

The Far InfraRED Polarimetric Large-area CMZ Exploration



(FIREPLACE) Survey

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+ FIREPLACE team



Introduction

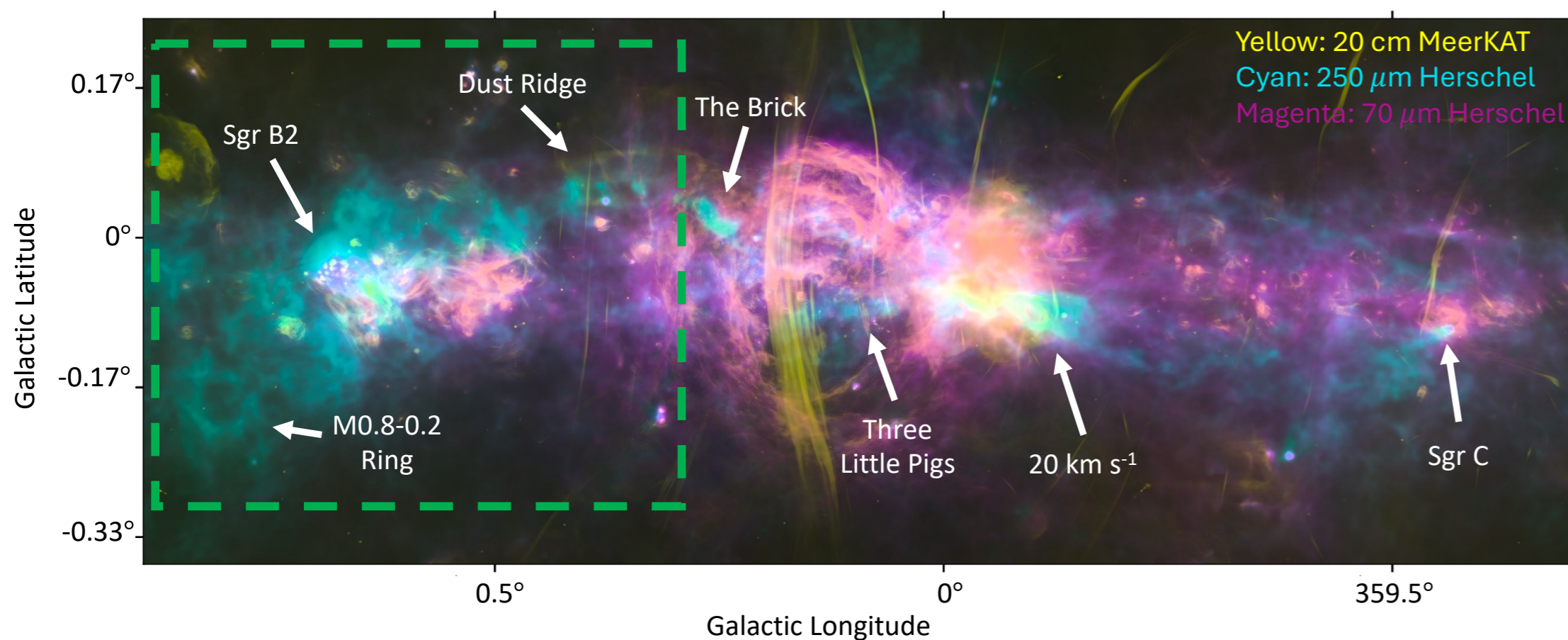


Figure 1: The CMZ observed in infrared and radio wavelengths (Paré et al. 2024). The 3-color image shows the 20 cm (1.28 GHz) MeerKAT observations that trace the hot plasma (yellow, Heywood et al. 2022) and the 70 μm and 250 μm warm and cool dust infrared emission observed by Herschel is shown in magenta and cyan, respectively (Molinari et al. 2011). Major CMZ clouds are labeled and the green box indicates the extent of the FIREPLACE pilot survey covering the Sgr B complex (Butterfield et al. 2024a).

