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Near-Infrared Mass Loss Diagnostics for Massive Stars

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Abstract: Stellar wind mass loss is a key process which modifies surface abundances, luminosities, and other physical properties of hot, massive stars. Furthermore, mass loss has to be understood quantitatively in order to accurately describe and predict massive star evolution. Two urgent problems have been identified that challenge our understanding of line-driven winds, the so-called weak-wind problem and wind clumping. In both cases, mass-loss rates are drastically lower than theoretically expected (up to a factor 100!). Here we study how the expected spectroscopic capabilities of the James Webb Space Telescope (JWST), especially NIRSpec, could be used to significantly improve constraints on wind density structures (clumps) and deep-seated phenomena in stellar winds of massive stars, including OB, Wolf-Rayet and LBV stars. Since the IR continuum of objects with strong winds is formed in the wind, IR lines may sample different depths inside the wind than UV-optical lines and provide new information about the shape of the velocity field and clumping properties. One of the most important applications of IR line diagnostics will be the measurement of mass-loss rates in massive stars with very weak winds by means of the H I Bracket alpha line, which has been identified as one of the most promising diagnostics for this problem.
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