The Cold Gas Content of Bulgeless Dwarf Galaxies

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We present an analysis of the neutral hydrogen (HI) properties of a fully cosmological hydrodynamical dwarf galaxy, run with varying simulation parameters. As reported by Governato et al. (2010), the high resolution, high star formation density threshold version of this galaxy is the first simulation to result in the successful reproduction of a (dwarf) spiral galaxy without any associated stellar bulge. We have set out to compare in detail the HI distribution and kinematics of this simulated bulgeless disk with what is observed in a sample of nearby dwarfs. To do so, we extracted the radial gas density profiles, velocity dispersion (e.g., velocity ellipsoid, turbulence), and the power spectrum of structure within the cold interstellar medium from the simulations. The highest resolution dwarf, when using a high density star formation threshold comparable to densities of giant molecular clouds, possesses bulk characteristics consistent with those observed in nature, though the cold gas is not as radially extended as that observed in nearby dwarfs, resulting in somewhat excessive surface densities. The lines-of-sight velocity dispersion radial profiles have values that are in good agreement with observed dwarf galaxies, but due to the fact that only the streaming velocities of particles are tracked, a correction to include the thermal velocities can lead to profiles that are quite flat. The ISM power spectra of the simulations appear to possess more power on smaller spatial scales than that of the SMC. We conclude that unavoidable limitations remain due to the unresolved physics of star formation and feedback within pc-scale molecular clouds.

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