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The Fueling Diagram Linking Galaxy H_2/HI Ratios and Bulge Disk Assembly to Interactions and Accretion

We analyze how external factors such as galaxy interactions and fresh gas accretion act on the global interstellar medium and bulge/disk growth of galaxies. We show that z=0 galaxies occupy several loci in a "fueling diagram" that plots H_2/HI ratio versus mass-corrected blue-centeredness, a metric tracing the degree to which galaxies have bluer centers than the average galaxy at their stellar mass. Spiral galaxies of all stellar masses show a positive correlation between H_2/HI ratio and mass-corrected blue-centeredness. When combined with previous results linking mass-corrected blue-centeredness to external perturbations, this correlation suggests a systematic link between local galaxy interactions and molecular gas inflow/replenishment and bulge/inner disk growth. We also identify a distinct population of blue-sequence E/S0 galaxies that define a completely separate regime in the fueling diagram. This population appears to be composed of low-mass, gas rich merger remnants currently in late- or post-starburst states that eventually migrate back towards the spiral locus after their central H_2 is exhausted. Trends in total (HI+H_2) gas-to-stellar mass ratios and star formation histories within this population demonstrate that low mass E/S0s accrete fresh gas as they emerge from their central starburst episodes, apparently leading to stellar disk regrowth. In a pilot project using Herschel data, we are constructing an alternate fueling diagram using dust continuum data instead of CO to track dense star-forming gas. This program aims to open up the possibility of large surveys using ALMA to track the fueling diagram across cosmic environments and/or cosmic time, providing a statistical view of how accretion and HI-to-H_2 conversion alter the ISM and drive bulge and disk assembly in the galaxy population.