Supplementary Information

Radio flare As MAXI J1820+070 (J1820) transitioned from the hard to soft X-ray states (i.e. was in the intermediate state) we observed a flaring event with the AMI-LA which lasted for $\sim$ 12 h. In Extended Data Figure 1 we demonstrate a subsection of our AMI-LA observations which covered the flare. In order to temporally resolve the event (which occurred over the typical timescale of a single observing track with the AMI-LA) we plot the amplitude of the (u,v) data directly, averaging over baselines and spectral windows in 30 min time bins. Modelling the radio emission as a flare (caused by a discrete relativistic ejection) superposed on a constantly decaying component (due to the compact core jet quenching) we estimate the amplitude and the rise time of the flare to be $\sim$ 46 mJy and 6.7 ± 0.2 h, respectively. Our estimated time that the flare began is MJD 58305.68 ± 0.01. When referring to observations of the bi-polar ejections, the observation time is taken with respect to the start of this flare. We note, however, that flares that peak due to optical depth effects are known to rise quicker, and peak first, at higher frequencies and so sub-mm observations of radio flares are likely a better proxy of the launch date of relativistic ejection[36]. Is is also possible that the flares are result of internal shocks, and there is a delay between the launch of ejections and collisions[26].

Soft state decay rates While BHXRBs are in the soft accretion state the compact core jet is significantly quenched and any radio emission from it drops by many orders of magnitude (always below observing sensitivity limits) or switches off completely. Radio emission observed during the soft state is almost certainly associated with ejections launched during the hard to soft state transition. This radio emission is transient, and is seen to fade as the ejections expand and cool. The e-folding decay timescale (which we will hereafter refer to as simply the decay timescale) of the emission from the ejections is seen to vary significantly between sources, but can broadly be categorised as either short (decay timescales from a few to $\sim 10\,\mathrm{d}$) or long (decay timescales from a few tens to hundreds of days). Short decay timescales are thought to be the result of ejecta expanding and cooling, with minimal ongoing energy injection resulting from interactions from the ISM. When longer decay rates are seen, it is thought that ongoing ISM interaction provides a source of particle acceleration, partially offsetting cooling, and results in the slowed flux decline. Example of fast decays include GRS 1915 during its 1994 and 1997 outbursts, showing decay timescales of $\sim$ 7 d and $\sim$ 2 d, respectively[12,56]. XTE J1748−288 showed a radio flux density decay timescale of $\sim$ 7 d at the start of the soft state during its 1998 outburst[28]. Slow decays have been seen in XTE J1550−564, which showed a flux density decay timescale of $\sim$ 85 d (at $1.4\,\mathrm{GHz}$) following a plateau period[41]. This decay rate appeared to be wavelength dependent, with X-ray observations revealing an exponential decay rate of $\sim$ 340 d from the same ejection component. An ejection from H1743−322 decayed with a timescale of $\lesssim$ 28 d.

In the main text we discuss the decay rate of the approaching ejection from J1820, which was seen to evolve throughout the soft state. To demonstrate the different decay rates we present a modified version of Figure 3 (Extended Data Figure 3) from the main text, in which we fit for the decay timescale for different segments of the light curve. The first segment, between MJD 58314 and MJD 58320, shows a decay timescale of 6 ± 1d. In the main text we refer to this as a 'fast decay'. The second segment, dates after MJD 58320, we fit with a broken exponential which shows decay rates of 51 ± 6 d and 21.0 ± 0.9 d with a break occurring at MJD 58386 ± 4. In the main text we refer to these as a 'slow decay'. Both of these decay phases are also seen in our eMERLIN data, although due to the course sampling we do not include them in Extended Data Figure 3. It appears, therefore, that the approaching ejection from J1820 initially showed a period of unimpeded cooling, followed by a long and slow decay caused by continued ISM interaction. We note that for both XTE J1550–564 and H1743–322 the decay rate of the ejecta were frequency dependent, with higher frequencies decaying slower[41,42]. This is similar to what we see for J1820, with the slower decay rate corresponding to the higher frequency (AMI-LA) data. The short delay between the ejection launch and this slow decay phase (in contrast to XTE J1550-564) may indicate that J1820 is not contained within an ISM cavity (and the decay is due to ongoing ISM interaction from the outset), or, if present, such a cavity may have a significantly smaller radius causing an earlier transition to the slow decay phase. The cause of the rise in flux between the two light curve segments (and between the end of the flare and the start of the first segment) is uncertain, but could be indicative of multiple ISM density enhancements.