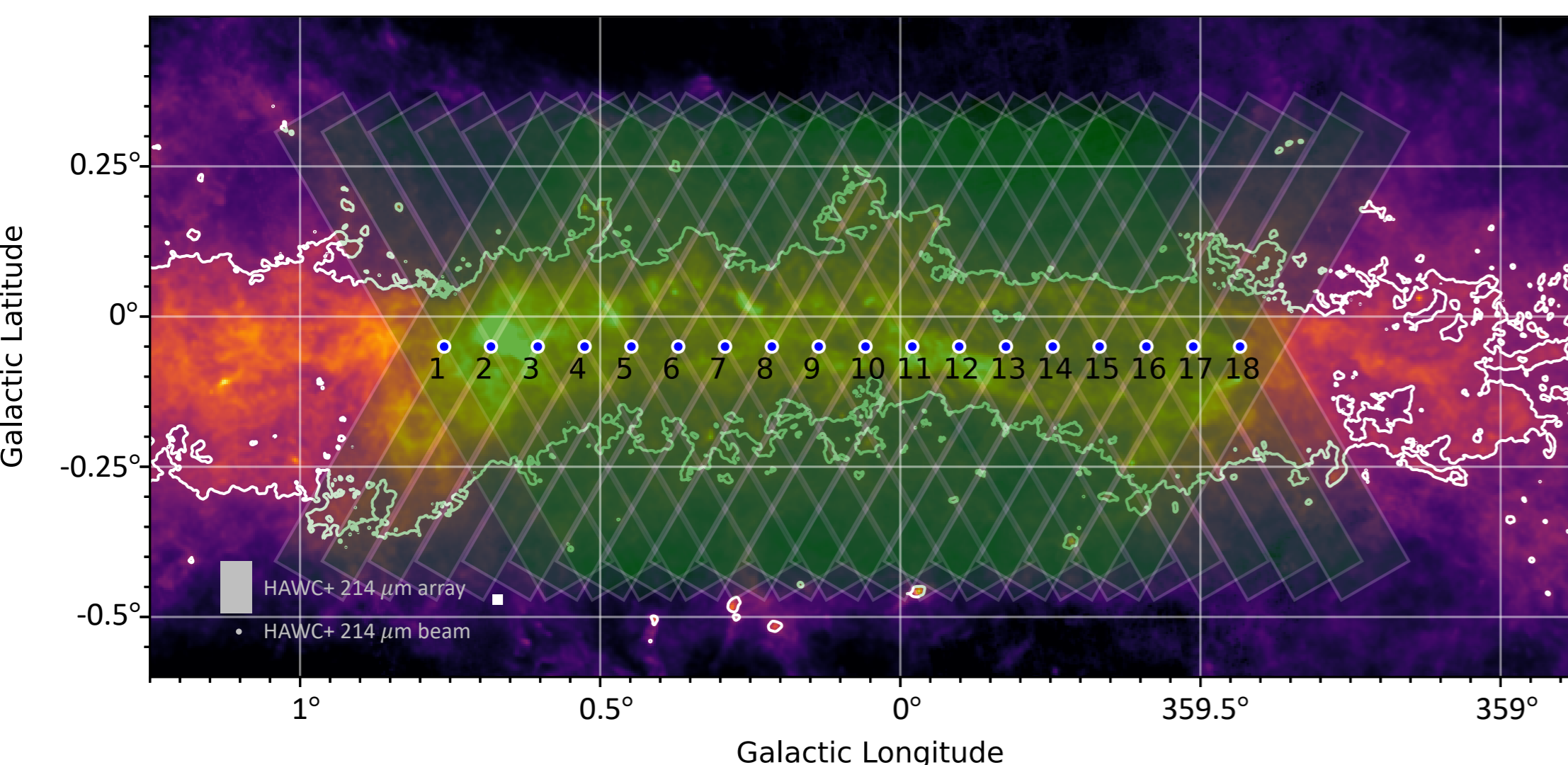


Figure 2: The observing strategy for FIREPLACE. Numbered dots show the centers of each field and the semi-transparent rectangles show the approximate areas covered by the the SOFIA/HAWC+ scans. Background colorscale is Herschel 250 μm (Molinari et al. 2011), with the white contour level representing the targeted sensitivity of FIREPLACE (7189 Mjy sr⁻¹). The field numbers, HAWC+ array footprint, and beam size at 214 μm are shown in the lower-left (Paré et al. 2024).

The goal of FIREPLACE was to study the magnetic field inferred from cool dust polarization (214 μm) throughout the CMZ. This study builds on previous CMZ-wide polarimetric studies (like PILOT and ActPOL) with its improved resolution (19.6'' compared to 1 – 2') and sensitivity.

