Bilateral symmetry in Supernova Remnants and the Connection to the Galactic Magnetic Field

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Is there a connection between the Galactic Magnetic Field and Supernova Remnants?



Gaensler (1998): a highly significant tendency for the axes of these SNRs to be aligned with the Galactic plane

Leckband et al. (1989): no preferred orientation between the angle of symmetry and the Galactic plane G003.8-00.3



G332.0+00.2

G327.6+14.6 (SN1006)

G046.8-00.3

Quasi-perpendicular



Model Radio Synchrotron Intensity



Quasi-parallel





Isotropic





Method: Use a model of the Galactic magnetic field to model the appearance of SNRs at their specific location in the Galaxy

What do we know about the magnetic field of the Milky Way Galaxy?

How do we know its shape?





Rotation measure studies of extra-galactic point sources



Credit: VanEck/Brown



Modelling SNRs in the Galaxy





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Model Synchrotron Intensity





Model with no vertical magnetic field (Sun et al. 2008)



Quasi-perpendicular



Quasi-parallel

G003.7-00.2



G036.6+02.6











Quasi-perpendicular

Quasi-parallel





Reich et al. 1992



Conclusions

- supportive of a connection between Galactic ISM and SNR morphology
- favours the quasi-perpendicular CRE scenario for this select sample of evolved bilateral SNRs
- future studies:
 - SNR case studies: magnetic fields of SNRs through polarization and rotation measures, progenitor studies, SNR distances (e.g., GALFACTS data)
 - Galactic magnetic field parameters such as turbulence, pitch angle, and shape of the vertical field

Supernova remnant Models & Images at Radio Frequencies (SMIRF) http://www.physics.umanitoba.ca/snr/smirf/



West et al. 2016, A&A, 587, 148 West et al. 2016, A&A, submitted