The SMA Legacy Survey of the Central Molecular Zone

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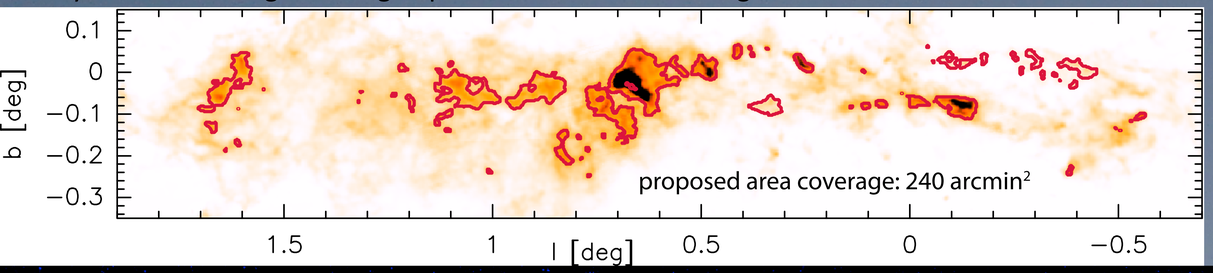
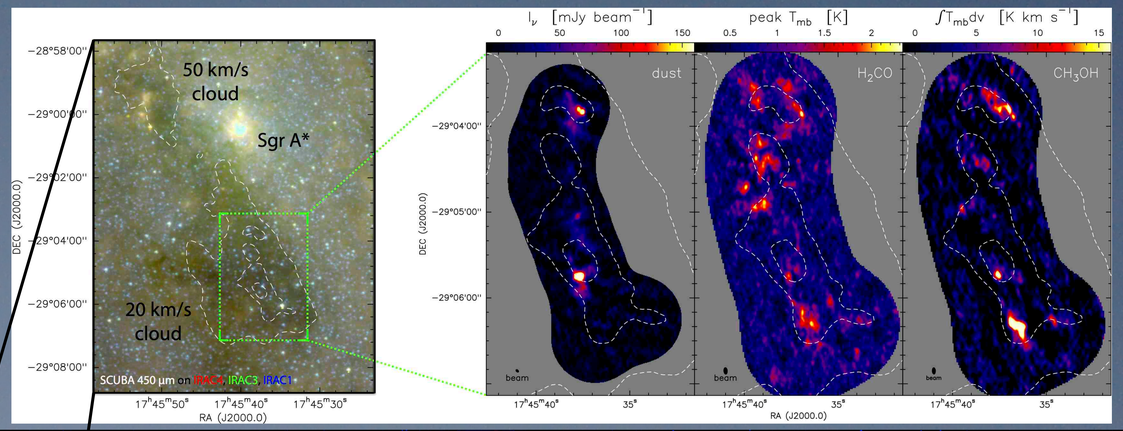
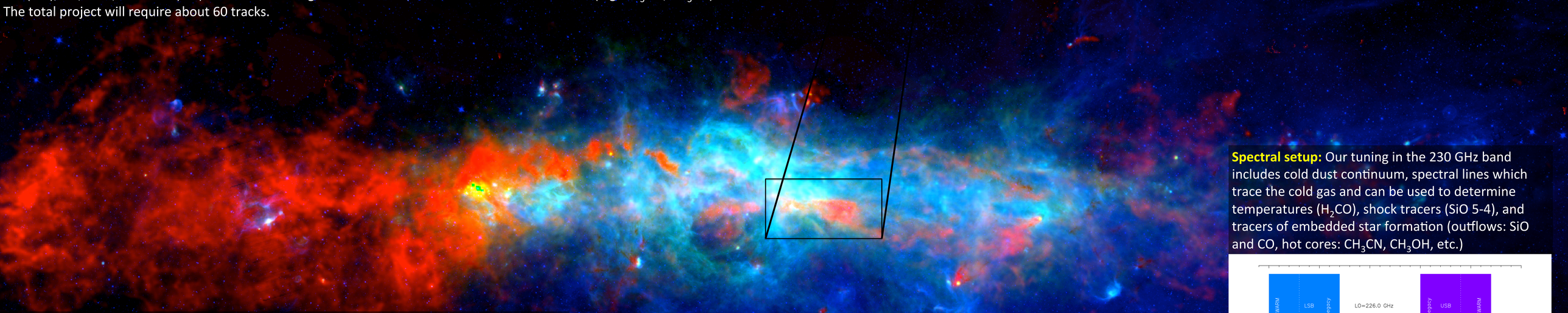
Abstract: I present plans for an ongoing SMA Large-Scale Project to map the Central Molecular Zone (CMZ, the central 500 pc of the Milky Way). The nature and basic processes at work in the CMZ are still being uncovered. With it's combination of large primary beam, high angular resolution, and large instantaneous bandwidth, the SMA presents a unique opportunity to perform the first large-scale survey of dense gas in the CMZ at sub-pc resolution. From mysteries about the order of magnitude dearth in star formation at the Galactic center to the nature of strong shocks in the CMZ to searching for the pre-cursors to the most massive stars in the Galaxy, the SMA CMZ survey will have a long-standing impact on our understanding of this extreme environment.



