Seou¹, ²Korea Astronomy and Space Science Institute, ³Department of Astronomy, Yonsei University, ⁴Department of Physics, University of Seoul

We introduce a novel method for reconstructing the projected matter distributions of galaxy clusters with weak-lensing (WL) data based on convolutional neural network (CNN). We control the noise level of the galaxy shear catalog such that it mimics the typical properties of the existing Subaru/Suprime-Cam WL observations of galaxy clusters. We find that our mass reconstruction based on multi-layered CNN with architectures of alternating convolution and trans-convolution filters significantly outperforms the traditional mass reconstruction methods.

[구 ML-03] Reconstructing the cosmic density field based on the generative adversarial network.

Feng Shi
Korea Astronomy and Space Science Institute

In this topic, I will introduce a recent work on reconstructing the cosmic density field based on the GAN. I will show the performance of the GAN compared to the traditional Unet architecture. I'd also like to discuss a 3-channels-based 2D datasets for the training to recover the 3D density field. Finally, I will present some performance tests based on the test datasets.

[구 ML-04] From dark matter to baryons in a simulated universe via machine learning

Yongseok Jo Seoul National University

The dark matter (DM) only simulations have been exploited to study e.g. the large scale structures and properties of a halo. In a baryon side, the high-resolution hydrodynamic simulation such as IllustrisTNG has helped extend the physics of gas with stars and DM. However cost expansive computational of hydrodynamic simulations limits the size of a simulated universe whereas DM-only simulations can generate the universe of the cosmological horizon size approximately.

I will introduce a pipeline to estimate baryonic properties of a galaxy inside a dark matter (DM) halo in DM-only simulations using a machine trained on high-resolution hydrodynamic simulations. An extremely randomized tree (ERT) algorithm is used together with multiple novel improvements such as a refined error function in machine training and two-stage learning. By

applying our machine to the DM-only simulation of a large volume, I then validate the pipeline that rapidly generates a galaxy catalog from a DM halo catalog using the correlations the machine found in hydrodynamic simulations. I will discuss the benefits that machine-based approaches like this entail, as well as suggestions to raise the scientific potential of such approaches.

항성 및 항성계

[구 SA-01] Sejong Open cluster Survey (SOS). VII. A Photometric Study of the Young Open Cluster IC 1590

Seulgi Kim (김슬기)¹, Hwangyung Sung (성환경)¹, Michael S. Bessell², Beomdu Lim (임범두)³
¹Department of astronomy and space science, Sejong University, Seoul, Republic of Korea,
²Research School of Astronomy & Astrophysics, The Australian National University, Canberra, ACT 2611, Australia, ³School of Space Research, Kyung Hee University 1732, Deogyeong-daero, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea

We present deep $UBVI_c$ and $H\alpha$ photometry for the young open cluster IC 1590 which is at the center of the HII region NGC 281. From Hα index, 39 $H\alpha$ emission stars and 15 $H\alpha$ emission candidates are selected. The reddening law toward IC 1590 is slightly abnormal ($R_{V,cl}$ = 3.6 \pm 0.2). The distance modulus of IC 1590 obtained from the reddening-free (Q', $Q_{V\lambda}$) diagrams is 12.4 ± 0.1 mag (d = 3.02 ± 0.14 kpc), which is consistent with distance $d = 2.91 \pm 0.42$ kpc from the parallax of Gaia DR2 catalogue within the error range. We also determined the age and mass function of IC 1590 using the stellar evolution models and PMS evolutionary tracks. The median age of PMS stars is 2.4 ± 2.2 Myr. The initial mass function (IMF) of IC 1590 is the Salpeter-type IMF with a slope of Γ = -1.26 ± 0.14 for m > 1 M_{\odot} stars.

[7 SA-02] Discovery of Raman-scattered He II Features at 6545 Å in Planetary Nebulae NGC 6886 & NGC 6881 from BOES Spectroscopy

Bo-Eun Choi¹, Hee-Won Lee¹

¹Department of Physics and Astronomy, Sejong University

We report our discovery of Raman-scattered He II $\lambda6545$ feature in young planetary nebulae NGC

