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Constraining Stellar Feedback: Ionized Gas Structures In Local Starburst Galaxies

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Abstract
Stellar feedback, i.e., the return of mechanical energy from supernova explosions, and massive star and AGN winds to the interstellar medium, is one of the fundamental processes that shape galaxy evolution. Yet, some of its fundamental parameters, such as the efficiency of feedback, have not been solidly constrained from an observational point of view. In this thesis, we aim at addressing this issue. First, we investigate the kinematics of Damped Ly-alpha Absorbers (DLAs) at z = 3 using high-

resolution cosmological hydrodynamical simulations. Our simulations include a heuristic model for galactic outflows driven by stellar feedback to test how these components affect the kinematics of neutral gas in high redshift systems. We determine that, without outflows, our simulations fail to yield a sufficient number of DLAs with broad velocity dispersion ('wide DLAs'), as in previous studies. With outflows, our predicted DLA kinematics are in much better agreement with observations. In the second part of the thesis, I investigate stellar feedback within 8 nearby star-forming galaxies, selected to fill the 2-dimensional parameter space of host galaxy stellar mass and star formation rate density. Here, I employ forbidden-line diagnostic diagrams, [O III](5007Å)/Hβ versus [S II](6716Å+6731Å)/Hα (or [N II](6584Å)/Hα) to separate shock-ionized from photo-ionized gas within and outside the central star forming regions in these galaxies. I find that the Hα luminosity from the shock-ionized gas correlates with the SFR density, in the sense of more luminous shocks for higher SFR density. The ratio of Hα luminosity from shocks to the total Há luminosity is related to the galaxy's stellar mass; increasing ratios are observed for decreasing stellar mass. The accepted HST proposal (GO-12497; P.I.: Hong) will expand on the observed correlations by adding two more starbursts to our sample.