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 planetary 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 ~ 25° for NGC 6886, and NHI = 4 × 10^{20} cm^{-2} and v_{exp} = 30 km s^{-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

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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

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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 α 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 α 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 Kim[1], Chaeyeon Jeon[1], Hyung Won Lee[2], Jeongcho Kim[2] , Hideyuki Tagoshi[3],
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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

of various black hole binaries, we performed the code sanity check and performance test. In this talk, we present the situation of GW observation with the Covid-19 pandemic. In addition to preliminary PE results with the KAGALI MCMC PE pipeline, we discuss how we can optimize a CBC PE pipeline toward the next observation run.

고에너지천문학/이론천문학

[구 HT-01] Test-particle Solutions for Electron Acceleration in Low Mach Number Shocks

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We propose semi-analytic models for the electron momentum distribution in weak shocks that accounts for both in situ acceleration and re-acceleration through diffusive shock acceleration (DSA). In the former case, a small fraction of incoming electrons is assumed to be reflected at the shock ramp and pre-accelerated to the so-called injection momentum, $p_{\rm inj}$, above which particles can diffuse across the shock transition and participate in the DSA process. This leads to the DSA power-law distribution extending from the smallest momentum of reflected electrons, $p_{\rm ref}$, all the way to the cutoff momentum, $p_{\rm eq}$, constrained by radiative cooling. In the latter case, fossil electrons, specified by a power-law spectrum with a cutoff, are assumed to be re-accelerated from $p_{\rm ref}$ up to $p_{\rm eq}$ via DSA. We show that, in the in situ acceleration model, the amplitude of radio synchrotron emission depends strongly on the shock Mach number, whereas it varies rather weakly in the re-acceleration model.

[구 HT-02] Microinstabilities at Quasi-Perpendicular Shocks in the High-β ICM

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At quasi-perpendicular shocks in the high-β ($\beta = P_{gas}/P_{mag}$~100) intracluster medium (ICM), various microinstabilities occur by the temperature anisotropies and/or drift motions of plasma. In the downstream, the Alfvén ion cyclotron instability (AIC) due to the ion temperature anisotropy ($T_{i\perp} > T_{i\parallel}$) is triggered by shock-reflected ions, the whistler instability (WI) is driven by the electron temperature anisotropy ($T_{e\perp} > T_{e\parallel}$) as a consequence of the shock compression of magnetic fields, and the mirror instability is generated due to the ion and/or electron temperature anisotropy. At the shock foot, the modified two stream instability (MTSI) is possibly excited by the cross-field drift between ions and electrons. In the upstream, electron firehose instability (EFI) is driven by the electron temperature anisotropy or the relative drift between incoming and reflected electrons. These microinstabilities play important roles in the particle acceleration in ICM shocks, so understanding of the microinstabilities and the resultant plasma waves is essential. In this study, based on a linear stability analysis, the basic properties of the microinstabilities in ICM shocks and the ion/electron scale fluctuations are described. We then discuss the implication of our work on the electron pre-acceleration in ICM shocks.

[구 HT-03] Turbulence Dynamo in Compressively Driven Fluids

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천문학적 유체는 강하게 자화되어 있는 경우가 많은데, 이러한 강한 자기장을 얻는 한 방법이 난류에 의한 자기장의 증폭이다. 플라즈마 효과나 기타의 이유로 약한 씨앗 자기장이 유체에 생길 경우, 난류는 이 씨앗 자기장을 매우 효과적으로 증폭시킬 수가 있다. 이 과정을 난류 다이너모라 하는데, 난류 다이너모는 주로 비압축성 난류 구동력을 사용하여 연구해 오고 있다. 비압축성 구동력을 사용할 때의 난류 다이너모 과정은 비교적 잘 규명되어 있다. 기존의 연구 결과에 의하면, 자기장의 세기는 지수 함수적 성장을 거친 후 선형적 성장 단계를 겪는다. 이후, 자기장의 에너지 밀도가 난류의 에너지 밀도와 비슷해지면 자기장은 더 이상 성장하지 못하고 포화 상태에 접어든다. 결론적으로 난류는 자기장이 동력학적으로 중요한 수준까지 증폭을 시킬 수 있다. 압축성 난류 구동력을 사용한 난류 다이너모 연구도 일부 존재하는데, 기존의 연구 결과에 의하면 다이너모 효과가 비압축성 구동력의 경우보다 비효율적이다. 본 연구에서는 압축성 구동력을 사용하여 난류 다이너모를 체계적으로 연구하였다. 특히 압축성 구동력과 비압축성 구동력이 난류 다이너모 효과에 어떤 차이를 주는지 체계적으로 비교하였다.

[구 HT-04] ERotating Bondi Accretion Flow with and without outflow