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Strong Line Metallicity Calibrations for high- z Galaxies from Local Analogs.

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Strong nebular emission lines in the optical are routinely used to study the ISM of galaxies. In fact, thanks to the JWST, such measurements are now possible for galaxies at very high redshifts ($z > 7$), well into the epoch of reionization (EoR). Often, the physical properties derived from these lines rely on local calibrations that are not necessarily accurate for the extreme populations that the JWST has been uncovering in the distant Universe. In this work, we present a study of a sample of local galaxies with strong-line ratios (e.g., OIII/H β , NII/H α) similar to those of $z \geq 2$ galaxies for which we have acquired very deep optical spectra using the Magellan/MagE spectrograph. The data reveal weak lines (e.g., [OIII]4364, [OII]7319+7330 [SIII]6312, [NII]5755) that are difficult to observe directly on distant galaxies, even with the JWST, and that allow us to make accurate estimates of the electron temperature and density of the ISM of these galaxies. These quantities are crucial to make the best estimates of the metallicities for these local analogs of high- z galaxies and may provide the best calibrations to estimate ISM metallicities in galaxies in the EoR. In addition to the rest-frame optical spectra, our data set also includes NIR spectra obtained with the Magellan/FIRE spectrograph. NIR emission lines are inaccessible in EoR galaxies even for the JWST. These lines will help us better characterize the nature of the ionizing source in these galaxies as well as help us determine the shape of the extinction curve (using Hydrogen lines from the Paschen and Balmer series). This project is part of a China-Chile fund awarded in 2020 that has sparked a fruitful collaboration that remains strong and that has exploited some of the powerful telescopes available in Chile, contributing to the theses of both Chilean and Chinese students. .

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