The Galaxy Disk in Cosmological Context
Proceedings IAU Symposium No. 254, 2008
J. Andersen, J. Bland-Hawthorn & B. Nordström, eds.

doi:10.1017/S1743921308027439

An 84-μG Magnetic Field in a Galaxy at Z=0.692?

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1. Abstract

The magnetic field pervading our Galaxy is a crucial constituent of the interstellar medium: it mediates the dynamics of interstellar clouds, the energy density of cosmic rays, and the formation of stars (Beck 2005). The field associated with *ionized* interstellar gas has been determined through observations of pulsars in our Galaxy. Radio-frequency measurements of pulse dispersion and the rotation of the plane of linear polarization, i.e., Faraday rotation, yield an average value $B \approx 3$ μG (Han *et al.* 2006). The possible detection of Faraday rotation of linearly polarized photons emitted by high-redshift quasars (Kronberg *et al.* 2008) suggests similar magnetic fields are present in foreground galaxies with redshifts $z > 1$. As Faraday rotation alone, however, determines neither the magnitude nor the redshift of the magnetic field, the strength of galactic magnetic fields at redshifts $z > 0$ remains uncertain.

Here we report a measurement of a magnetic field of $B \approx 84$ μG in a galaxy at z =0.692, using the same Zeeman-splitting technique that revealed an average value of $B = 6$ μG in the *neutral* interstellar gas of our Galaxy (Heiles *et al.* 2004). This is unexpected, as the leading theory of magnetic field generation, the mean-field dynamo model, predicts large-scale magnetic fields to be weaker in the past, rather than stronger (Parker 1970).

The full text of this paper was published in Nature (Wolfe *et al.* 2008).

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Wolfe, A. M., Jorgenson, R. A., Robishaw, T., Heiles, C., & Prochaska, J.X. 2008 *Nature* 455, 638

Birgitta Nordström, Jan Palouš and Hans Zinnecker at Carlsberg.
Ole Strömgren and Aage Bohr in the background.

Photo: Bruce Elmegreen.

Marija Vlajic emphasising a point during her lecture.