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A First-Look Image of M87* from the 2026 EHT Monitoring Campaign

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ABSTRACT

In 2026, the Event Horizon Telescope (EHT) carried out the first time-lapse monitoring campaign comprising a series of 18 observations of the $6.16^{+0.71}_{-0.57} \times 10^9\,M_\odot$ black hole at the center of M 87 with a cadence of approximately twice per week over a few months, matched to the expected dynamical timescale. Here we present a first-look image from the campaign, reconstructed from a single four-minute scan obtained on 2026 April 3. The resulting image displays the now-familiar asymmetric ring morphology first revealed by the 2017 EHT observations and subsequently confirmed by observations obtained in 2018 and 2021. While representing only a very small subset of the full program, this image demonstrates a significant advance in the operational capabilities of the EHT. Through improvements in array operations, data transport and processing, the collaboration has reduced the interval between observation and imaging to only a few months, establishing the EHT as a facility capable of routinely undertaking time-domain studies of the dynamic universe at extremely high resolutions of $\sim 20\,\mu$as.

Keywords: Black Hole (162), Accretion (14), Relativistic Jets (1390), Gravitation (661), Active Galaxies (17), Very Long Baseline Interferometry (1769)

1. INTRODUCTION

In 2019, the Event Horizon Telescope (EHT) collaboration released the first images of the supermassive black hole M87* at the center of the nearby radio galaxy M 87 (EHT Collaboration et al. 2019a). The images revealed a bright, asymmetric ring of emission surrounding a central brightness depression whose angular size was consistent with the shadow predicted by general relativity for a $6.16^{+0.71}_{-0.57} \times 10^9\,M_\odot$ black hole (EHT Collaboration et al. 2019d). The ring emission was found to be linearly polarized (EHT Collaboration et al. 2021a), revealing a strongly magnetized plasma flow (EHT Collaboration et al. 2021b). Subsequent observations obtained in 2018 and 2021 confirmed the persistence of this asymmetric ring morphology while revealing modest but significant changes in the azimuthal brightness distribution of the emission in both total intensity and linear polarization (EHT Collaboration et al. 2024, 2025a,b). Such variability is expected, as the dynamical timescale at the innermost stable circular orbit (ISCO) of M87* ranges from approximately one week to one month, depending on the black hole spin. General relativistic magnetohydrodynamic (GRMHD) simulations predict that horizon-scale emission evolves naturally on these timescales as turbulent plasma orbits and accretes onto the black hole. In fact, the 2017 EHT observations capture a glimpse of time evolution in interferometric data and the reconstructed ring emission within ~ 4 days (EHT Collaboration et al. 2019c, 2021a).

Characterizing this evolution requires repeated horizon-scale imaging with a cadence matched to the intrinsic variability of the source. To this end, the EHT Collaboration carried out an intensive monitoring campaign spanning primarily March through May 2026, supplemented by one additional observation in late January, to obtain a densely

sampled sequence of images of M87* with a cadence of approximately twice per week (every 3–4 days). Such a program places demands not only on observational cadence but also on the collaboration's end-to-end scientific throughput. Historically, the interval between EHT observations and publication has been measured in years. This latency reflects the complexity of operating a global mm-VLBI array, processing petabyte-scale datasets, and validating calibration, imaging, and analysis procedures with multiple independent pipelines. Although rigorous validation remains essential, time-domain studies benefit from a short turnaround from data acquisition to delivery. In preparation for the 2026 campaign, the collaboration implemented coordinated improvements throughout the observational pipeline, including array operations, data transport, correlation, calibration, imaging, and scientific review, with the goal of enabling the rapid production of rigorously validated horizon-scale images.

In this *Research Note*, we present a first-look image from the EHT monitoring campaign, reconstructed from a four-minute scan obtained on 2026 April 3. While representing only a single scan of an epoch in the full program, this result demonstrates that the EHT has achieved the scientific throughput required for routine time-domain studies of black hole accretion.

