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First Mid-Infrared Flare Detection of the Milky Way's Supermassive Black Hole with JWST

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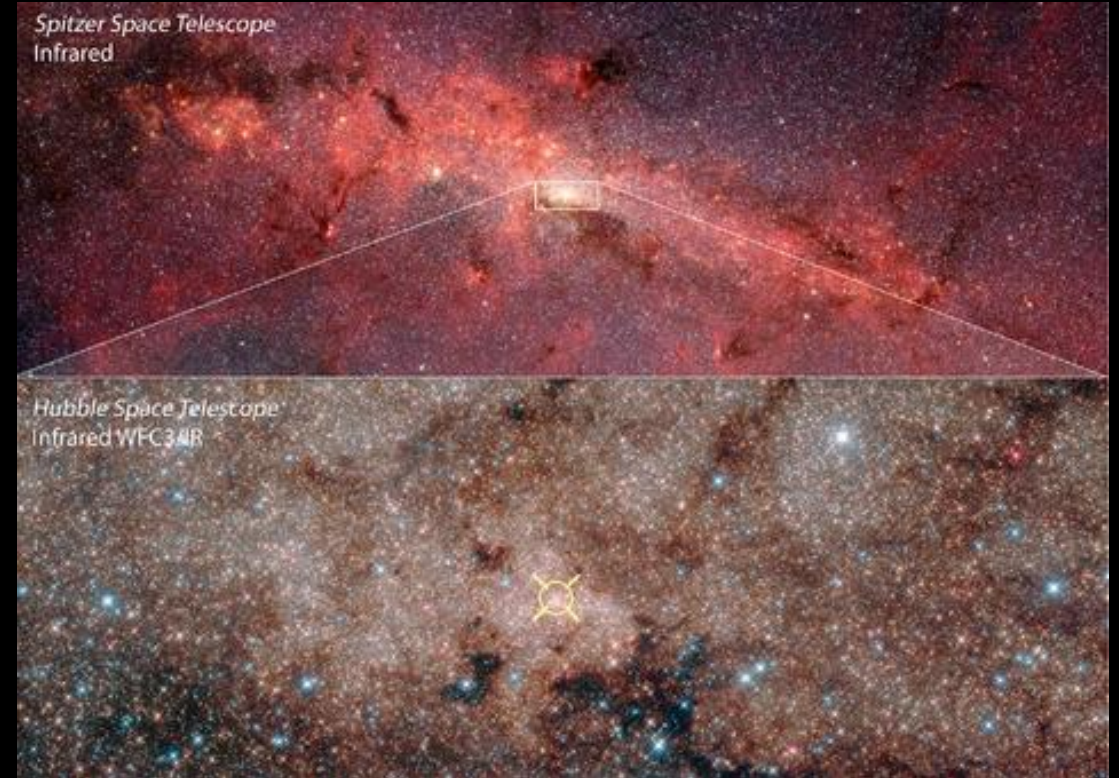
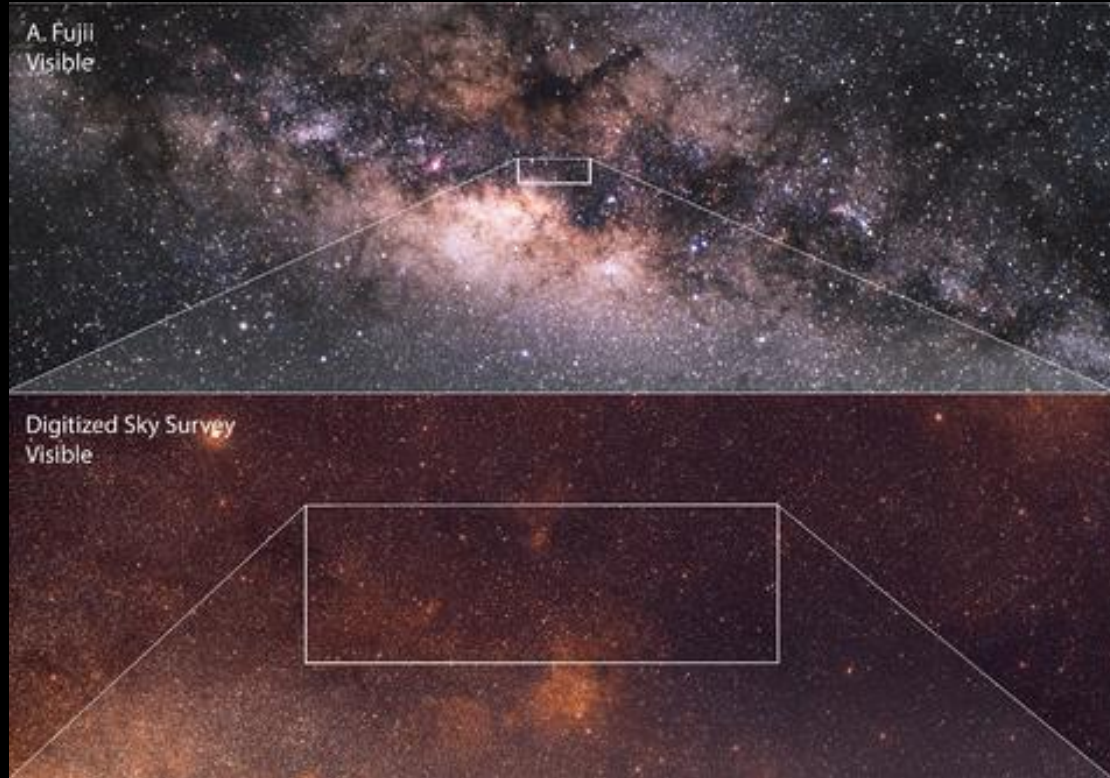
