The HI morphology of low–mass dwarf galaxies

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1. The case of Holmberg I and M 81 dw A

Dwarf irregular galaxies in general show a patchy structure in their neutral hydrogen (HI) distribution. Supernovae and stellar winds shape the Interstellar Medium (ISM), creating bubbles and shells of various sizes, the dimensions of which increase with decreasing gravitational potential. We present deep optical Calar Alto and high–resolution multiarray VLA data in the 21 cm line of neutral hydrogen of both Holmberg I and M 81 dw A. These members of the nearby M 81 group with total HI masses of 1.1×10^8 and $8.4 \times 10^6\,\mathcal{M}_\odot$ are at the lower mass range of dwarf irregular galaxies. The HI in these objects is distributed in a prominent ring–like structure, encompassing the optical counterparts. The radii of the rings are 0.85 kpc for Holmberg I and 0.75 kpc for M 81 dw A, and show HI fractions of 3/4 and virtually all of the overall HI content, respectively. The standard model, in which stellar winds and especially supernova explosions are held responsible for the creation of these huge structures, predicts that the shells, if the energy input happened to be recently, are expanding. As our data don't show clear evidence for expansion, we speculate that break–out and hence the loss of hot gas, has occurred which might explain that the shells have stalled.

Optical UBV$R_c I_c$ surface photometry shows in both cases a rather flat, but exponential decrease of the light distribution from the centre of these objects right up to the peak of the HI distribution (the HI annulus) followed by a steeper slope exponential disk.