2. OBSERVATIONS AND DATA PROCESSING

The observation was conducted on 2026 April 3 with the EHT at 230 GHz. The campaign involved the following stations: SMA, JCMT, SMT, GLT, ALMA, LMT, KP, APEX, NOEMA and IRAM 30 m telescope (see EHT Collaboration et al. 2019b, for details of each station). For this epoch, we note: IRAM 30 m was wind-stowed and did not participate; SMT and ALMA recorded linear polarization; other stations recorded circular polarization. Standard procedures were employed during the observing track, interleaving M87* with calibrator sources 3C 273, 3C 279, and J1337-1257.

In the week directly after the campaign, data corresponding to a single four-minute scan from 05:02–05:06 UT of M87 from EHT band 2 (214–216 GHz) were electronically transferred to the MIT Haystack Observatory for correlation with the DiFX software correlator (Deller et al. 2011). Stations with limited transfer bandwidth (APEX, GLT) sent a 30 s segment of data for a first-look correlation on 2026 May 11 (which did not include ALMA). The correlation results were updated on 2026 June 5, when the data modules from ALMA and APEX arrived at Haystack. Compared to previous EHT observing campaigns, correlation was significantly accelerated for several reasons: the observing program was simpler and involved only 230 GHz observations, reducing the likelihood of unexpected changes in data-collection parameters at the stations; during the campaign, the collaboration performed regular checks of short calibration data segments, transferred electronically, to verify station performance and monitor timing parameters; and the software correlation was sped up by more than a factor of two by optimizing data throughput at the correlator.

Correlated data were phase-calibrated in the `EHT-HOPS` pipeline (Blackburn et al. 2019). The data were subsequently amplitude-calibrated using system equivalent flux densities estimated with instrument and atmospheric models implemented in `ngehtsim` (Pesce et al. 2024a,b) using daily weather data at each site from the MERRA-2 satellite. A first-look image was obtained using `Comrade.jl` (Tiede 2022) through a joint calibration and imaging method outlined in Tiede et al. (2026). The end-to-end calibration (`EHT-HOPS`) and imaging (`Comrade.jl`) pipelines have been updated to directly process correlated data from a heterogeneous mixed-polarization setup in the EHT array, recording both linear and circular polarization. This enables rapid data processing and image production within 24 h for the presented data, bypassing the PolConvert step for linear-to-circular polarization conversion (Martí-Vidal et al. 2016; Matthews et al. 2018).

3. RESULTS

Figure 1 presents the reconstructed image and corresponding (u, v) coverage of M87* from 2026 April 3. The image exhibits the now-familiar ring-like morphology surrounding a central brightness depression (EHT Collaboration et al. 2019c, 2024, 2025a). The emission remains asymmetric, with the brightest region located on the southwestern side of the ring. At the angular resolution achieved by the EHT, the overall ring diameter is broadly consistent with previous observing epochs. The persistent ring morphology reinforces the conclusion that the large-scale geometry of the horizon-scale emission is stable on multi-year timescales, despite the variability expected within the accretion flow.

The principal significance of this result lies not in identifying new astrophysical features, but in demonstrating the capability to produce scientifically validated EHT images on a substantially shorter timescale. The elapsed time between observation and completion of the scientific analysis is now measured in months rather than years, representing an important operational milestone for the collaboration. Furthermore, the expanded EHT array enables snapshot imaging of the ring morphology from a single scan.