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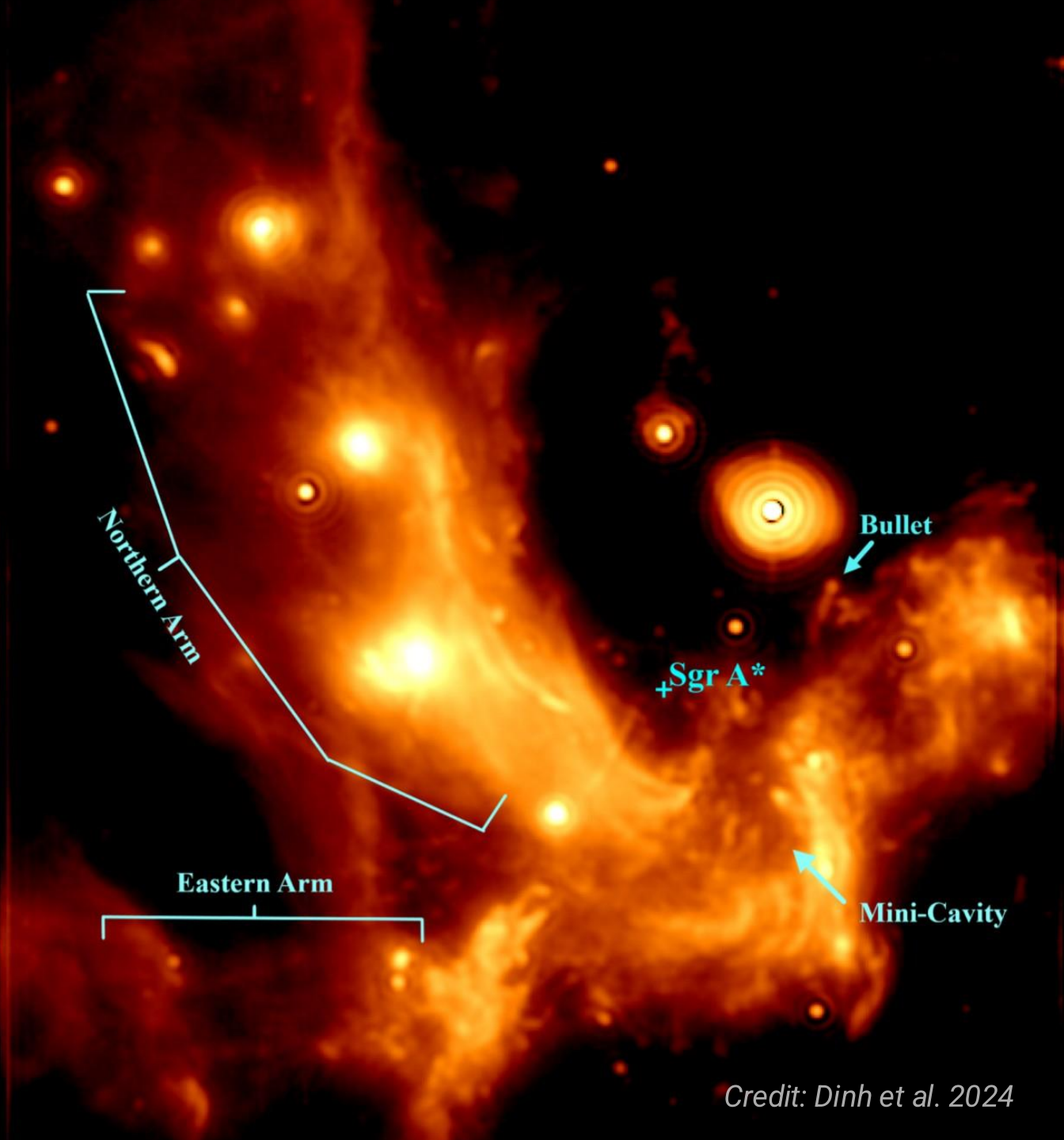
Credit: CfA/Melissa Weiss

