The chemical content of the gas-phase ISM as revealed through infrared emission lines

Future and ongoing infrared and radio observatories such as JWST, METIS, and ALMA will increase the amount of rest-frame IR spectroscopic data for galaxies by several orders of magnitude. While studies of the chemical composition of the interstellar medium (ISM) based on optical observations have been widely spread over decades for star-forming galaxies (SFGs) and, more recently, for active galactic nuclei (AGN), similar studies need to be performed using IR data. In the case of AGN, this regime can be especially useful given that it is less affected by temperature and dust extinction, traces higher ionic species, and can also provide robust estimations of the chemical abundance ratio N/O. Moreover, regarding (Ultra)-Luminous Infrared Galaxies ([U]LIRGs), the IR regime peers through their dusty medium and allow us to include the obscured metals in their studies. In this contribution, I will provide a summary of the bayesian-like code HII-CHI-Mistry-IR, which takes advantage of photoionization models, characterized by the chemical abundance ratios O/H and N/O, and the ionization parameter U, to compare their predicted emission-line fluxes with a set of observed values. I will also review our most recent findings from the study of IR emissions, starting from the performance of the code and its comparison to optical studies, following by a discussion on the universality of the S/O chemical abundance ratio, which can be independently estimate thanks to the set of emission lines available in this regime, and ending up by the finding of deviations from the mass-metallicity relation (MZR).