Detection and Evolution of Polarized Emission from the Galactic Center Transient MAXI J1744-294

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MAXI J1744-294, likely a low-mass X-ray binary system, is a Galactic-center transient source, detected at radio and X-ray wavelengths, located approximately 19” southeast of Sgr A*. We report the first detection of its variable linear polarization across four epochs between 2025 April 04–09. The normalized 33 and 43 GHz Stokes parameters q and u over the four epochs imply a common Faraday rotation screen with a rotation measure RM = $-63{,}606^{+844}_{-861}$ rad m^{-2}, the third largest RM detected within the Galaxy. The RM is consistent with that of the Galactic center magnetar PSR J1745-2900, giving the first direct evidence that MAXI J1744 lies within the Galactic center region, bound to Sgr A*, and therefore part of the nuclear star cluster. The uniformity in the Galactic center Faraday screen suggests that Sgr A*'s $\approx -5\times10^5$ rad m^{-2} RM is intrinsic rather than originating from an unrelated line-of-sight source. On 2025 April 06, we detected a secondary polarized component with an additional RM $\approx$ -6000 rad m^{-2} which was not seen at any other epoch, consistent with a short-lived knot in a putative jet.

Discovery and Background

MAXI J1744-294 (MAXI J1744) is the most recent Galactic center transient source. It was discovered in X-rays by the Monitor of All-sky X-ray Image (MAXI) on board the International Space Station in early 2025 January [1] located ~19" southeast of Sgr A*, with later X-ray followup by NinjaSat [2] and SWIFT [3]. Further analysis by [4] found MAXI J1744 is a **rebrightening of SWIFT J174540.2-290037**, discovered in 2016 May [5]. Additional multiwavelength coverage included Chandra, NuSTAR, XMM-Newton, XRISM [4], NICER [6], IXPE [7], Keck [4], and MeerKAT [8]. A comprehensive study of the temporal evolution of the IR and X-ray properties is given in [4].

VLA Observations and Imaging

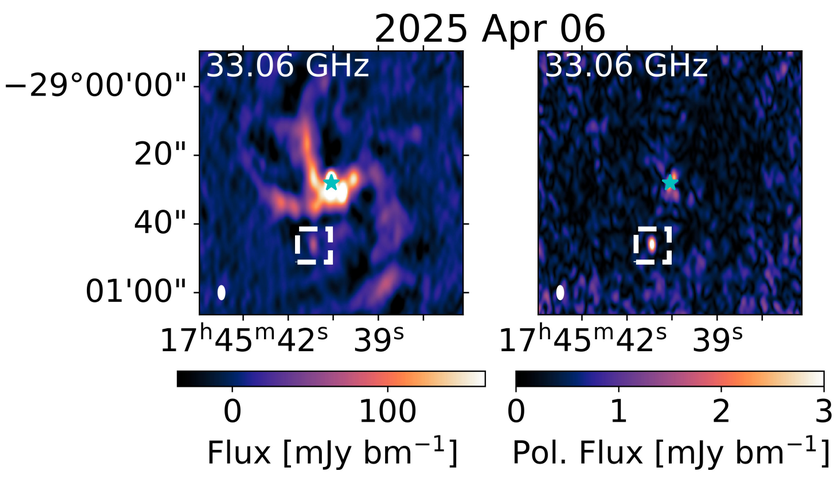

Figure 1: 33 GHz Stokes I and polarized intensity maps of the Galactic Center on 2025 April 06. The location of MAXI J1744 is marked in a white box; Sgr A* is marked with a star.

We fortuitously observed MAXI J1744 with the VLA over four closely-spaced epochs as part of a multiwavelength campaign of Sgr A*, including JWST/MIRI, SMA, and Chandra. The VLA data consist of full-track observations at 33 and 43 GHz in full polarization. 33 GHz total and polarized intensity maps of the central parsec from a single observation are shown in Fig. 1. Primary-beam corrected Stokes *I*, *Q*, *U*, and *V* cubes at 32 MHz spectral resolution were produced using baselines $\geq 10\,k\lambda$. We completed aperture photometry on the Stokes *I, Q,* and *U* cubes with an aperture 1.25 × the clean beam.

