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Abstract

We present a multi-wavelength study of the gas dynamics and star formation in the grand-design spiral galaxy NGC 5248, illustrating how coupled dynamical mechanisms can generate spiral structures from tens of kpc to hundreds of pc, drive disk evolution, and fuel star formation on progressively smaller scales. Although to date NGC 5248 has been classified as unbarred or claimed to host a weak bar less than 2.2 kpc in size, we argue that its prominent large-scale spiral structures are driven by a stellar bar whose corotation radius and semi-major axis are at least 70'' (5.1 kpc). We confirm this prediction with new observations. In this barred potential, our high resolution (1.9'' x 1.4'') OVRO CO (J=1->0) map reveals two massive trailing molecular spiral arms which can be followed from 1.3 kpc to 375 pc, and feed a circumnuclear ring of HII regions and super star clusters. A weakly-spiral molecular gas feature and a dust spiral extend between this starburst ring and a second Hα ring of radius 95 pc. To account for the observed morphology within the inner kpc, we compare NGC 5248 to theoretical models of gaseous spiral density waves and nested dynamically decoupled bars. We also find that the emission-line complexes which have the largest extinction and show evidence of hosting the youngest embedded stellar clusters coincide with the brightest CO peaks. In contrast, many of the young visible clusters with moderate extinction are associated with little CO emission and are surrounded by shells and bubbles of ionized gas. This suggests a scenario where young star-forming regions form within dense gas complexes, whereupon stellar winds and supernovae very efficiently clear out gas on timescales less than a few megayears. This work is supported by NSF grant AST 99-81546, and a grant from the K. T. and E. L. Norris Foundation

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