

Abstract for oral presentation on the 1st International Online Conference on Atoms

Title: [OIII] line ratios and oxygen abundance evolution with redshift

Introduction

JWST reveals the spectral of high red-shift galaxies as younger as hundreds Myrs since Big Bang. These spectral firstly showed the forbidden lines [OIII], [SII], and [OII], which contains the information of electron temperature and density in HII region of galaxies and gives the estimation of oxygen abundance of galaxies. The aim is to reveal the oxygen abundance evolution trend with redshift from local environment at $z=0$ to high redshift galaxies at $z=10$.

Methods

Focusing on JWST and complemented by ground-based telescopes, the electron density, electron temperature, and oxygen abundance are estimated from the line fluxes data in literature with CRR(collisional-radiative-recombination) mode, which calculates the atomic processes between atomic levels. Two different empirical oxygen abundance formulas give estimation of oxygen abundance with electron temperature and line fluxes.

Results and Discussion

With a considerable amount of scattering reflecting different conditions of galaxies in a same redshift, an overall downward trend of oxygen abundance with higher redshift could be perceived. The less scattered anti-linear-correlation of oxygen abundance with temperature is also observed, which is consistent to the expectation of the empirical oxygen abundance formulas.

Conclusions

The overall oxygen abundance evolution profile reveals systematic oxygen enrichment from early universe to current age.

Authors and Affiliations

Mingyi Xu², Vidit Bhandari¹, Sultana N. Nahar², Anil K. Pradhan^{2,3}, and Kevin Hoy⁴

¹ Department of Physics, Denison University, Granville, OH, USA.

² Department of Astronomy, ³ Chemical Physics Program, The Ohio State University, Columbus, OH, USA 43210.

⁴ Chile.