Collaborators: T. Roychowdhury, Z. Sumners, G. Sanger-Johnson, N. Ford, B. Seefeldt-Gail, G. Fazio, D. Haggard, J. Hora, A. Philippov, B. Ripperda, H. Smith, S. Willner, G. Witzel, S. Zhang, E. Becklin, G. Bower, S. Chandra, T. Do, M. Garcia Marin, M. Gurwell, K. Hada, S. Markoff, M. Morris, J. Neilsen, N. Sabha

Approximately 26,000 light years of gas, dust, and stars lie between Sgr A* and the Earth



This material **blocks our view** at optical wavelengths



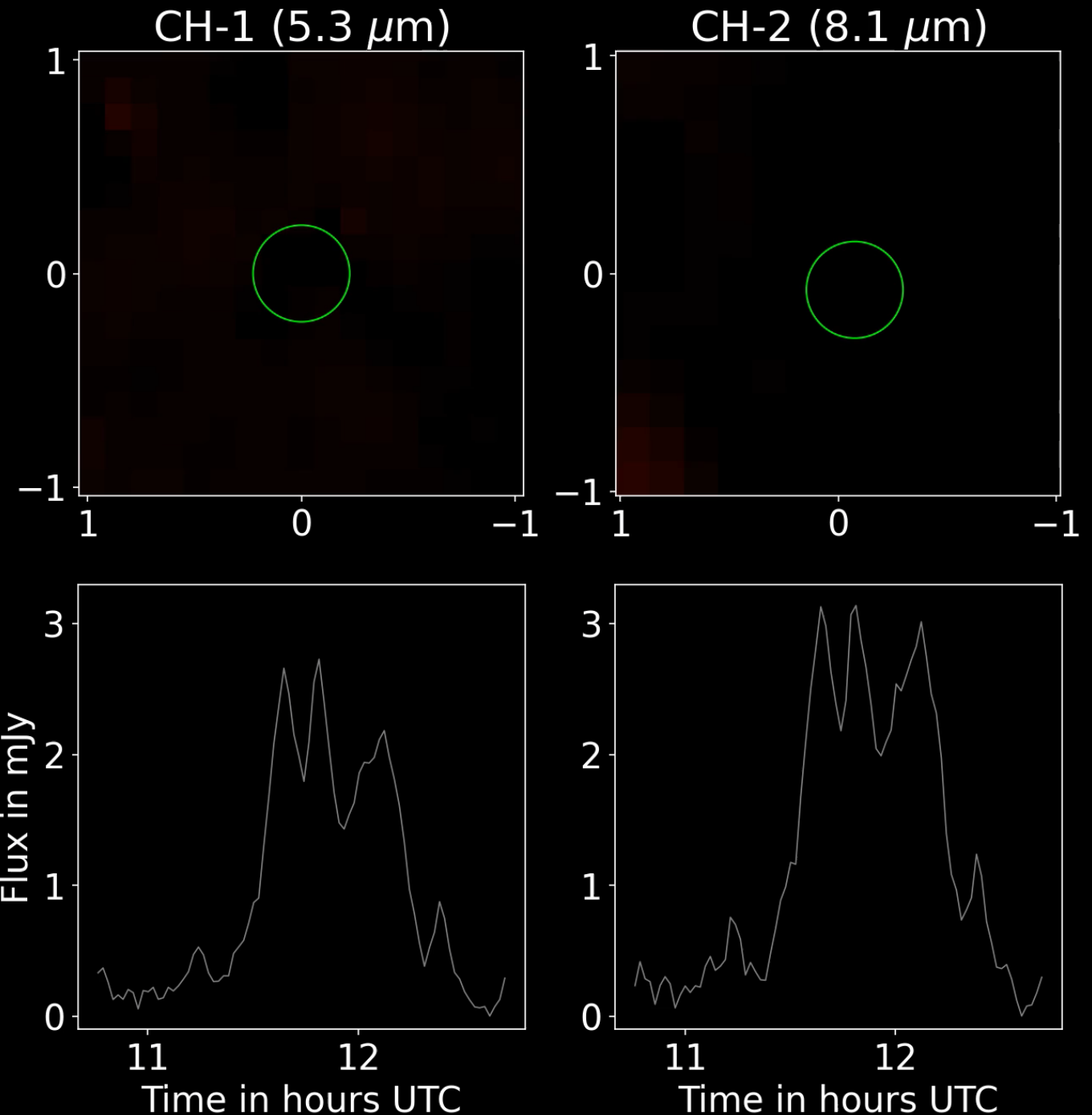
Until now, Sgr A* and its variability have been detected from radio to X-ray but not in the mid-IR

Previous ground-based projects **lacked the sensitivity and photometric stability** to detect Sgr A*'s mid-IR variability

