CMZoom: Star Formation in our Extreme Galactic Center

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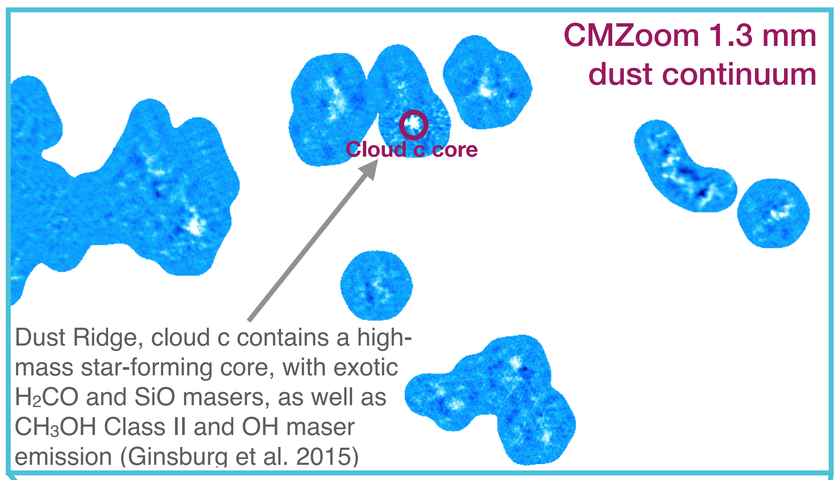
CMZoom is a 550 hour **Submillimeter Array (SMA) Legacy Survey**, the first ever large-scale sub-parsec (4" or 0.2 pc) survey of the **Central Molecular Zone (CMZ)** in the **1.3 mm dust continuum and spectral lines** (**dense gas tracer:** H_2CO; **shock and outflow tracers:** SiO, CO, ^{13}CO, $C^{18}O$; **hot core tracers:** CH_3OH, CH_3CN; etc). We include observations in compact and subcompact configurations and combine with single-dish data (BGPS and APEX) to achieve **good image fidelity.**



Basic Science Questions:

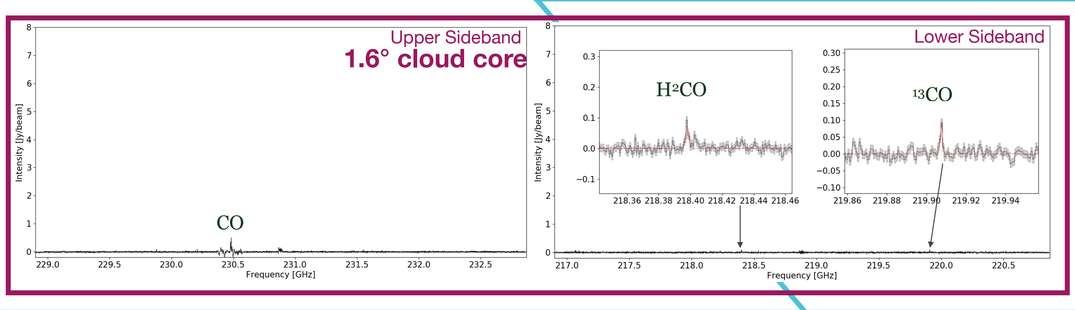
★ What is the cause of the exceptionally **low star formation efficiency**, given the large reservoir of dense gas, in the CMZ?

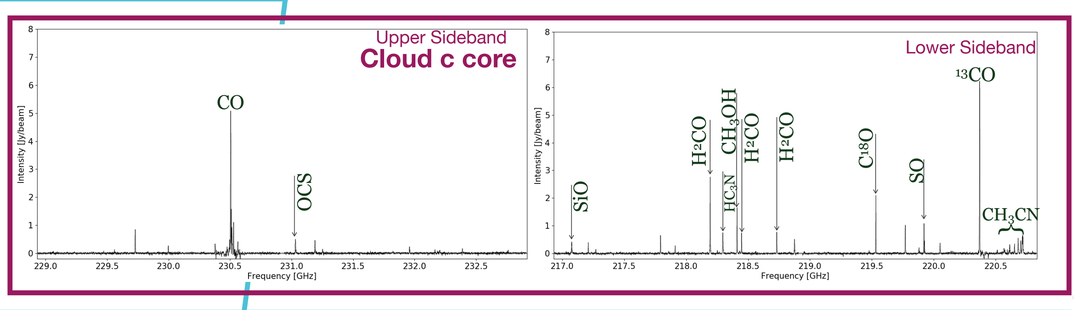
★ Is there an **energy and star formation cycle** in the CMZ? Where does gas enter the CMZ?