The measured time of the break in the second light curve segment is remarkably close to the date where J1820 returned to the hard X-ray state (MJD 58393), and the core jet turned back on. For the two events to be connected there would have to be transport of information between the core and the approaching jet (separated by $\sim 7''$ at this epoch) on a ~ 7 d timescale. This would require an extremely high inferred proper motion of ~ 1 arcsec day^{-1} ($22\,c$ at 3.8 kpc). This is obviously significantly superluminal, and we would require the approaching ejection component to have a small angle (maximum $\theta \sim 5^{\circ}$) to the line of sight for the actual velocity to be at or less than c. This angle is not compatible with the one that we measure from our fitted proper motions. It is more likely that the difference in decays is either due to the fact that the AMI-LA is probing much larger angular scales, or that contamination from the receding jet (which is contained within the AMI-LA synthesised beam) is altering the decay rate. While we have no direct measurement of the flux density from the receding jet during the AMI-LA observations presented in Figure 3 and Extended Data Figure 3, we note that the receding jet is not detected in any of our eMERLIN observations and is below $\sim$ 600 μJy in our MeerKAT observations and so is likely to be a significantly less dominant component.

Proper Motions In Supplementary Table 1 we present the measured positions for the core, approaching ejection and receding ejection that we use to fit for the proper motions of each ejection (for details on this procedure see the Methods section). The angular separation with time for the two ejections is presented in Extended Data Figure 4.

We opt to exclude measurements made from two of our eMERLIN epochs. These are marked in Supplementary Table 1, and correspond to the smallest angular separation component in the first observation demonstrated in Figure 2 and the second observation shown in Figure 2. Between these two observations this component moves with a proper motion of $\sim\ 30\,\mathrm{mas\,d^{-1}}$, and was therefore launched around the same time as the faster approaching ejecta. It is evident, however, that this component is not well described alongside the rest of our measurements for either a linear or decelerating fit. Due to our lack of observations at multiple angular resolutions at this epoch, we cannot be sure if the two components detected in our first eMERLIN observation are part of a larger structure, the details of which we resolve out, or if they are distinct ejections. It is possible (though unlikely) that we missed a flare (and potentially associated ejection) with our AMI-LA monitoring, or that a single flare actually corresponded to a complex ejection morphology[36]. In this case the early time eMERLIN observations could be probing this morphology, and the later time data reveals the motion of the aggregated structure. We note that we could use the smaller angular separation component in our initial eMERLIN observation (MJD 58308; $\Delta t\ =\ 3.32\,\mathrm{d}$), instead of the larger angular separation component. While this provides a better fit to the first three eMERLIN observations (not underestimating the position of the component observed on MJD 58329; $\Delta t\ =\ 23.33\,\mathrm{d}$) it requires a significant deceleration to fit the entire data set. The inclusion of deceleration is not in itself an issue, however including this component when fitting both a linear and decelerating fit provide a launch date significantly *after* the radio flare observed by AMI. Additionally, the observation on MJD 58310 ($\Delta t = 4.35\,\mathrm{d}$) shows a component that is consistent with the smaller angular separation component on MJD 58308 as discussed above. Finally, our VLBA observation made earlier than our eMERLIN observation on MJD 58306 reveal a component is already present, well before this inferred launch date.

