Simulating Jellyfish Galaxies: A Case Study for a Gas-Rich Dwarf Galaxy

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Abstract

We investigate the formation of jellyfish galaxies using radiation-hydrodynamic simulations of dwarf galaxies with a multi-phase interstellar medium (ISM). We find that the stripped ISM is the dominant origin of molecular gas in a near wake while in-situ formation becomes a major channel for molecular clumps in the distant ram pressure stripped tail of a gas-rich galaxy undergoing a strong ICM wind. A star formation rate of 0.001-0.01Msun/yr is found in the tail, and about 90% of the tail stars are born in the stripped wake closer than 10 kpc from the galactic plane. Less than 20% of the molecular gas originates from a cooled intracluster medium (ICM) in the near wake, while the fraction reaches _˜50% in the molecular clouds located behind 80 kpc, as the typical cooling time of the ionized ICM mixed well with the ISM is short ($<$ 1 Myr). We find good agreement between the intrinsic star formation rate and that estimated from bright Hα regions in the tail as well as in the disk. A correlation is also seen between the X-ray and Hα surface brightness of the tail, with some scatter depending on the stage of the mixing between the ISM and ICM. By contrast, few molecular clumps, and accordingly no stars, are formed in the stripped wake of a dwarf galaxy with a normal gas fraction. Our results suggest that jellyfish features emerge when the abundant ISM is stripped by strong ram pressure and mixes well with the ICM.

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