

of the perturber. The flows behind the shock are initially non-steady, causing the detached shock distance to oscillate and vortex rings to form around the perturber. The vortex rings are eventually shed downstream and the flows evolve toward a quasi-steady state. Increasing the perturber mass enhances the detached shock distance and symmetrizes the density wake near the perturber, resulting in a diminished drag force on a massive perturber compared to the prediction of the linear analysis. This implies that the decay time of a perturber does not scale as the inverse of the perturber mass.

**[GC-06] Dynamical Evolution of Globular Clusters within Mini Dark Matter Halos**

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According to the primordial scenario of globular cluster formation, star clusters were formed within mini dark matter halos in the early universe. If globular clusters initially had a dark matter halo around them, their early dynamical evolution could be different from the case without the halo, which has been the usual assumptions made for the studies of the dynamical evolution of globular clusters. With the most advanced 2-dimensional Fokker-Planck models, we study the effects of the presence of the dark matter halo on the dynamical evolution and the present mass-to-light ratios of globular cluster systems. Moreover, we test a possibility of globular clusters as building blocks of galaxies using comparison between models and observations.

**[GC-07] CFHT/OSASIS에 의한 Seyfert 은하 분광 연구 - 1. NGC 5728**

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OASIS는 능동 광학(adapted optics) 기술과 마이크로 렌즈 배열이 적용되어, 한 번의 노출로 1100여개 지역의 스펙트럼을 동시에 얻을 수 있는 장점을 가진 3D( $\alpha$ ,  $\delta$ ,  $\lambda$ ) 분광기이다. 1998년부터 CFHT 3.6 m 망원경에 부착되어 5년간 운영되면서 Seyfert과 LINER형 나선 은하들을 관측해왔다. 우리는 이 중에서 2001년 3월에 관측된 7개 Seyfert 은하들의 핵 주위 중심영역을 연구하고 있다. 이러한 3D 분광기를 이용한 연구방법을 소개하고, 첫 번째 연구대상인 Seyfert 2 은하 NGC 5728의 시선 속도 영상과 방출선 비 등을 이용해 중심 12"×10" 영역의 운동과 물리적 상태를 연구한 결과를 발표한다. 처음으로 이 은하 내부 ring의 운동에 대해 다루었다. 영상에서 나타난 기하학적 구조와 분

광선의 시선 속도를 통해 ring의 회전 및 팽창 모델을 만들고, 이 ring은 반경이 5".4인 원형이고, 시계방향으로 245 km s<sup>-1</sup> 정도로 회전하고 있으며, 동시에 62 km s<sup>-1</sup> 정도의 팽창 속도를 가짐을 밝혔다. 방출선 영상에서 밝게 나타나는 두 core는 서로 반대방향의 시선 속도를 보이는데, [O III]5007 시선 속도 연구에서 두 core는 서로 회전하는 것으로 보이며, core 내부에서는 물질들이 안쪽으로 흘러들어가는 양상을 보였다. [S II]6716/6731 비를 이용해 구한 두 core 영역의 전자밀도는 약 500 cm<sup>-3</sup> 정도이며, IUE 자료의 Si III]1892/C III]1909 비를 이용한 BLR의 전자밀도는 1010 cm<sup>-3</sup> 정도로 추정하였다.

**■ Session : 초청강연 (IS)**

**4월 29일(수) 14:00 - 14:30 제1발표장**

**[IS-01] International Collaboration is the Most Crucial Challenge for Astronomy in the Future**

Seok Jae Park

*KASI*

While working on the KVN (Korean VLBI Network) project, I realized that cooperation with astronomers of Japan was most essential because KVN is similar to VERA (VLBI Exploration of Radio Astrometry) of Japan. Collaboration is crucial in the field of optical astronomy also. For example, KASI joined the GMT (Giant Magellan Telescope) project from 2009. The GMT is a next-generation 25m ELT (Extremely Large Telescope) founded by six American and two Australian institutions. Construction of telescopes like the GMT that are costly and large in scale cannot be accomplished by one country alone. Many expensive projects await for us, and the importance of international cooperation should never be overlooked.