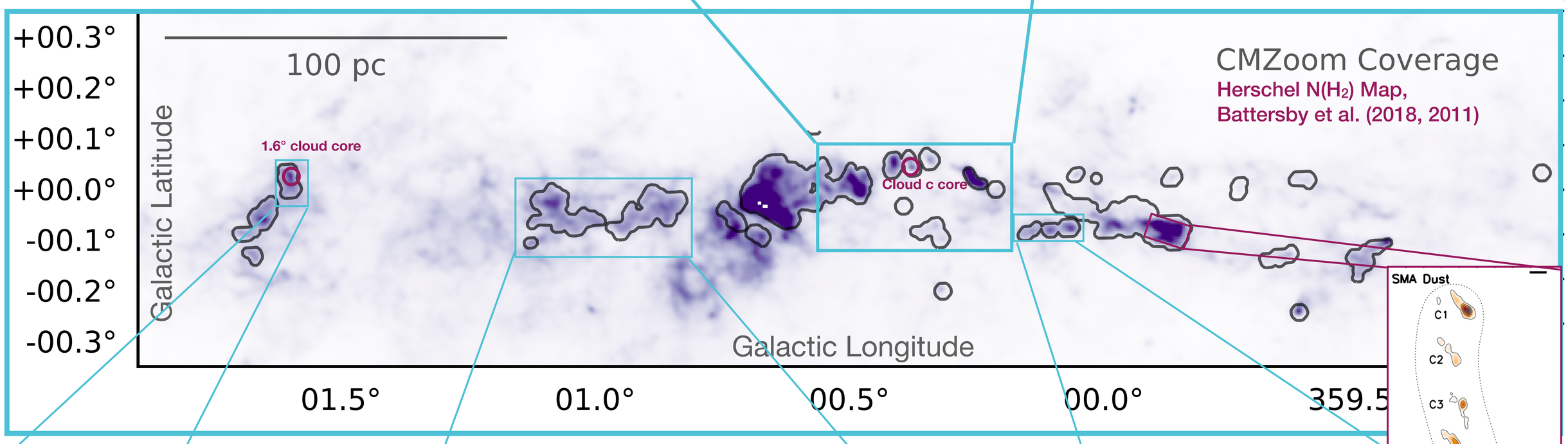
★ Is star formation induced by **tidal compression by SgrA***?

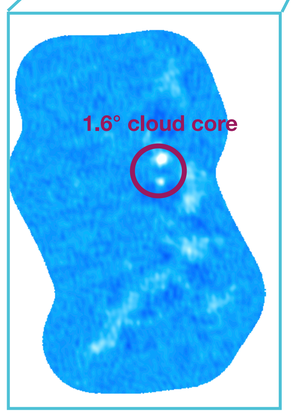
★ Can we find **precursors to the most massive stars** in the Galaxy?

(Right) Comparison of varied chemistry / excitation in two otherwise similar-looking regions, on the same scale.

