P136a Probing the ion-neutral drift velocity towards the L1544 prestellar core

Doris Arzoumanian (Kyushu University), Silvia Spezzano, Paola Caselli, Jaime Pineda (MPE), Yoshiaki Misugi (NAOJ)

The role of magnetic fields in the star formation process remains unclear. If sufficiently strong, magnetic fields may support dense clouds against gravitational collapse and thus delay star formation. The importance of the magnetic field is tightly linked to the coupling between matter and the magnetic field lines. This coupling is due to the interaction between the ions and neutrals in a partially ionized plasma. When the ionisation degree drops in the dense environment of prestellar cores, the magnetic field and the matter are decoupled and the ions and neutrals are predicted to behave differently for gravitational infall; show different velocity structures. This theoretically expected velocity drift has not been convincingly detected in observations yet. I will present our new study searching for a signature of ion-neutral velocity drift to probe the presence of ambipolar diffusion and study its role in the onset of prestellar core collapse. We analyzed deuterated ion N_2D^+ and neutral pNH_2D molecules towards the prototypical prestellar core L1544. These two molecules are ideal tracers of prestellar cores sampling the same high densities in the interior of the cores. We detected a mean ion-neutral velocity difference of $\sim 0.05\,\mathrm{km/s}$ towards the core. By comparing with non-ideal MHD simulations of filament fragmentation and core collapse, we interpret the observed ion-neutral velocity difference in L1544 as a result of ambipolar diffusion.