*Highlights of Astronomy, Volume 16*
*XXVIIIth IAU General Assembly, August 2012*
*T. Montmerle, ed.*

doi:10.1017/S1743921314011624

# CGPS studies of the Galactic Magnetic Field

**Joern Geisbuesch, R. Kothes and T. L. Landecker**

DRAO, NSI-NRC, Penticton, V2A 6J9, Canada; email: Joern.Geisbuesch@nrc-cnrc.gc.ca

**Abstract.** The Canadian Galactic Plane Survey (CGPS) is the largest effort of its kind to study and understand the Galactic Magnetic Field (GMF) and Interstellar Medium (ISM) in our Galaxy (see e.g. Taylor *et al.* 2003). The CGPS has mapped the Galactic plane visible from DRAO on all spatial scales down to arcminute resolution in total intensity and polarized emission at $\nu_{\rm obs}$ = 1.4 GHz (see Landecker *et al.* 2010). The latest results invoking Faraday rotation and polarization gradient studies of the CGPS are discussed.

**Keywords.** Radio continuum: ISM, Polarization, ISM: magnetic fields, Methods: statistical

Faraday rotation measures (RMs) and polarization gradients (PGs), a method advocated by Gaensler *et al.* 2011, have been derived for the CGPS and its northern and southern latitude extensions (NLE & SLE). Stokes Q and U maps have been corrected for instrumental effects. The PG maps have been statistically analyzed by utilizing higher order moments of the probability density functions of selected regions within the CGPS, namely the skewness and excess kurtosis. In the NLE, the state of the ISM turbulence shows a latitude dependence. In particular, at the disk-halo transition around $\sim$10.5° the magneto-ionic ISM appears often trans- and at times even super-sonic, while it is rather sub- to trans-sonic at lower latitudes. Possible explanations are projection effects, disk warping and/or Galactic in- and outflows. The chosen areas for the PG analysis exclude structures caused by compact and discrete extended polarized emitters to avoid biased statistics. On the basis of the CGPS data, we demonstrate the potential of the method when applied to single-frequency interferometer data and perform a resolution study on the combined Effelsberg, DRAO 26m and ST data to show how PGs probe different structures in the field of view. Under the assumption of negligible polarization angle rotation on scales of half a degree and above, which the angular regularity of the polarization angle on these scales at $\nu_{\rm obs}$ supports, we obtain fairly low RM estimates ($|{\rm RM}| \lesssim 100$ rad/m$^2$) for most of the diffuse polarized emission around the Cygnus X region suggesting that the region resembles a polarization horizon, whose boundary is the nearside of the nearby very active star forming region. Hereby, implications on deviations from a simple Faraday structure along the sightline are obtained by using chi-squared statistics and the Bayesian Information Criterion. RM estimates on a grid towards compact and confined extended sources with implied simple Faraday structures along their sightlines are derived for the SLE. Its large-scale RM structure and the angular distribution of H$\alpha$ emission in the region are correlated. The average RM value is $-170$ at $b \approx -2°$ and decreases to $-70$ rad/m$^2$ at $b \approx -12°$. The disk-halo transition as indicated by diffuse polarization and PG structures occurs in the SLE at a lower absolute latitude than in the NLE ($b \sim -7°$). PGs of HB9 show structures caused by shocked ionized gas and indicate a possible outflow. In regions with less complex polarized emission along sightlines, spatial correlations between polarized emission and HI features can be identified.

## References

Gaensler, B., Haverkorn, M., Burkhart, B., Newton-McGee, K. J., *et al.* 2011, *Nature*, 478, 214
Landecker, T., Reich, W., Reid, R., Reich, P., Wolleben, M., *et al.* 2010, *A&A* 520, 80
Taylor, A. R., Gibson, S., Peracaula, M., Martin, P., Landecker, T. L., *et al.* 2003, *ApJ* 125, 3145