[석 GC-07] The impact of the ISM on Lyman alpha emission in idealized galaxy simulations

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수소 라이먼 알파선은 관측이 어려운 외부은하의 성간물질이나 성운 주위의 물질의 운동학적, 기하학적 상태를 알려주는 지표이다. 특히 라이먼 알파 방출 스펙트럼의 두 최고점에서 측정한 선속도 차이(Vsep)는 물질의 수축, 팽창 여부에 영향을 받기 때문에 은하의 역학적 특성을 연구하는 데에 있어 새로운 도구로서 각광받고 있다. 이 연구에서는 복사유체역학 시뮬레이션 코드 RAMSES-RT를 이용하여, 다양한 물리량을 가진 은하가 만드는 라이먼 알파선 특성을 분석하였다. 은하 내 기체 함량 및 중원소 함량비를 다르게 하였으며, 각 시뮬레이션들은 몬테-카를로 공진선 복사전달 코드 RASCAS를 이용하여 라이먼 알파선의 복사 과정을 계산하였다. 그 결과, 거대분자운 시뮬레이션 대비(Kimm et al. 2019) Vsep이 크게 증가하였으며 (약 150->300km/s), 관측되는 은하들 수준의 Vsep이 재현되는 것을 확인하였다. 은하의 중원소 함량비가 증가한 경우, 은하 내 먼지량과 젊은 별들이 거대분자운에 머무는 시간이 늘어나기 때문에 기준 은하와 비교하여 선속도 차이가 작아졌으며(Vsep~270km/s), 은하의 기체 함량을 증가시켰을 때는 산란 횟수 증가로 인하여 선속도 차이가 증가함(약 345km/s)을 확인할 수 있었다. 합병하는 은하의 경우, 성간물질의 역학적 상태를 극적으로 만든다고 알려져 있음에도 불구하고, 고립된 은하와 비슷한 정도의 산란 특성을 보였다. 마지막으로 시뮬레이션 상에서 강하게 발달하지 않는 중성상태의 은하주변물질의 존재가 선속도차이 예측에 미치는 영향에 대해서 토론하고자 한다.

[구 GC-08] Lyα Polarization: An Implication to the Lyα Blobs

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The extended Lyα nebulae (also known as Lyα blobs or LABs) observed at z=2-6 can provide clues to galaxy formation in the early universe. The connection of LABs with the overdensities of compact Lyα emitters suggests that they are associated with matter density peaks in the universe and thus likely to evolve into the present-day groups and clusters of galaxies. However, the mechanism powering the extended Lyα emission in LABs is remained controversial. The detection of polarization signals that follow the theoretically predicted trend is interpreted as strong evidence supporting that the LABs are caused primarily by the resonance scattering of Lyα originating from star-forming galaxies and AGNs. However, Trebitsch et al. (2016) claimed that the radial profile of polarization could be better explained by the scenario in which Lyα photons are produced in the cooling gas surrounding galaxies and then self-scattered by the gas, rather than by the scattering scenario of photons originating from the central galaxies. In this presentation, using LaRT, a state-of-art Lyα radiative transfer code, it is demonstrated that the observed polarization pattern can be reproduced even with the scattering scenario.

[구 GC-09] On-the-fly ionizing photon non-conservation correction for the Excursion-set reionization models

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In order to generate the 3D structure of the 21-cm signal during the reionization, semi-numerical simulations based on Excursion set formalism are broadly used. However, semi-numerical simulations in the realization of the 3D structure are known to be the ionizing photon non-conserving by the structure of the Excursion set approach. Recently, explicit photon conserving algorithms for semi-numerical simulations introduced, but they are still too slow when forward modelling the 21-cm signal with high-dimensional parameter spaces. Here, we introduce a new method for *approximately correcting* photon non-conservation, which can be applied *on-the-fly*. This method is tailored towards the efficient simulation and Bayesian inference with high-dimensional parameter space. Then, we investigate how large an impact that photon non-conservation has on astrophysical parameter inference by performing an MCMC analysis. We find that the ionizing escape parameter is deviated from the fiducial value by 2 sigma when we infer astrophysical parameters without this correction.