It is important to attempt to account for systematic uncertainties that arise when measuring the positions of components observed at very different angular scales. There is no guarantee that the centroid of the emitting region is the same on these different angular scales when a significant amount of the flux density is resolved out, as is the case for the approaching ejection component here (the receding component was only measured quasi-simultaneously by telescopes with similar angular resolutions). Using the ratio of beam size to signal to noise for the positional error will cause the eMERLIN data to be artificially over constraining given the previous argument, so instead we derive errors based on physics considerations. Considering the ejection as a spherical region expanding at a speed of $\sim 0.05\,c$, launched at the start of the flare observed with the AMI-LA during the hard to soft state transition, we estimate the emitting region would have an angular size of $0.015''$, $0.051''$, $0.11''$, and $0.42''$ on MJD 58308.98, 58316.96, 58329.00 and 58398.73, respectively, and use these values as our separation error. For the final observation we cap the error at $0.2''$ as it is now comparable with the position error derived from our lower resolution images.

We have demonstrated the results of fitting the angular separation with both a linear proper motion model, and one with constant deceleration. Determining the statistically appropriate model for data with vastly different error bars is challenging. Even when reevaluating the errors on our eMERLIN measurements, the error on the position for these observations (especially the ones only a few weeks after the launch of the approaching ejection) are significantly smaller than those made with the VLA and MeerKAT. This is also true for the VLBA observation. Adding a free parameter to our proper motion model (e.g. a deceleration) will essentially serve only to fit the early-time eMERLIN/VLBA observations, with other data barely constraining the model. There is also the issue that the centroids of the emitting regions do not necessarily align on the very different angular scales, and as such any inferred deceleration is not necessarily the physical deceleration of the ejections. It is also worth noting that different proper motions have been reported for the jets in XRB GRS 1915+105 from observations taken with different angular resolution, and do not necessarily imply that deceleration is occurring[56,57]. We consider both models in the text, but note that the parallax distance[31] for J1820 is strong evidence against the deceleration model being required to fit this data set.

Radio – X-ray Correlation Quasi-simultaneous X-ray and radio observations of accreting black hole X-ray binaries have been used to establish a connection between the accretion process and the production of jets, particularly the continuously-replenished relativistic jets typically observed in the hard states (and in quiescence). Particularly well-known is the non-linear correlation between the X-ray and the radio luminosity, originally discovered in the black hole X-ray binary GX 339$-$4[58]. This correlation was initially considered universal[59], however, more recently it has become clear[60,61] that some BHXRBs are considerably less luminous in the radio band than the canonical sources such as GX 339$-$4, and populate a second track in the radio–X-ray plane that is known as the radio-quiet track, as opposed to the original track, which is referred to as the radio-loud track. While some sources (e.g. H1743$-$322[9]) clearly follow an alternative track, it is not unambiguous that the whole population of BHXRBs can be separated into a bi-modal distribution of tracks[60].

Attempts to identify the physical origin of the existence of such tracks have been so far unsuccessful. Differences have been explained in terms of different jet magnetic field configurations[62], the accretion flow radiative efficiency[9] or in the contribution from an additional inner accretion disc[63]. More recently, it was proposed that the morphology of the distribution is the result of an inclination effect, which, however, remains to be confirmed by more observations of black hole X-ray binaries in the hard state[44], although we note that J1820 goes against the proposed trend.

During the initial hard-state, J1820 travelled along the radio-loud track following a power law of the form $L_R = AL_X^{\alpha}$, with $\alpha = 0.42 \pm 0.05$. The correlation showed the same slope throughout the long initial hard state, all the way up to X-ray and radio luminosities of $\sim 4 \times 10^{37}\,\mathrm{erg\,s^{-1}}$ and $\sim 6 \times 10^{30}\,\mathrm{erg\,s^{-1}}$, respectively. During the intermediate state J1820 left the radio loud track, with its radio emission dropping rapidly. The source was then detected continually throughout the soft state (although we determine this does not represent a connection between accretion and core-jet emission). We then track the core-jet turning back on as J1820 returns to the radio loud correlation, following a track with $L_R = AL_X^{-1.4\pm0.4}$, and joining at a similar location to our first quasi-simultaneous radio/X-ray detection. The radio–X-ray correlation during the end-of-outburst hard state shows $\alpha = 0.37 \pm 0.03$, consistent with (but slightly shallower than) that on the initial hard state. A joint fit of the initial and final hard state radio–X-ray correlation returns a slope of $\alpha = 0.50 \pm 0.09$.

