Title: Studying molecular cloud assembly and filament formation with SKA and FIR observations

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Abstract:
Studying both low- and high-mass star forming regions with spectral lines that cover a large density range, i.e. HI, [CII] and CO isotopologues, we found indications that molecular cloud and star formation might be universally triggered in the Milky Way by a high-velocity collision (typically v > 7 km/s) of CO-dark neutral clouds with substantial substructure. This scenario neither perfectly fits HI colliding flows nor head-on molecular cloud-cloud collisions. Specifically, we arrived at a scenario where local overdensities, which sometimes are molecular, seem to interact with the diffuse, mostly atomic, gas of the colliding cloud. This interaction bends the magnetic field arounds the overdensities which initiates organized mass inflow towards the compressed filament as predicted by the models in Inoue et al. (2018). To further improve our understanding of the physics at work during the assembly of molecular clouds, and to connect these observations to the galactic scale dynamics, observations at high (spatial & spectral) resolution and sensitivity of the CO-dark neutral medium are required. SKA and its precursors, combined with future FIR observations that can probe multiple cooling lines, will be instrumental to unveil this diffuse neutral medium both in the Milky Way and nearby galaxies and can be highly complementary with large surveys of molecular gas such as SEDIGISM (Schuller et al. 2017) and PHANGS-ALMA (Leroy et al. 2021).