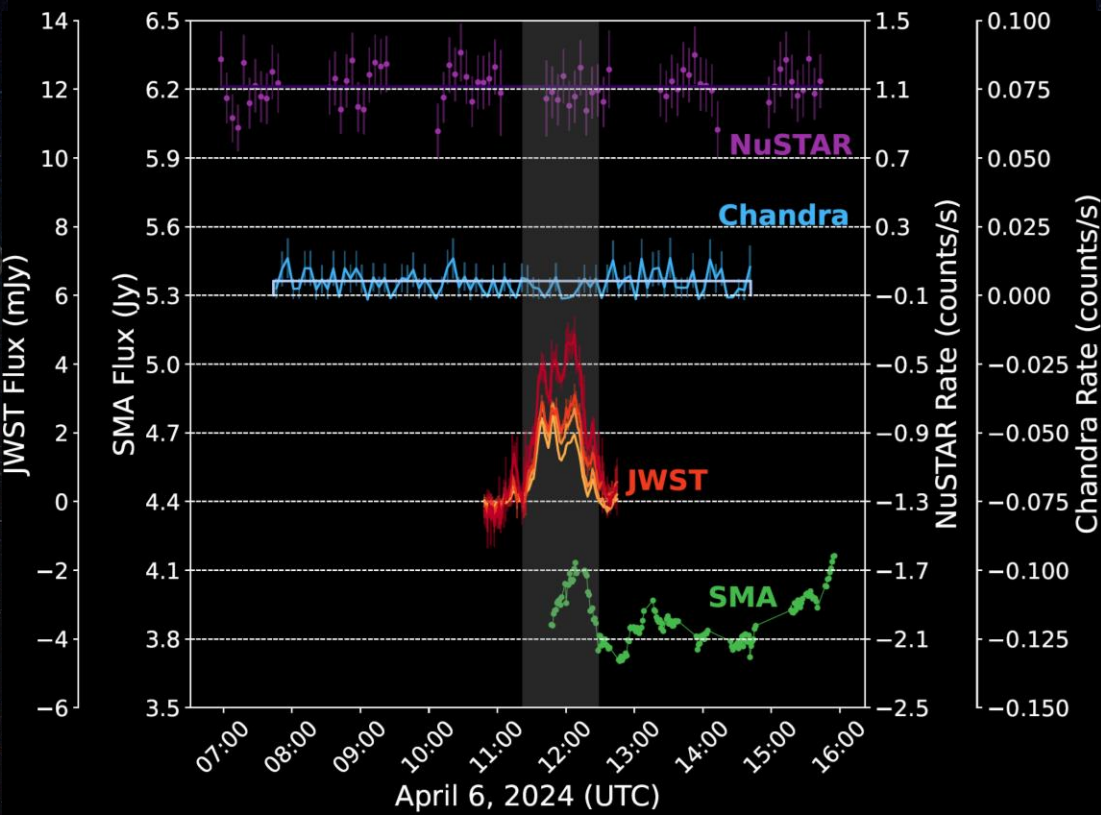
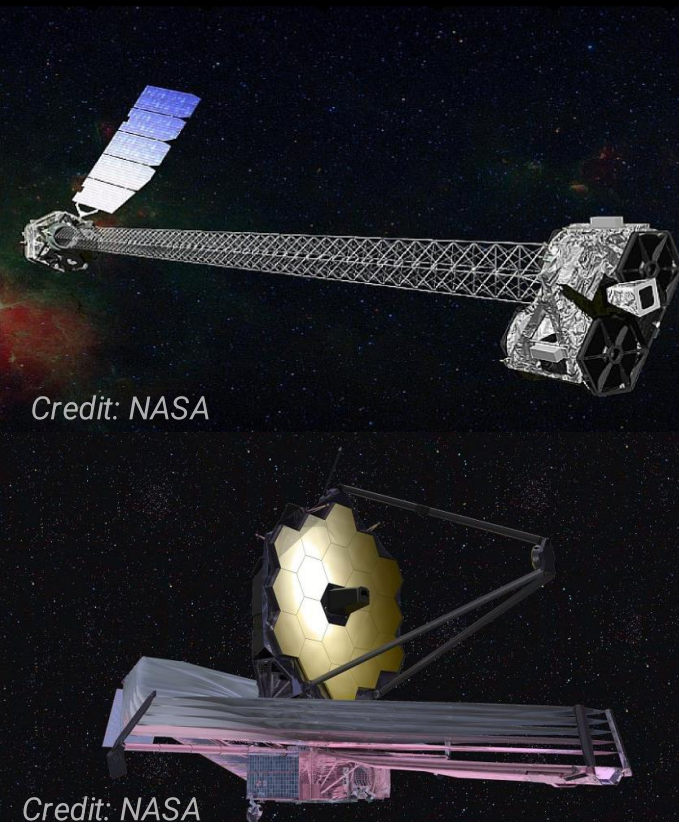
Credit: Dinh et al. 2024

We report the **first-ever** detection of Sgr A*'s **mid-infrared variability** using JWST/MIRI at wavelengths ranging from 5 to 21 microns

JWST/MIRI has the required **sensitivity** and **stability** to make this detection

