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The role of magnetic fields in the early stages of star formation

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Abstract. Magnetic fields are believed to redistribute part of the angular momentum during the collapse and could explain the order-of-magnitude difference between the angular momentum observed in protostellar envelopes and that of a typical main sequence star. The Class 0 phase is the main accretion phase during which most of the final stellar material is collected on the central embryo. To study the structure of the magnetic fields on 50-2000 au scales during that key stage, we acquired SMA polarization observations (870μm) of 12 low-mass Class 0 protostars. In spite of their low luminosity, we detect dust polarized emission in all of them. We observe depolarization effects toward high-density regions potentially due to variations in alignment efficiency or in the dust itself or geometrical effects. By comparing the misalignment between the magnetic field and the outflow orientation, we show that the B is either aligned or perpendicular to the outflow direction. We observe a coincidence between the misalignment and the presence of large perpendicular velocity gradients and fragmentation in the protostar (Galametz *et al.* 2018). Our team is using MHD simulations combined with the radiative transfer code POLARIS to produce synthetic maps of the polarized emission. This work is helping us understand how the magnetic field varies from the large-scale to the small-scales, quantify beam-averaging biases and study the variations of the polarization angles as a function of wavelength or the assumption made on the grain alignment (see poster by Valdivia).

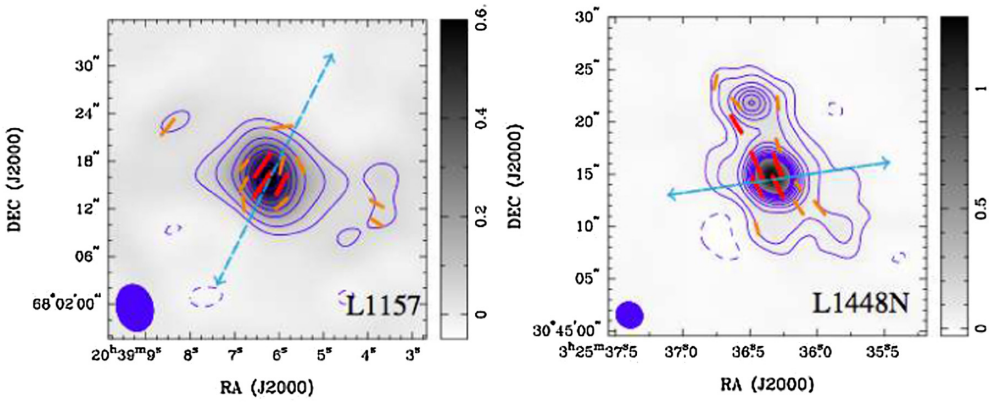

Figure 1. SMA 870μm dust emission of two Class 0 protostellar enveloppes. The blue arrows indicate the outflow direction. The B line segments are overlaid (>3σ in red, >2σ detections in orange).

References

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