions and dynamics in star-forming regions because of its large abundance variations between hot and cold regions. Herschel/HIFI allows us to observe the multiple rotational transitions of H2O including the ground-state levels, and its isotopologues toward high-mass star-forming regions in different evolutionary stages. Photodissociation regions (PDRs) are also targeted to investigate the distribution of water and its