**■ Session : 은하/우주론 II (GC)**

**4월 29일(수) 14:40 - 15:55 제1발표장**

**[GC-08] Early-type galaxies prevailed by super-Helium-rich EHB populations: Evidence from the UV upturn and the Balmer absorption lines**

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A growing body of evidence is suggesting that peculiar globular clusters (GCs) with the extended HB (EHB) are most likely the remaining relics of primordial galaxy building blocks. Far-UV photometry of M87 GCs is also suggesting the prevalence of EHB population in early-type galaxies (ETGs). Here we have included the super-He-rich EHB

population in our population synthesis models for the old stellar systems. Our models are based on the updated Y2 isochrones and HB evolutionary tracks with enhanced Helium abundance, and are calibrated to reproduce the color-magnitude diagram morphology and/or FUV color of EHB GCs in the Milky Way and in M87. We find that our composite models for the 12–13 Gyr old early-type galaxies (ETGs) can naturally reproduce both the far-UV upturn and the Balmer absorption lines of nearby ETGs. We also show, for the first time, that passive evolution of these models back to the past Universe can reproduce the GALEX UV ( $0 < z < 0.2$ ) and the SDSS ( $z \sim 0.1$ ) and the DEEP2 ( $z \sim 0.9$ ) optical data. Moreover, our models with EHB population resolve the well-known discrepancy in ages derived from different Balmer lines, producing consistent ages both from the H-beta and H-delta lines. All of these are significant development compared to the previous models without EHB population.

#### [GC-09] The Star Formation History of Low Surface Brightness Galaxies

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The star formation histories of low surface brightness galaxies are interesting but poorly constrained. These objects tend to be rather blue, contradicting the initial impression that they may simply be faded remnants of higher surface brightness galaxies whose star formation has finished. Other scenarios span a broad range: a young mean age, less dust, a lower metallicity, perhaps even a variable IMF. Distinguishing between these scenarios requires sufficient information to build stellar population synthesis models which, if not unique, at least exclude certain possibilities. The total stellar mass ( $M_*$ ) of a galaxy is most closely traced with the K<sub>s</sub>-band light. Considering that this mass must form over a Hubble time, this in effect gives a measure of the time averaged star formation rate ( $\langle \dot{M}_* \rangle$  [approximate]  $M_* H_0$ ). H $\alpha$  emission traces the location of star formation, and also provides a fairly robust quantitative measure of its current rate ( $\dot{M}_*$ ). We have obtained near-infrared broadband photometry and H $\alpha$  photometry of a large sample of low surface brightness galaxies to measure the current and the time-averaged star formation rate in order to constrain their star formation histories. The current star formation rates of LSBGs generally are higher than their past star formation rate, suggesting that the mean age of their stellar population is relatively young. This may stem from either a late epoch of

formation or a sluggish evolution. In the latter case, the star formation efficiency may be an increasing function of time, perhaps due in part to the slow build up of metals and dust. Nevertheless, star formation remains sporadic and is generally not well organized across the disk. We find a strong correlation between the ratio of current to past average star formation rate and the gas mass fraction. Galaxies with large reservoirs of gas have relatively high current SFRs. There is a conspicuous absence of high gas mass fraction, low SFR galaxies, suggesting that the observed trend is not driven by bursts of star formation with short duty cycles.

#### [GC-10] An HST/ACS Survey of Star Clusters in the Irregular Galaxy IC10

Sungsoon Lim and Myung Gyoon Lee

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We present the result of a survey of star clusters in the Local Group irregular galaxy IC10 using F435W, F606W, & F814W images obtained with the Hubble Space Telescope (HST) Advanced Camera for Surveys (ACS). Bright star clusters in IC10 are partially resolved into stars, allowing us to obtain their Color-Magnitude Diagrams (CMDs). We have found 36 star clusters based on their morphological and photometric informations. The star clusters in IC10 are divided two groups by their morphology. One third of star clusters are circular, and the others are irregular. We estimate ages of the star clusters using the CMDs. Several clusters are young, and most of them are embedded in HII regions. We also find several globular cluster candidates. We discuss the photometric and physical properties of these star clusters in regard to the formation history of star clusters in IC10.

#### [GC-11] An Ultraviolet Study of Star-Forming Regions in M31

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We present a comprehensive study of star-forming (SF) regions in the nearest large spiral galaxy M31. We use GALEX far-UV (1344–1786 Å, FUV) and near-UV (1771–2831 Å, NUV) imaging to detect young massive stars and trace the recent star formation across the galaxy. The FUV and NUV flux measurements of the SF regions, combined with ground-based data for estimating the