PHASE COHERENT STAR FORMATION PROCESSES IN THE DISCS OF GRAND DESIGN SPIRALS

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ABSTRACT. We show examples of a new technique we have devised to compare star formation efficiencies in the arms and discs of spirals. First results show striking evidence of the presence and influence of density wave systems of star formation in grand design galaxies.

Using imaging of the highest quality, from the TAURUS camera on the William Herschel Telescope on La Palma, we obtain Hα isophote maps of galaxies. Using these, and the best literature data, we measure, along the arms of galaxies, a function which is a quotient of ionized to neutral (HI+H_2) gas, and ratio this with the same quotient in the neighbouring disc. The results of this work are shown in Fig. 1.

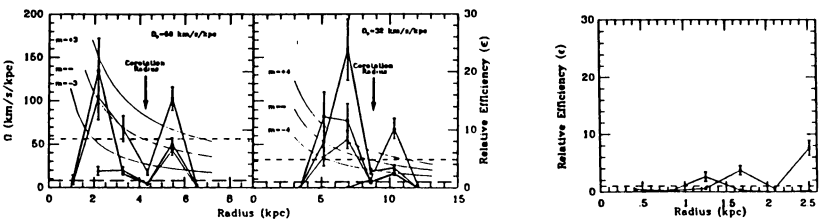

Figure 1. Star formation efficiency ε, with radius in grand design spirals (a) NGC 628, and (b) NGC 3992 with a flocculent galaxy (c) NGC 598 for comparison.

Key features of the results: (i) In grand design galaxies ε shows sharp peaks in each arm to values of over 10 at the antinodes, and steep falls to the nodes, *i.e.* Inner and Outer Lindblad resonances and co–rotation. Patterns correspond qualitatively to density wave predictions, and strongly suggest star formation triggering (for no triggering $\varepsilon \sim 1$). (ii) The pattern speeds Ω_p of NGC 3992 and NGC 628 can be inferred by assuming the dips in ε correspond to co–rotation. (iii) In the flocculent NGC 598, $\varepsilon \sim 1$ everywhere, and the patterns are not congruent from arm to arm. The technique is still in a trial phase, and offers prospects of further insights into spiral structure.

References

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