[구 GC-10] Possibility of a second AGN in NGC 1068

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We will present a scenario of the presence of a second AGN in a nearby Seyfert galaxy, NGC 1068. Using VLT/MUSE IFU data, we investigated the complex kinematics of ionized gas in the central region of NGC 1068. Interestingly, at a distance of 180 pc to the northeast from the nucleus of NGC 1068, we detected a kinematical signature of the launching point of AGN gas outflows, which suggests that there would be a second AGN. We will also discuss another supporting evidence of the second AGN based on previous spectropolarimetric results.

[구 GC-11] Merging, Recoiling, or Slingshotting of Supermassive Black Holes in a Red AGN 1659+1834

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We report the Gemini Multi-Object Spectrograph (GMOS) Integral Field Unit (IFU) observation of a red active galactic nucleus (AGN), 2MASSJ165939.7+183436 (1659+1834). 1659+1834 is a prospective merging supermassive black hole (SMBH) candidate due to its merging features and double-peaked broad emission lines. The double-peaked broad emission lines are kinematically separated by 3000 km/s, with the SMBH of each component weighing at 10^8.9 and 10^7.1 solar mass. Our GMOS IFU observation reveals that the two components of the double-peaked broad emission line are spatially separated by 0.085" (~250pc). In different assumptions for the line fitting, however, a null (<0.05") or a larger spatial separation (~0.15") are also possible. For this GMOS IFU observational results of 1659+1834, various models can be viable solutions, such as the disk emitter and multiple SMBH models. We believe that these results show the need for future research of finding more multiple SMBH systems in red AGNs.

[구 GC-12] The faintest quasar luminosity function at z ~ 5 from Deep Learning and Bayesian Inference

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To estimate the contribution of quasars on keeping the IGM ionized, building a quasar luminosity function (LF) is necessary. Quasar LFs derived from multiple quasar surveys, however, are incompatible, especially for the faint regime, emphasizing the need for deep images. In this study, we construct quasar LF reaching $M_{1450} \sim -21.5$ AB magnitude at z ~ 5, which is 1.5 mag deeper than previously reported LFs, using deep images from the Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP). We trained an artificial neural network (ANN) by inserting the colors as inputs to classify the quasars at z ~ 5 from the late-type stars and low-redshift galaxies. The accuracy of ANN is > 99 %. We also adopted the Bayesian information criterion to elaborate on the quasar-like objects. As a result, we recovered 5/5 confirmed quasars and remarkably minimized the contamination rate of high-redshift galaxies by up to six times compared to the selection using color selection alone. The constructed quasar parametric LF shows a flatter faint-end slope $\alpha = -1.27^{+0.16}_{-0.15}$ similar to the recent LFs. The number of faint quasars ($M_{1450} < -23.5$) is too few to be the main contributor to IGM ionizing photons.

[구 GC-13] The Relative Role of Bars and Galaxy Environments in AGN Triggering of SDSS Spirals

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We quantify the relative role of galaxy environment and bar presence on AGN triggering in face-on spiral galaxies using a volume-limited sample with 0.02 < z < 0.055, Mr < 19.5, and σ > 70 km s-1 selected from Sloan Digital Sky Survey (SDSS) Data Release 7. To separate their possible entangled effects, we divide the sample into bar and non-bar samples, and each sample is further divided into three environment cases of isolated galaxies, interacting galaxies with a pair, and cluster galaxies. The isolated case is used as a control sample. For these six cases, we measure AGN fractions at a fixed central star formation rate and central velocity dispersion, σ. We demonstrate that the internal process of the bar-induced gas inflow is more efficient in AGN triggering than the external mechanism of the galaxy interactions in groups and cluster outskirts. The significant effects of bar instability and galaxy environments are found in galaxies with a relatively less massive bulge. We conclude that from the perspective of AGN-galaxy coevolution, a massive black hole is one of the key drivers of spiral galaxy evolution. If it is not met, a bar instability helps the evolution,