Pilot Survey and the M0.8-0.2 Ring

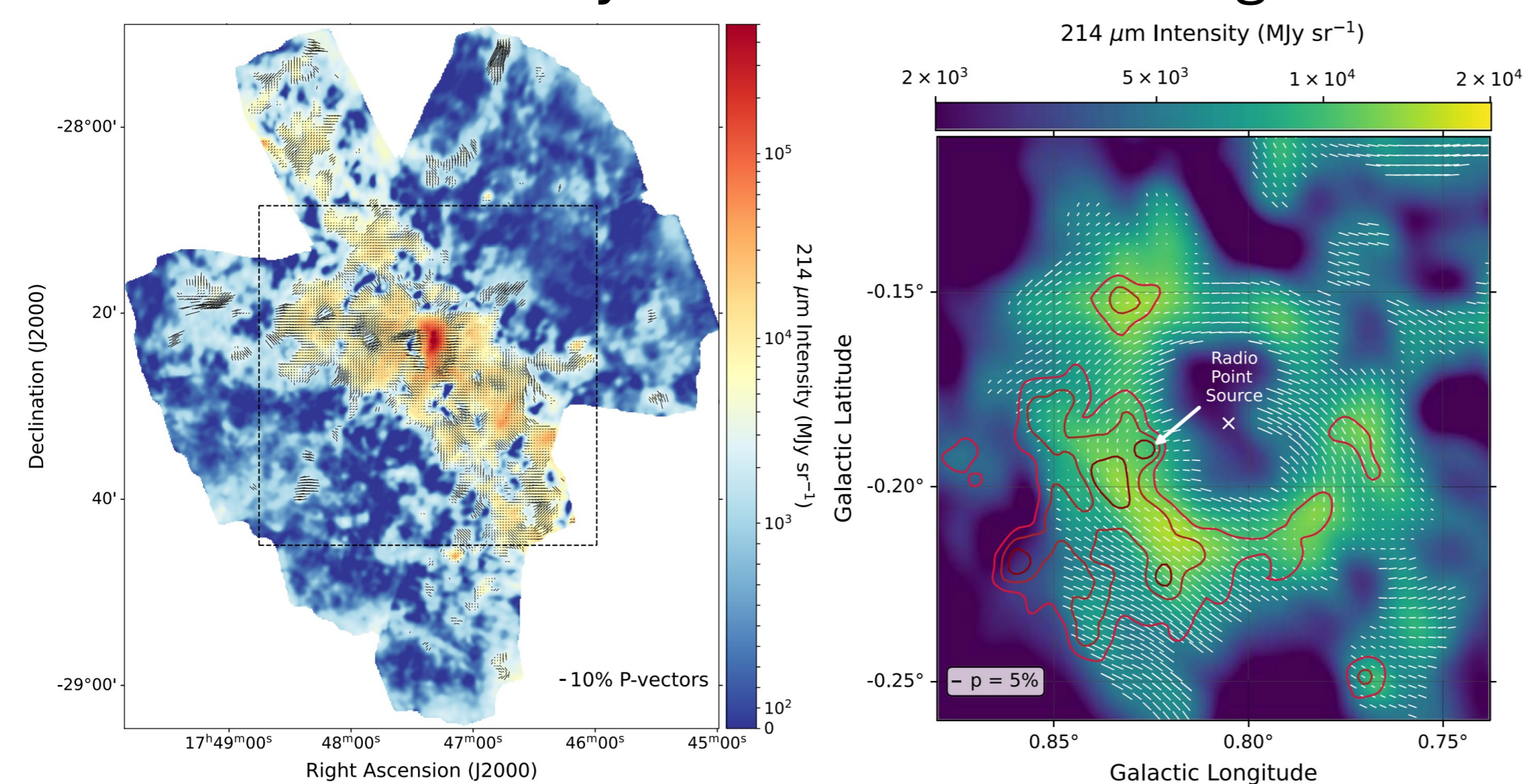


Figure 3: **Left** The pilot observations of FIREPLACE covering the Sgr B region. The colorscale background shows the 214 μm total intensity from SOFIA/HAWC+ and the black line segments indicate the polarization angle pseudovectors. Pseudovectors are only shown for lines of sight where $l/\sigma_l > 200$, $p/\sigma_p > 3$, and $p < 50\%$ (Butterfield et al. 2024a). **Right** The M0.8-0.2 Ring located to the Galactic East of the Sgr B complex (Figure 1). The magnetic field is found to generally trace the ring structure, and the expansion of this ring is possibly inducing compression of the molecular material (Butterfield et al. 2024b).

