THE CHINESE UNIVERSITY OF HONG KONG
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Gravitational Lensing Reveals Spatially-Resolved Metal-Rich Gas Flows in The Circumgalactic Medium of a z=0.86 Galaxy

by

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Date: May 12, 2026 (Tuesday)
Time: 11:00 a.m. - 12:00 n.n.
Place: Rm G25, Science Centre North Block, CUHK

ALL INTERESTED ARE WELCOME
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Abstract

Studying gas flows in the circumgalactic medium (CGM) is crucial for understanding galaxy evolution and addressing various problems in galactic astrophysics. Conventional analyses typically probe the CGM using absorption lines in the spectra of bright background quasars. However, the relatively small cross-section area of quasar sightlines necessitates averaging over multiple quasar-galaxy pairs to study spatial variation, leading to a crude statistical picture of the CGM. Recently, gravitationally lensed images of background galaxies have been used to probe the CGM with a significantly larger cross-section than quasar sightlines, This technique, known as gravitational arc tomography, enables investigation of the spatio-structural and kinematic properties of the CGM at the level of single galaxies.

In this talk, I present the results of a tomographic investigation of gas flows in the CGM of an inclined disc-like intervening galaxy at z=0.86 along the line-of-sight to the lens system AGEL152509. Using KCWI integral field spectroscopy, we detect Mg II 2796,2803 and Fe II 2857,2600 absorption lines at z=0.86 in the spectrum of 3 lensed images of a background galaxy. These observations allow us to measure the column density, covering fraction and kinematics of CGM gas at ~5-25 kpc scales. First, I discuss how the characteristic anti-correlation between the rest-frame Mg II equivalent width and impact parameter observed in multi-galaxy quasar absorption studies is reproduced with significantly less scatter for a single galaxy. Next, I present kinematic maps of the CGM, revealing gas that is co-rotating with the galaxy out to ~25 kpc. I discuss that the observed kinematics are inconsistent with an extended rotating gas disc, but rather indicate gas accretion onto the galaxy. Finally, I present the detection of gas outflows from the galaxy's ISM to the CGM. Hence, through spatially resolved observations of the CGM made possible by gravitational lensing, I present 3D tomographic maps inflows and outflows — major processes in the baryon cycle — for an individual galaxy.