RADIO CONTINUUM EMISSION FROM MAGELLANIC-TYPE AND DWARF IRREGULAR GALAXIES

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High-frequency radio continuum observations of a small sample of irregular and dwarf galaxies (Klein et al., 1983) have revealed that their integrated radio continuum spectra tend to be significantly flatter than those found for normal spirals (Gioia et al., 1982). This indicates a higher relative amount of thermal (free-free) emission.

The common feature of Magellanic Cloud-type galaxies seems to be a general lack of synchrotron disk radio emission at high frequencies if compared to normal spirals. The distribution of high-frequency radio emission is governed by strong thermal radiation from large HII complexes (like e.g. 30 Doradus in the LMC) which are situated at the termination of the bar-like stellar disk. There is evidence that dwarf galaxies with the lowest average mass surface densities exhibit the weakest nonthermal disk radio emission (like e.g. the Local Group member NGC6822, see Fig.1).

It is suggested that this deficiency in non-thermal disk emission of dwarf irregular galaxies is due to the absence of an energetic non-thermal cosmic rays via supernova-induced shock fronts takes place. The typical average mass surface densities of dwarf irregular galaxies are probably too low to stabilize a thick disk against internal pressure. Thus cosmic ray electrons quickly lose their energy and diffuse out into intergalactic space.

Models of stochastic self-propagating star formation predict that star formation is a rather short-lived phenomenon in dwarf galaxies (Gerola et al., 1980). This further inhibits the formation of a nonthermal thick disk. Finally, the low shear in irregular dwarf galaxies might not be sufficient to drive a dynamo that is required in order to generate and maintain a galactic magnetic field that is strong enough to produce detectable synchrotron emission at high frequencies.

S. van den Bergh and K. S. de Boer (eds.), Structure and Evolution of the Magellanic Clouds, 313–314.

REFERENCES

Gerola, H., Seiden, P.E., Schulman, L.S.: 1980, Astrophys. J. 242, pp. 517-527
Gioia, I.M., Gregorini, L., Klein, U.: 1982, Astron. Astrophys. 116, pp. 164-174
Klein, U., Gräve, R., Wielebinski, R.: 1983, Astron. Astrophys. 117, pp. 332-342

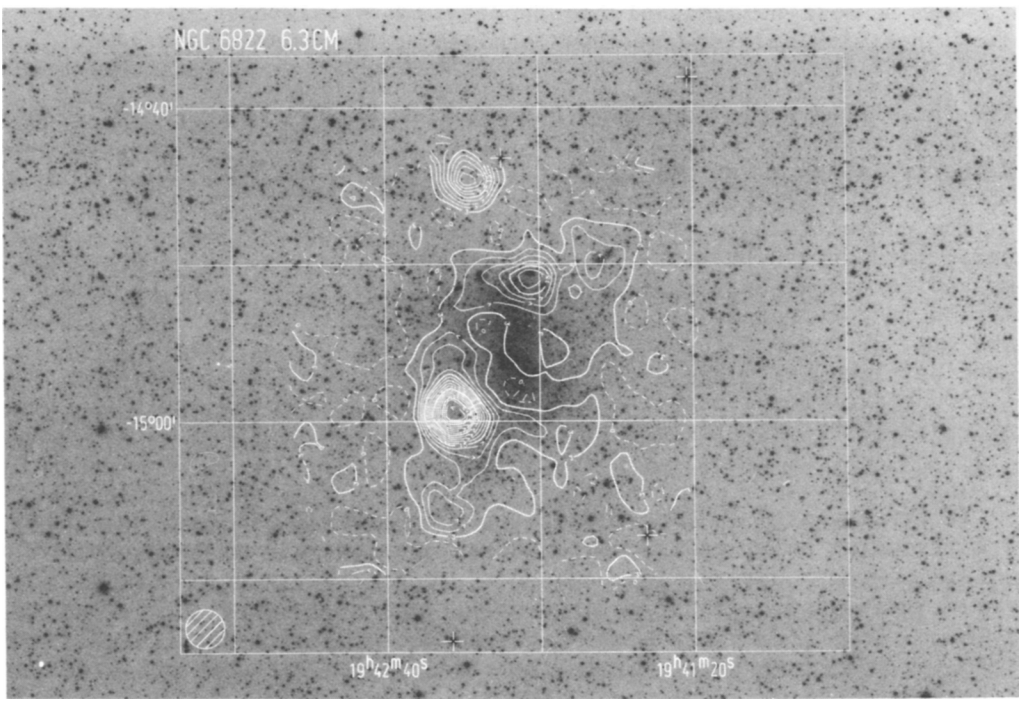

Figure 1

Radio map of NGC6822 at 4.75 GHz obtained with the Bonn 100-m telescope (HPBW 2.47 arcmin), superimposed onto a POSS plate. Contours are: 3,6,... mJy/beam area. The strongest source in the field has a rather steep spectrum ($S_\nu \sim \nu^{-1.02}$) and is most likely a background source. At the northern end of the bar-like stellar body a chain of HII complexes emits strong thermal emission. The radio emission from the disk of NGC 6822 is rather weak at this frequency.

https://doi.org/10.1017/S0074180900040420 Published online by Cambridge University Press