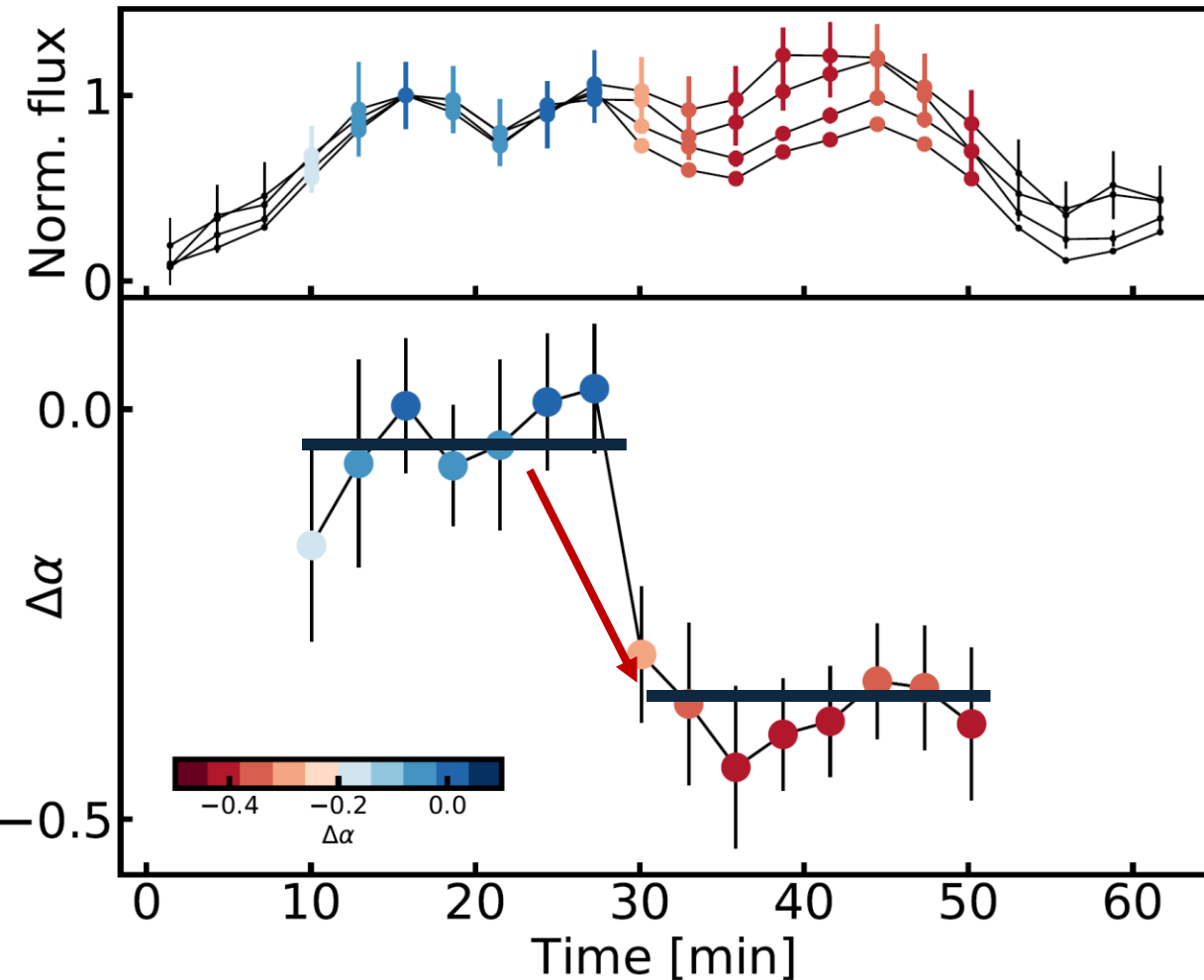


Simultaneous multiwavelength observations spanned submillimeter to X-ray frequencies



While no X-ray flare was observed, the Submillimeter Array detected **variable emission delayed by 10 minutes** after the last mid-IR peak.

Measuring the mid-IR flare color evolution



Spectral index, or color, probes the **distribution of electron energies** powering the flare

The **change in color is consistent with synchrotron cooling** of the highest energy electrons

Multiwavelength flare matches an orbiting hotspot

The flare may **originate** from particles accelerated in a region with strong, tangled magnetic fields.



Credit: CfA/Melissa Weiss

Implications for future studies of Sgr A*



Crucial **missing link** for future studies of the flares from the submm to X-ray

New view will aid understanding the microphysics responsible for the **formation of the flare**

Use flares in Sgr A*'s accretion flow as a **unique laboratory** for extremely energetic magnetic processes

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Credit: CfA/Melissa Weiss