The FIREPLACE pilot study reveals that the magnetic field generally traces the cloud structure in the Sgr B region; it is ordered but spatially variant (Figure 3, left). The Pilot study also reveals the M0.8-0.2 Ring, finding an azimuthal magnetic field that traces the ring and is possibly caused by the compression of dust due to the expansion of the ring (Figure 3, right).

References:

Butterfield, N. O. et al. 2024a, ApJ, 963, 130; Butterfield, N. O. et al. 2024b, ApJ, 968, 63; Heywood, I. et al. 2022, ApJ, 925, 165; Molinari, S. et al. 2011, ApJL, 735, L33; Paré, D. M. et al. 2024, ApJ, 969, 150; Paré, D. M. et al. 2025, ApJ, 978, 28; Zhao, R. J. et al. 2025, ApJ, 988, 252

Full Data Release (Entire CMZ)

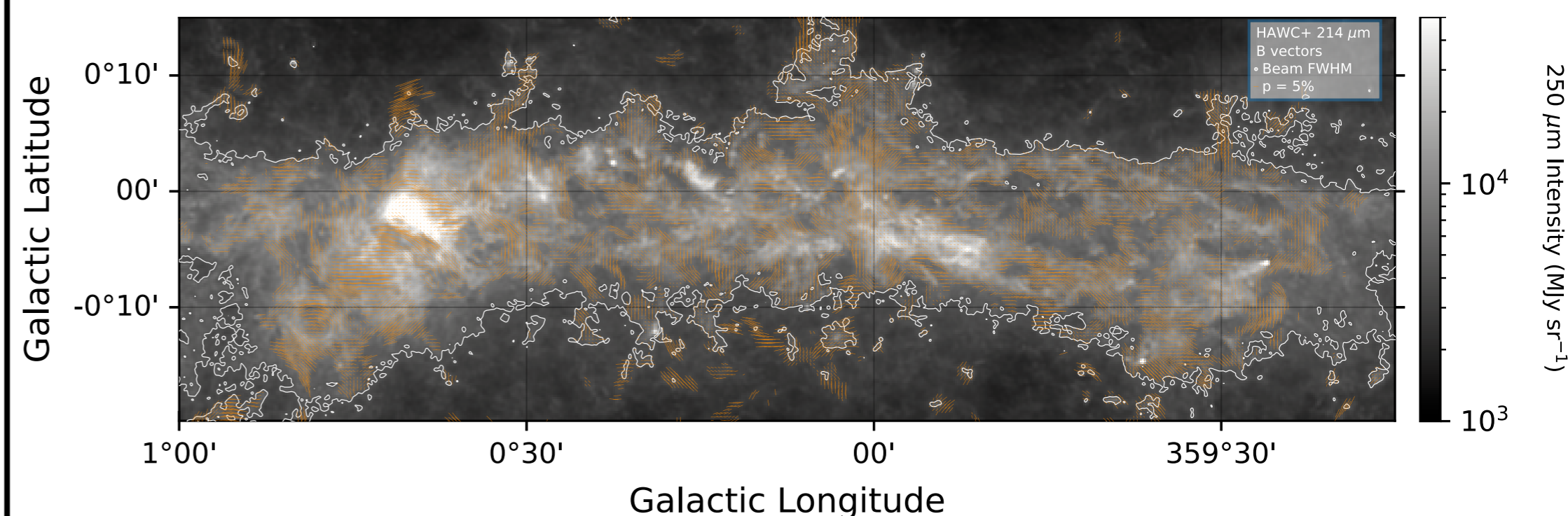


Figure 4: CMZ-wide magnetic field pseudovectors obtained from the second FIREPLACE data release. Pseudovectors only shown for lines of sight that satisfy the polarimetric significance cuts described in Figure 2 caption. 64,000 pseudovectors are obtained throughout the CMZ showing that the field exhibits significant spatial variability and generally traces the CMZ cloud elongation (Paré et al. 2024).