Daily-Timescale Variability

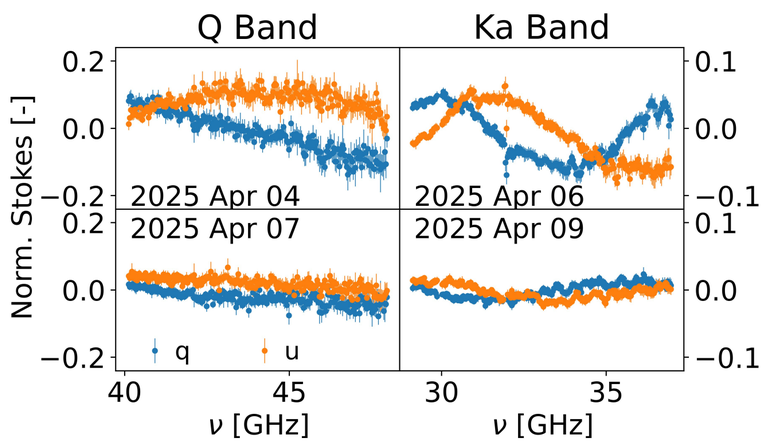

Figure 2: Normalized Stokes q and u spectra for MAXI J1744 over all epochs at 32 MHz spectral resolution, showing daily-timescale variability.

We detect daily-timescale variability in the total intensity, spectral index, and polarization over the four epochs. Notably, MAXI J1744 displays increasing flux, spectral hardening, and lower polarization fraction and polarized intensity. Fig. 2 shows the normalized Stokes *q* and *u* spectra, demonstrating a **persistent rotation measure** (RM) in all epochs.

Evolving Faraday Structure

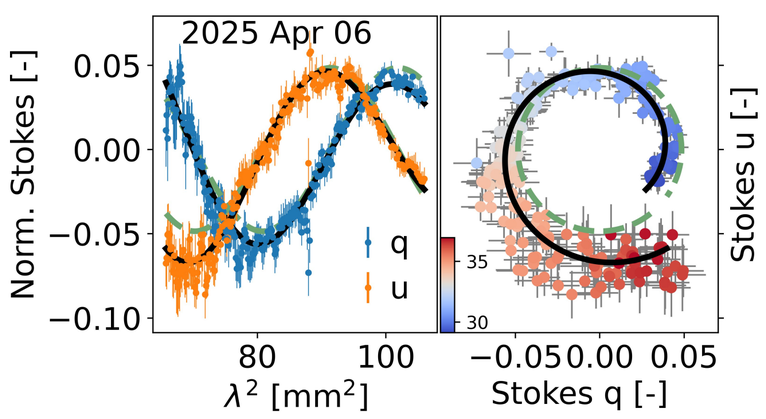

Figure 3: Best-fit single- (dashed green) and dual-component (solid black) Stokes *q* and *u* models to the 2025 April 06 data, displaying the presence of a second, unresolved polarized feature. The color bar denotes the spectral frequency in GHz.

We directly fit the *q*/*u* spectra with unresolved single- and dual-component polarized models, mitigating $n\pi$ ambiguities in EVPA. 2025 April 04, 07, and 09 were best-fit by a single component with total **RM $\approx -64{,}000$ rad m^{-2}, consistent with the Galactic Center magnetar PSR J1745-2900**. 2025 April 06 is characterized by two components (Fig. 3): one consistent with the Galactic Center screen, and a second with an additional ≈ -6000 rad m^{-2}.

Joint Epoch Polarization Model

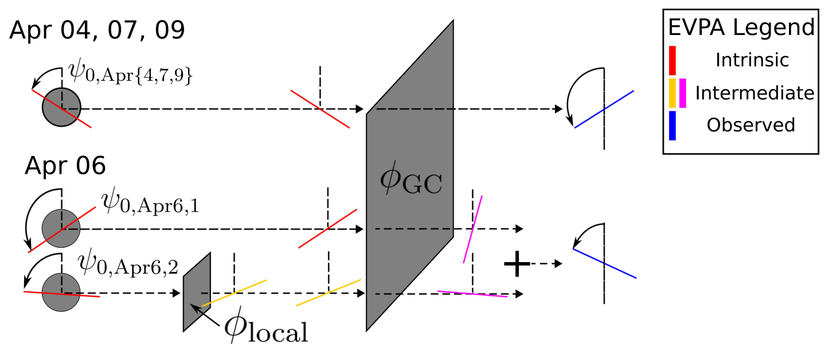

Figure 4: Schematic setup of the joint polarization fit.