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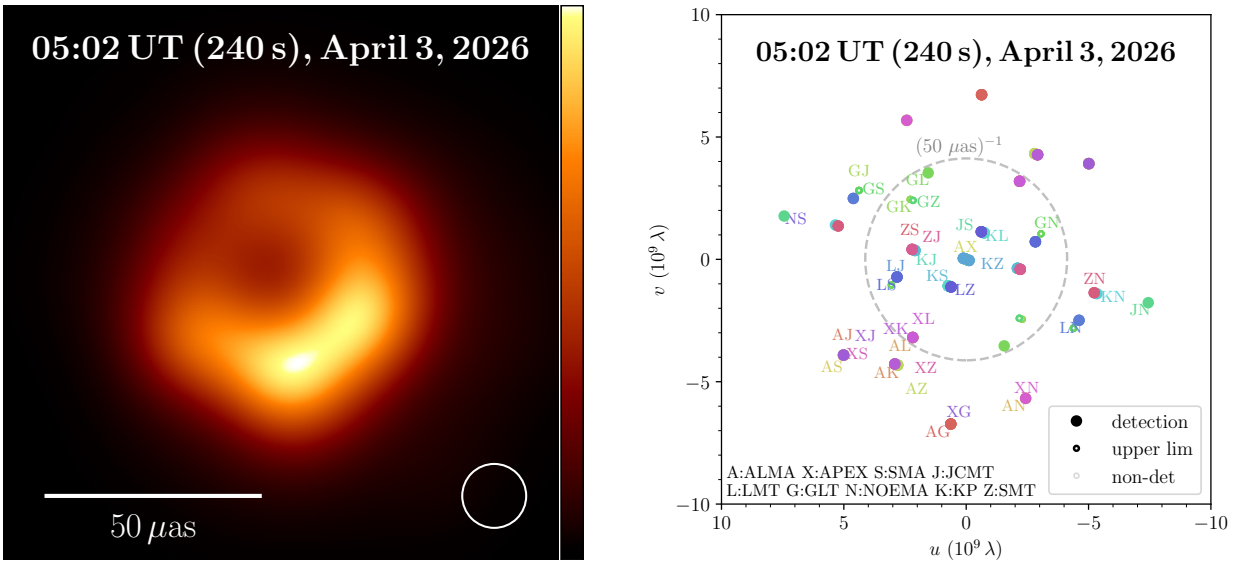


Figure 1. A first-look M87* image (left) and the corresponding (u, v) coverage (right) from EHT's 2026 monitoring campaign, obtained from a single 4-minute scan on 2026 April 3 and making use of ALMA data: ADS/JAO.ALMA#2025.1.00830.V.

4. DISCUSSION

After producing the first still images of a black hole, the EHT is now entering an era in which it can follow the dynamical evolution of plasma orbiting black holes on timescales comparable to the sources' intrinsic dynamical timescales. This transition from static imaging to time-domain astronomy fundamentally changes the operational requirements for the array. The present work demonstrates that this transition is now underway. Improvements introduced across the collaboration have substantially increased data throughput while preserving the rigorous validation procedures that underpin confidence in EHT results. These operational advances are as essential to the achievement of dynamic imaging of black holes as improvements in telescope sensitivity or imaging algorithms.

Rapid image production also enables new scientific opportunities (EHT Collaboration 2024). Timely analysis permits closer coordination with multi-wavelength observatories, facilitates rapid comparison with numerical simulations, and provides the possibility of responding dynamically during future observing campaigns. As the cadence of horizon-scale imaging increases, reducing analysis latency becomes increasingly important for maximizing scientific return. While this paper presents only a single scan of an epoch, it represents an important proof of concept for the broader objectives of the 2026 campaign. The complete multi-epoch dataset will provide an unprecedented opportunity to investigate the dynamics of black hole accretion and the evolution of magnetic field structures.

5. CONCLUSIONS

We present a first-look image from the 2026 EHT monitoring campaign targeting M87*. The image confirms the characteristic asymmetric ring morphology previously observed and demonstrates a major improvement in the operational efficiency of the EHT Collaboration. The principal achievement reported here is the ability to produce a scientifically validated, horizon-scale image only a few months after the data were acquired. This marks a critical milestone in the evolution of the EHT from an instrument optimized for static images to an observatory capable of routine time-domain studies of black holes. This first image demonstrates the collaboration's readiness to exploit the full scientific potential of the EHT time-lapse monitoring mode; a substantially higher quality image will be produced from the complete set of observations and therefore we discourage quantitative analysis on the presented image. The full analysis of the 2026 observations will provide the first completely sampled time-resolved view of plasma dynamics in the immediate vicinity of the M87* supermassive black hole.

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