Magnetic Field Relative Orientation

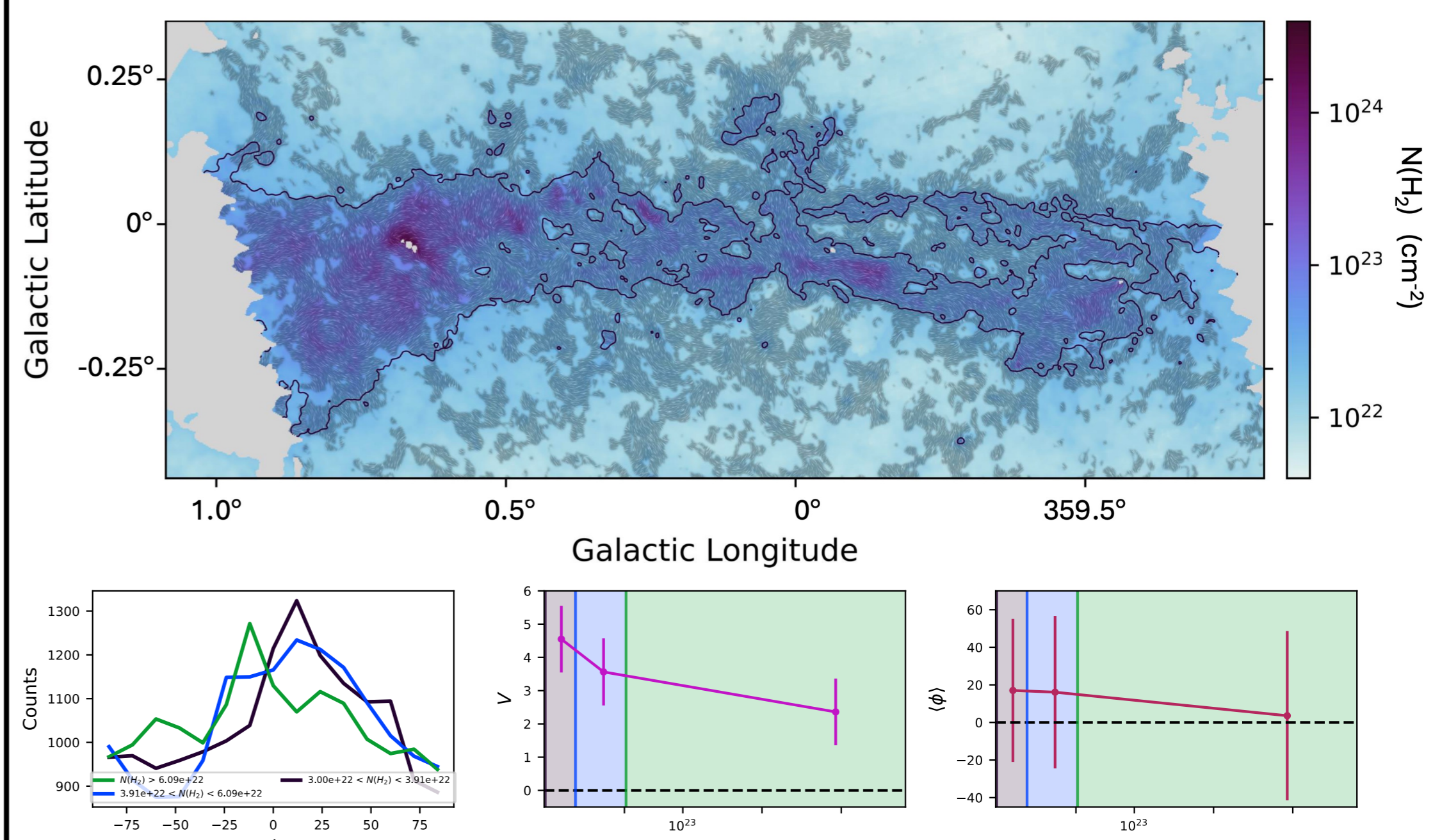


Figure 5: CMZ-wide column density as derived from Herschel with FIREPLACE magnetic field orientation overlaid. The relative alignment of the magnetic field with the column density structure is shown in the lower panels indicating a parallel field pointing to the importance of shear in the CMZ.

