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Abstract

I undertake a comparative high resolution study of the molecular gas and star formation properties in the inner kpc of eleven nearby starburst and non-starburst spiral galaxies. I carry out 2&inches; interferometric CO (J = 1 --> 0), optical (broad-band and Hα), and near- infrared observations, which I complement with published radio continuum maps, Brγ fluxes, and HST images. The sample includes the most intense, relatively undisturbed, nearby starbursts, and is almost 3 times larger than previously studied 2&inches; CO samples of nearby galaxies. The main results are: (1)I investigate why the SFRs in the inner kpc of the starbursts exceed those in the non-starbursts by an order of magnitude, although they host comparable amounts ($2\times10^{8} M_{solar}$ to $2.4\times10^{9} M_{solar}$) of molecular gas. I find that many non- starbursts host massive gas concentrations with little star formation, despite azimuthally-averaged gas surface densities (Σ_{gas} as high as 1000 M_{solar} pc^{-2}. In these regions, the gas shows complex kinematics, and non-circular motions, and theoretical models of star formation show that in some cases Σ_{gas} below the critical density for the onset of gravitational instabilities. In the starbursts, most of the circumnuclear gas is forming stars, the gas and star formation distributions are more centrally concentrated, and the peak Σ_{gas} is larger by a factor of 3-4. In the star-forming regions of starbursts and non- starbursts, conditions for the onset of gravitational instabilities, the growth of shearing perturbations, and marginally efficient swing amplification are satisfied. (2)The inner kpc hosts larger Σ_{gas}, gas mass fractions, epicyclic frequencies, and turbulent gas pressures than the outer disk, and may have a different star formation efficiency. (3)I investigate how large central gas concentrations developed. Large-scale stellar bars and/or spiral arms, possibly tidally triggered, have likely driven molecular gas into the inner kpc. I present evidence that the panoply in circumnuclear gas distributions and kinematics are in large part due to the molecular gas being in different regions of a large-scale stellar bar, and to the presence of nuclear stellar bars. I suggest evolutionary connections between non-starbursts and starbursts. (4)I present detailed studies of several individual galaxies.