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Theoretical Near-IR Spectra for Surface Abundance Studies of Massive Stars

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Abstract: We present initial results of a study of abundance and mass loss properties of O-type stars based on theoretical near-IR spectra computed with state-of-the-art stellar atmosphere models. The James Webb Space Telescope (JWST) will be a powerful tool to obtain high signal-to-noise ratio near-IR (1-5 micron) spectra of massive stars in different environments of local galaxies. Our goal is to analyze model near-IR spectra corresponding to those expected from NIRSpec on JWST in order to map the wind properties and surface composition across the parameter range of O stars and to determine projected rotational velocities. As a massive star evolves, internal coupling, related mixing, and mass loss impact its intrinsic rotation rate. These three parameters form an intricate loop, where enhanced rotation leads to more mixing which in turn changes the mass loss rate, the latter thus affecting the rotation rate. Since the effects of rotation are expected to be much more pronounced at low metallicity, we pay special attention to models for massive stars in the the Small Magellanic Cloud. This galaxy provides a unique opportunity to probe stellar evolution, and the feedback of massive stars on galactic evolution in conditions similar to the epoch of maximal star formation.

Plain-Language Abstract: We present initial results of a study of abundance and mass loss properties of massive stars based on theoretical near-infrared (1-5 micron) spectra computed with state-of-the-art stellar atmosphere models. This study is to prepare for observations by the James Webb Space Telescope.

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