Parameter	Posterior (1σ)	Parameter	Posterior (1σ)
[rad m^{-2}]	$-63{,}606^{+844}_{-861}$	[rad m^{-2}]	-6224^{+2119}_{-2482}
$p_{0,\,\mathrm{Apr\,4}}$ [%]	$9.84^{+0.16}_{-0.16}$	$\psi_{0,\,\mathrm{Apr\,4}}$ [°]	$39.75^{+2.44}_{-2.38}$
$p_{0,\,\mathrm{Apr\,6,1}}$ [%]	$8.12^{+5.50}_{-2.82}$	$\psi_{0,\,\mathrm{Apr\,6,1}}$ [°]	$79.95^{+6.11}_{-7.69}$
$p_{0,\,\mathrm{Apr\,6,2}}$ [%]	$11.42^{+5.67}_{-3.19}$	$\psi_{0,\,\mathrm{Apr\,6,2}}$ [°]	$33.15^{+11.99}_{-10.37}$
$p_{0,\,\mathrm{Apr\,7}}$ [%]	$3.63^{+0.11}_{-0.11}$	$\psi_{0,\,\mathrm{Apr\,7}}$ [°]	$61.94^{+2.54}_{-2.56}$
$p_{0,\,\mathrm{Apr\,9}}$ [%]	$1.54^{+0.04}_{-0.04}$	$\psi_{0,\,\mathrm{Apr\,9}}$ [°]	$62.13^{+4.32}_{-4.25}$

Table 1: Posterior and 68% credible intervals (1σ) for the joint fit. Uniform priors of $\phi \in [-110{,}000,\,0]$ rad m^{-2}, $p \in [0,100]$%, and $\psi \in [0,\,180]$ degrees (cyclic) were used.

We jointly fit all VLA epochs with a single component on 2025 April 04, 07, and 09 and two components on April 06 (see Fig. 4), one of which has a local RM screen (parameters listed in Table 1). A uniform **Galactic Center RM screen of $-63{,}606^{+844}_{-861}$ rad m^{-2}** is obtained.

Central Parsec RM Profile

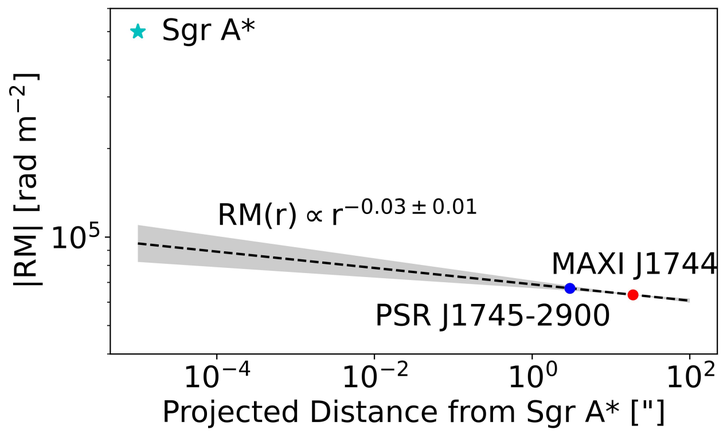

Figure 5: Known RMs of central parsec sources. This work now constrains the radial RM profile within the inner 20".

Measured RMs of PSR J1745-2900 [9] and MAXI J1744 imply a nearly flat RM screen on a scale of ~1 pc (Fig. 5). Thus, **~90% of Sgr A*'s RM $\approx -5\times10^5$ rad m^{-2} is intrinsically produced**.

References: [1] Kudo et al. (ATel #16975); [2] Watanabe et al. (ATel # 17009); [3] Heinke et al. (ATel # 17010); [4] Mandel et al. (2026); [5] Degenaar et al. (ATel #9109); [6] Jaisawal et al. (ATel #17040); [7] Marra et al. (2025); [8] Grollimund et al. (ATel # 17045); [9] Eatough et al. (2013)

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