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Department of Astronomy, Tsinghua University

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Revealing the Recycled inflow of the massive galaxies at high redshift

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学术活动日程表

时间: Friday, June 30, 2023, 12:00am
标题: Revealing the Recycled inflow of the massive galaxies at high redshift
主讲人: Shiwu Zhang (THU)
地点: S727

ABSTRACT

The gas surrounding galaxies is known as the circumgalactic medium (CGM) which is considered to be deeply coupled with the evolution of galaxies. Although lots of works have been done, how galaxies co-evolve with the CGM is still poorly understood. To explore the CGM-galaxy ecosystem, especially the baryon cycle, we conduct observations on the high redshift CGM.

First, we study the gas surrounding a massive galaxy hosting a type-II quasar at $z = 2.3$ based on the multi-wavelength observations. With the state-of-art integral field spectroscopy (IFS), Keck Cosmic Web Imager (KCWI), we reveal the extended $\text{Ly}\alpha$, He II, and C IV emissions. Besides, the diffuse $\text{H}\alpha$ emission is also detected with our narrowband imaging. Through detailed comparison with the cosmological simulations, we find that these diffuse emissions trace the recycled gas with the metallicity of $1Z_{\odot}$. The gas is inflowing to the central galaxy. Our kinematic model suggests that the recycled inflow could be the main source sustaining the star formation in the high- z galaxy.

Furthermore, detailed check on simulations shows that 46% of the simulated galaxies at $z = 2$ have the recycled inflow in their CGM. This result indicates that the recycled inflow could be a non-negligible process in the CGM at high redshift. We observe another type-II quasar at $z = 2.6$ and reveal the recycled inflow in its CGM. This support the result from simulations. We further construct a semi-analytic model of the inflow which naturally interpret the measured gas kinematics in both our two systems.

In addition, since people did not detect the recycled inflow around the type-I quasar yet, we construct a sample based on the KCWI public data to study the potential difference between the CGM of the type-I and type-II quasar. We find that for those with extended emissions, there is no significant difference. However, we do see that type-II quasars have 100% detection rate of the diffuse He II and C IV emissions while this value for type-I quasars is 68%. This result could indicate that the CGM of type-II quasars has larger metallicity on average than the CGM of type-I quasars.

For the future work, I stress the need of a large sample of the diffuse emission. This could help people to have a much deeper insight of the CGM ecosystem.

BIO

Shiwu Zhang is a phd candidate in the department of Astronomy, Tsinghua University since 2018. He is interested in using the integral field spectroscopy to study the circumgalactic medium at high redshift.

Related article: <https://arxiv.org/abs/2305.02344> (<https://arxiv.org/abs/2305.02344>).