Focused Study on Sgr C

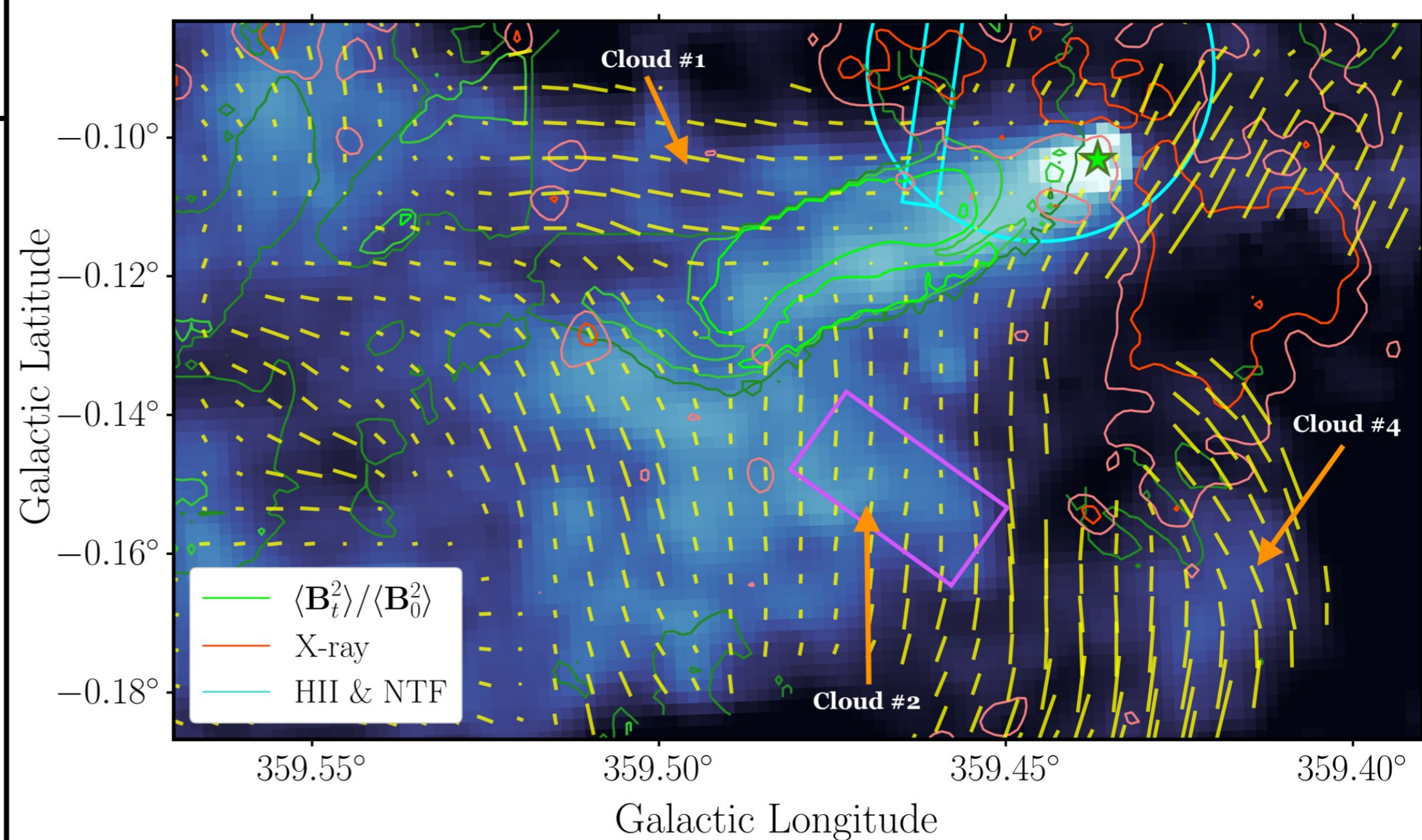


Figure 6: The Sgr C cloud as studied by FIREPLACE with the yellow line segments representing the FIREPLACE magnetic field pseudovectors and the background colorscale indicating the Herschel 250 μm intensity (Zhao et al. 2025).

Current Collaboration Members and Future Work

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We are always looking for new members! Ask any of us if you want to join, or contact dylan.pare@alma.cl!

Future work: DCF studies of CMZ clouds (e.g. TLP, 20 kms cloud), comparison of FIREPLACE and BISTRO magnetic fields, collaboration with ACES (B-fields compared to molecular line emission in the CMZ), and whatever ideas you have!