Proposed Survey Area: the entire CMZ above 10^{23} cm^{-2}. **Project Goals:** To map an approximately 240 arcmin^2 region of the CMZ in the 230 GHz band in compact/subcompact configuration with a 1-2 mJy/beam RMS in the 1.3 mm dust continuum. This will allow us to trace dust cores down to a point source sensitivity equivalent to a mass of 10 $M_\odot$. In addition to the 1.3 mm dust continuum, we will observe the 218 GHz ladder of H_2CO lines to trace dense gas and determine temperature, SiO (5-4), CO, C^{18}O, and ^{13}CO (2-1) to trace shocked gas and outflows, and hot core tracer molecules (e.g. CH_3OH, CH_3CN). The total project will require about 60 tracks.



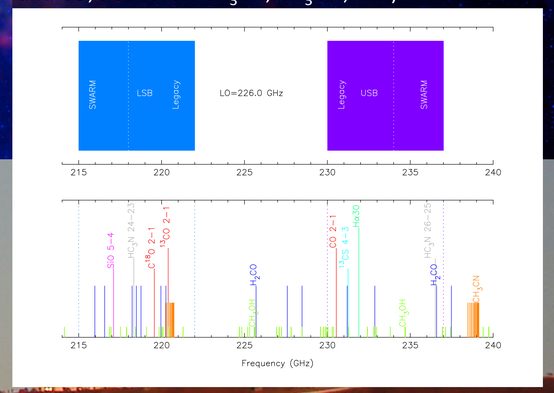
Pilot data toward dense gas near the central supermassive black hole, Sgr A* (PI: Lu). The right panel presents SMA maps of dust continuum (280 GHz), H_2CO (218 GHz) and CH_3OH emission (230 GHz). All panels show overlaid SCUBA 450 μm dust emission contours. Note that each dust continuum core shows corresponding emission in H_2CO and CH_3OH. Those molecules trace both the dense cores and warmer more diffuse material.



Basic Science Questions:

1) Can we explain star formation universally (or does the CMZ break star formation laws?
2) Is there an energy and star formation cycle in the CMZ? Where does gas enter the CMZ?
3) Is star formation induced by tidal compression by SgrA*? If so, can we see the formation of massive clusters as a function of absolute time?
4) Can we find precursors to the most massive stars in the Galaxy?

Spectral setup: Our tuning in the 230 GHz band includes cold dust continuum, spectral lines which trace the cold gas and can be used to determine temperatures (H_2CO), shock tracers (SiO 5-4), and tracers of embedded star formation (outflows: SiO and CO, hot cores: CH_3CN, CH_3OH, etc.)



Status: Our first observations were taken May 20th and, as of June 9 we have completed 6 tracks in compact configuration. We plan to complete 20-30 tracks this semester and present initial results and data to the community and observe an additional 20-30 tracks. next year.