Magnetic field morphologies at mpc scale

Ya-Wen Tang\textsuperscript{1,2}, Patrick M. Koch\textsuperscript{3}, Paul T. P. Ho\textsuperscript{3,4}, Stephane Guilloteau\textsuperscript{1,2} and Anne Dutrey\textsuperscript{1,2}
\textsuperscript{1}LAB, France; \textsuperscript{2}CNRS, France; \textsuperscript{3}ASIAA, Taiwan; \textsuperscript{4}CfA, USA

We report our new results of the magnetic field (B) morphologies toward W51 North, traced with the linear polarization of the dust continuum at wavelengths of 870 $\mu$m. The B morphologies are resolved with an angular resolution of typically 1" using the Submillimeter Array (SMA). Dense structures with a number density $10^5$ to $10^7$ cm$^{-3}$ are traced. In comparison, the B morphologies of sources at different evolutionary stages, from the collapsing core in W51 e2 (Tang et al. 2009a) and part of Orion BN/KL (Tang et al. 2010) to the ultra-compact HII region G5.89-0.39 (Tang et al. 2009b) clearly exhibit different morphologies, likely suggesting different roles of the B fields at different stages.

In the W51 North region we analyze field structures at three different physical scales (Tang et al. 2012). In a sequence of increasingly higher resolution observations - from CSO/JCMT single dish at 2 pc to the SMA highest resolution at about 10 mpc - it becomes manifest how the field morphologies change from the envelope surface layer to the inner core and disk. Structures vary from uniform to cometary and hourglass-like. We quantify these changes, providing evidence that the interplay of the B field with other forces, such as gravity, evolves with scale. Additionally, new analysis methods to interpret these observational results and to derive B field strength maps are also discussed (Koch et al. 2012a,b,c).

The figure in the left presents the B field morphologies observed in two different SMA configurations, which trace the B fields at two different scales. The dust continuum emission traced at these two scales is shown in contours. The magnetic-field-to-gravity force ratio map, derived from our newly developed method, is shown in grey scale. The ratio is smaller toward the denser regions, suggesting a varying role of the B field as a function of scale.

References