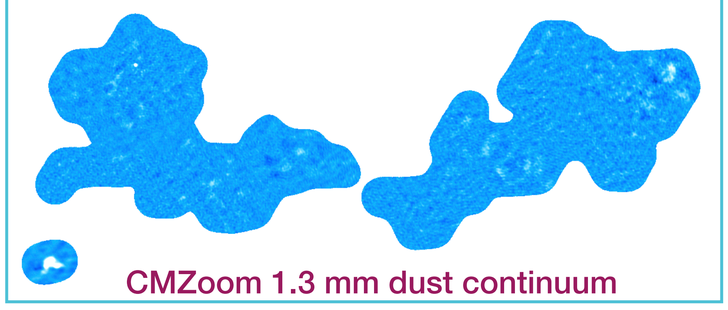




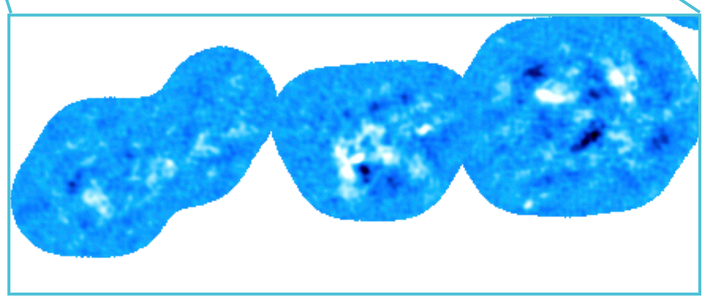




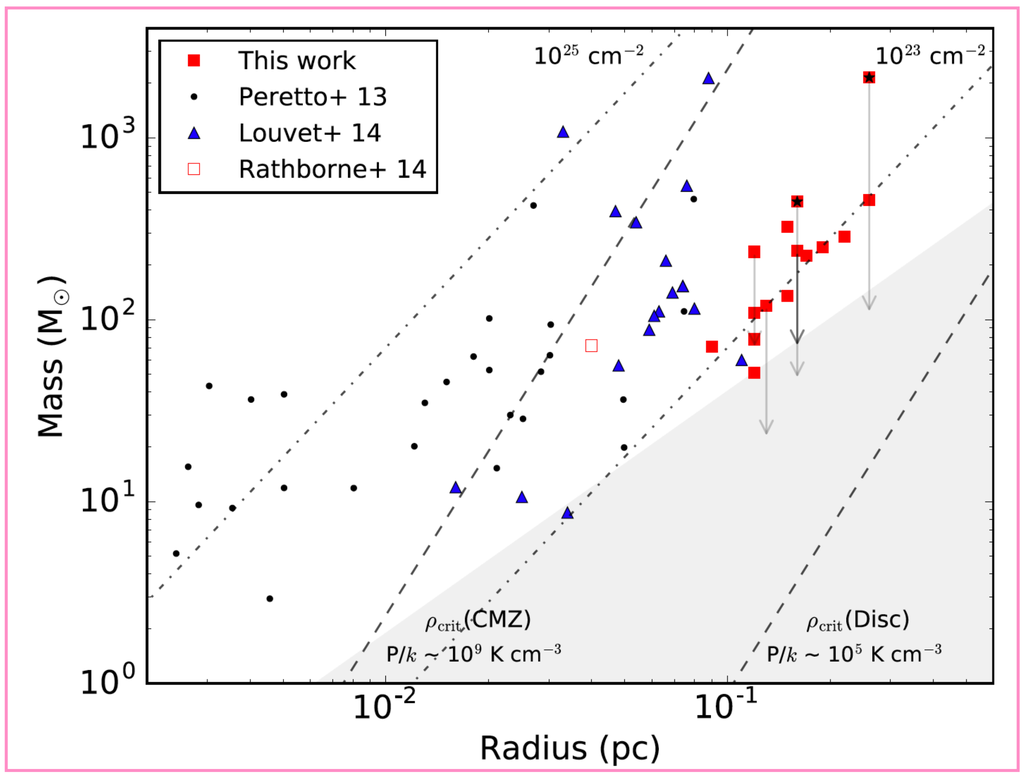
Left: The 1.6° cloud, thought to be just entering the CMZ, shows interesting filamentary structure and several 10s of $M_\odot$ cores
Right: The 1.1° clouds are similarly turbulent, but mostly diffuse gas.



Right: Lu et al. (2015,2017) uncovered hidden star formation with CMZoom and VLA in the 20 km/s cloud.
Below: The three little pigs, very similar global properties, but different degrees of substructure.

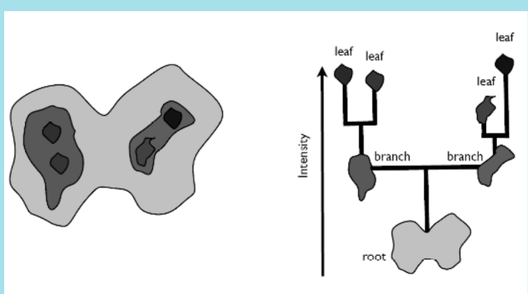


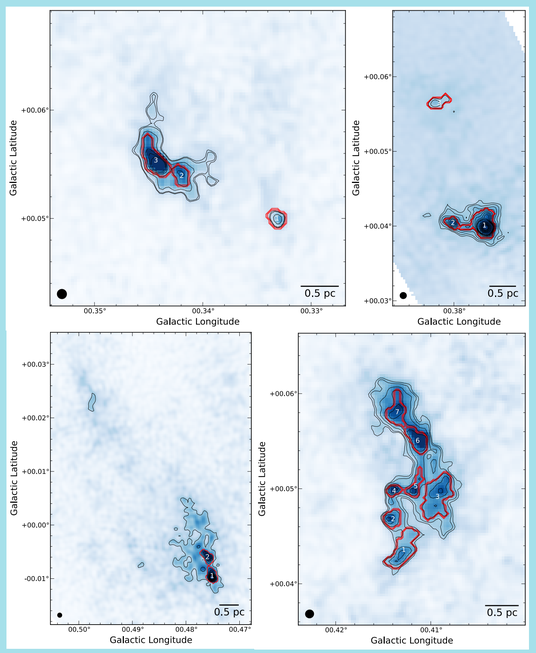
Our infinite thanks to the SMA staff for making this project possible!



Analysis of **CMZoom core properties** shows that, surprisingly, CMZ cores lie on the **same mass-radius plane** as cores in the Galactic disk, despite the **vastly different environmental conditions** of the CMZ. Figure from Walker et al. (2018) using CMZoom data in the "dust ridge".

The ***CMZoom*** catalog is created using the **dendrogram** algorithm (e.g., Shetty et al. 2012, Rosolowsky et al. 2008). An example is shown here from the **dust ridge**. The background shows the SMA 1.3 mm dust continuum, also as contours, and **dendrogram leaves (CMZoom catalog sources) in red.** Catalog by Hatchfield et al. (in prep.), figure from Walker et al. (2018).





The **CMZ is the only place in the Universe where we can examine star formation in extreme environments** (e.g. n(H_2) ~ 10-100x larger, T ~ 5x higher, Δv ~ 5x higher than the Galactic disk, akin to high-redshift galaxies) in great detail. While the CMZ is the birthplace of some of the most massive stars in the Galaxy, **globally it seems to be underproducing stars (contains 80% of the dense gas in the Milky Way, but only ~10% of the star formation).**