6886 and NGC 6881 which indicates the existence of atomic hydrogen components. Considering sharply increasing cross-section of hydrogen atom near the resonance, Raman-scattered He II features are a useful diagnostic tool to investigate the distribution and kinematics of H I region in nebulae. The high-resolution spectroscopic observation was carried out using BOES installed on the 1.8 m telescope of BOAO. We estimate the column density of H I region and its expansion velocity using our grid-based Monte-Carlo radiative transfer code. We assume that the H I region is uniformly distributed in spherical shell geometry with an opening angle and expands with constant speed. Our best-fit model is shown with the column density NHI = 3×10^{20} cm⁻² and expansion speed vexp = 25 km s^{-1} with the opening angle \sim 25° for NGC 6886, and NHI = 4 \times $10^{20}~\text{cm}^{\text{--}2}$ and v_{exp} = $30~\text{km}~\text{s}^{\text{--}1}$ with the opening angle ~ 35° for NGC 6881. We present brief discussions on the late-stage of evolution of stars with mass > 3 M_{\odot} .

[구 SA-03] The kinematic properties of stellar groups in the Rosette Nebula: its implication on their formation process

Beomdu Lim¹, Jongsuk Hong², Yaël Nazé³, Byeong-Gon Park⁴, Narae Hwang⁴, Jeong-Eun Lee¹, Hyeong-Sik Yun¹, Sunkyung Park¹ and Hee-Weon Yi¹

¹Kyung Hee University, ²Yonsei University, ³University of Liège, ⁴Korea Astronomy and Space Science Institute

The Rosette Nebula is the most actively star-forming region in the Monoceros OB2 association. This region hosts more than three stellar groups, including the most populous group NGC 2244 at the center of the region and the smaller stellar groups around the border of the H II bubble. To trace their formation process, we investigate the kinematic properties of these groups using the Gaia astrometric data and high-resolution spectra taken from observation with Hectochelle on MMT. The proper motions of stars in NGC 2244 show a pattern of radial expansion. The signature of cluster rotation is also detected from their radial velocities. On the other hand, the small groups appear to be physically associated with some clouds at the ridge of the H II region. Among them, the group near the eastern pillar-like gas structure shows the signature of feedback-driven star formation. In this presentation, we will further discuss the formation process and dynamical evolution of the stellar groups in the Rosette Nebula, based on the observation and results of N-body simulations.

[구 SA-04] Nature of Fe II fluorescent lines in Luminous Blue Variables

Jae-Joon Lee (이재준)¹, Seok-Jun Chang (장석준)^{1,2}, Kwang-il Seon (선광일)¹ and Hyun-Jeong Kim (김현정)³

¹Korea Astronomy and Space science Institute (한국천문연구원), ²Sejong University (세종대학교), ³Kyung Hee University (경희대학교)

Luminous blue variables (LBVs) are massive evolved stars that show unpredictable photometric and spectral variation. It is generally assumed that they undergo one or more of large eruptions. We have obtained high dispersion NIR spectra of several LBVs with Immersion GRating INfrared Spectrometer (IGRINS). One notable feature in their IGRINS spectra is the existence of broad lines (~ a few hundred km/s) with unusual boxy profile. They are fluorescent lines of Fe II by Lyman a photons in the stellar wind. However, modeling of these lines with radiative transfer code CMFGEN predicts much weaker line strength. We propose that incorporating broadening of Lyman a line by scattering processes in dense wind can enhance the Fe II fluorescent lines. We further discuss how these Fe II fluorescent lines can be used to characterize massive LBV wind.

[구 SA-05] Development of a Markov Chain Monte Carlo parameter estimation pipeline for compact binary coalescences with KAGRA GW detector (카그라 마코브 체인 몬테칼로 모수 추정 파이프라인 분석 개발과 밀집 쌍성의 물리량 측정)

Chunglee Kim¹, Chaeyeon Jeon¹, Hyung Won Lee², Jeongcho Kim², Hideyuki Tagoshi³, ¹Ewha Womans University, ²Inje University, ³University of Tokyo, The Institute for Cosmic Ray Research

We present the status of the development of a Markov Chain Monte Carlo (MCMC) parameter estimation (PE) pipeline for compact binary coalescences (CBCs) with the Japanese KAGRA gravitational-wave (GW) detector. The pipeline is included in the KAGRA Algorithm Library (KAGALI). Basic functionalities are benchmarked from the LIGO Algorithm Library (LALSuite) but the KAGRA MCMC PE pipeline will provide a simpler, memory-efficient pipeline to estimate physical parameters from gravitational waves emitted from compact binaries consisting of black holes or neutron stars. Applying inspiral-merge-ringdown and inspiral waveforms, we performed simulations