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Chemical signatures of a prestellar cluster in the Galactic Center

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The Central Molecular Zone (CMZ) contains most of the mass of our Galaxy but its star formation rate is one order of magnitude lower than in the Galactic disk. This is likely related to the fact that the bulk of the gas in the CMZ is in a warm (>100 K) and turbulent phase with little material in the prestellar phase.
In this talk, I will first present D/H ratios of HCN, HNC, HCO^+, and N_2H^+ obtained toward the CMZ molecular cloud G+0.693-0.027 (Colzi et al. 2022). These observations clearly show, for the first time, the presence of a colder, denser, and narrow component, with a line width of about 9 km s^{-1}, in addition to the typical gas component of the CMZ, warm, less dense, and turbulent with a line width of about 20 km s^{-1}. For this new component D/H ratios > 10^{-4} and excitation temperatures of 7 K for all molecules have been found, suggesting kinetic temperatures < 30 K and H_2 densities >5×10^4 cm^{-3}. This new method indicates that the degree of deuteration of different molecules, such as N_2H^+ and HCO^+, and their line profiles can be used to reveal the different gas components in the line of sight to the CMZ.
Then, I will present HC_3N excitation-derived gas densities and temperatures of the gas components towards the same source, using multiple transitions coupled with spatially resolved HC_3N images of the source. This approach allows us to identify denser gas that possibly is on the verge of gravitational collapse and that will host future protostars in the CMZ (Colzi et al. 2024).

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