# THE MAGNETIC FIELD IN M33

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Measurements at five radio wavelengths between 2.8 and 21.1 cm (Buczilowski and Beck, 1987) with the Effelsberg 100-m telescope make M33 the best studied nearby galaxy in linear polarization so far. The polarized emission is concentrated to the northwestern quadrant of the galaxy. Almost no polarization is detectable around the 35 known supernova remnant candidates. The explosions may have disturbed the interstellar magnetic field on scale sizes smaller than our antenna beams.

Compared with other spiral galaxies the magnetic field properties for M33 are remarkable: using either the minimum energy requirement or the internal rotation measures we find a total magnetic field strength of $B_t = 4.5 \pm 1.4$ $\mu$G. This represents *one of the weakest fields* in the sample of 8 spiral galaxies studied so far; values in the range $9 \pm 4$ $\mu$G are usually found.

From the degree of linear polarization ($11 \pm 5\%$) of synchrotron emission at 6.3 cm we obtain a ratio between the strength of the uniform and random magnetic field of $B_u/B_r = 0.4 \pm 0.1$ over the scale of the resolution element of 510 x 880 pc. M33 has the *lowest field uniformity* of 7 spiral galaxies for which comparable estimates are available.

We have averaged the distribution of unambiguous rotation measures obtained from the 6.3, 11.1 and 17.4 cm data azimuthally in two rings in the plane of M33. Double-periodical fits reveal a *low internal rotation measure* of $15 \pm 5$ rad/m$^2$, less than half the value for other galaxies. Following Tosa and Fujimoto (1978) we calculated from the fit parameters a bisymmetric model projected onto the sky. The orientations of the magnetic field can be determined from the 6.3 cm data after correction for the foreground Faraday rotation. A comparison of model and observations shows coincidences of the expected maximal field strength with the area of high polarization in the north as well as of the neutral lines with the areas of low polarization to the east and west. We conclude that the polarization data is *compatible* with a bisymmetric magnetic field although more sophisticated models would be desirable.

## References

Buczilowski, U.R. and Beck, R. (1987), Astron. Astrophys. Suppl. **68**, 171-185.
Tosa, M. and Fujimoto, M. (1978), Publ. Astron. Soc. Japan **30**, 315-325.



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