Magnetic Fields in Massive Star-forming Regions

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In this presentation, I will introduce the recent results of the Magnetic Fields in Massive Star-forming Regions (MagMaR) survey. In MagMaR, we have observed 30 high-mass star-forming regions at 0.3" (~1000 au resolution) in polarized emission and molecular lines, such as $H^{13}CO^+$ J=3-2. Polarized dust continuum emission provides the morphology of the magnetic field while $H^{13}CO^+$ provides the turbulent component. Case studies of many MagMaR fields reveal a zoo of magnetic field morphologies, spiral features produced by rotation in a gravity-dominated environment, filamentary features with magnetic fields aligned with the elongation of the filaments in which accretion flows likely drag the field along them, a radial magnetic field likely produced by an explosive event, and magnetized cases with hourglass shaped magnetic fields. Based on the dust continuum morphology, we have separated the observed star-forming regions in 3 categories: (i) limited fragmentation, characterized by a single dominant bright object, (ii) aligned fragmentation, where multiple cores are embedded within filamentary structures traced by diffuse dust emission, and (iii) clustered fragmentation, which features multiple bright objects with no clear filamentary structure in the dust continuum emission. We will determine if the magnetic field plays a role shaping the morphology seen in the dust continuum emission by comparing the magnetic field to gravity and turbulence.