Our simultaneous radio and X-ray monitoring ended on MJD 58439 at which point we measure, with the VLA, the receding jet flux density to be around 20% of the core flux density at 6 GHz. Assuming the core has a flat spectrum[64] and the ejection is optically thin with a spectral index of –0.7, we estimate that the ejection could be contributing around 10% of the flux density measured by the AMI-LA by this date. Fifteen days previous, a detection of the core and receding ejection with MeerKAT at 1.28 GHz measured the receding component flux density to be around 30% of the core flux density. Under the same assumptions this would imply around a 5% contribution to the AMI-LA flux density at this epoch. Removing (quasi-)simultaneous observations after MJD 58424 alters the slope during to second hard state to $L_R = AL_X^{0.34\pm0.06}$, and the jointly fit slope becomes $L_R = AL_X^{0.55\pm0.02}$. We conclude that the slopes are not being significantly altered by the presence of ejecta components contaminating the AMI-LA measurements of the core.

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Supplementary Data Table 1 | Positions of the core, approaching ejection, and receding ejection from the 2018 outburst of J1820. Positions of the approaching jet, receding jet, and core components for observations with eMERLIN, MeerKAT, the VLA and the VLBA. Dates report the observation mid-point.

	Core			Approaching ejection			Receding ejection			
Date	RA	Dec	Error	RA	Dec	Error	RA	Dec	Error	Facility
[MJD]	[hh:mm:ss.s]	[dd:mm:ss.s]	[$''$]	[hh:mm:ss.s]	[dd:mm:ss.s]	[$''$]	[hh:mm:ss.s]	[dd:mm:ss.s]	[$''$]	
58193.42	18:20:21.9384	+07:11:7.182	0.004	-	-	-	-	-	-	eMERLIN
58194.40	18:20:21.9386	+07:11:7.172	0.003	-	-	-	-	-	-	eMERLIN
58199.41	18:20:21.9391	+07:11:7.182	0.008	-	-	-	-	-	-	eMERLIN
58201.27	18:20:21.93867	+07:11:7.169	0.001	-	-	-	-	-	-	eMERLIN
58202.31	18:20:21.9385	+07:11:7.166	0.006	-	-	-	-	-	-	eMERLIN
58203.26	18:20:21.9384	+07:11:7.168	0.004	-	-	-	-	-	-	eMERLIN
58206.27	18:20:21.93858	+07:11:7.168	0.001	-	-	-	-	-	-	eMERLIN
58306.22[b]	-	-	-	18:20:21.9382	+07:11:07.157	0.003	18:20:21.93887	+07:11:07.1785	0.0007	VLBA
58308.98[c,d]	-	-	-	18:20:21.9368	+07:11:07.111	0.006	-	-	-	eMERLIN
58308.98[c]	-	-	-	18:20:21.9285	+07:11:06.853	0.005	-	-	-	eMERLIN
58310.02[c,d]	-	-	-	18:20:21.9361	+07:11:07.083	0.006	-	-	-	eMERLIN
58316.96[c]	-	-	-	18:20:21.9145	+07:11:06.308	0.005	-	-	-	eMERLIN
58329.00[c]	-	-	-	18:20:21.8780	+07:11:05.230	0.006	-	-	-	eMERLIN
58389.75	18:20:21.93	+07:11:08.1	0.6	18:20:21.73	+07:11:02.4	0.6	-	-	-	MeerKAT
58396.70	18:20:21.91	+07:11:07.6	0.6	18:20:21.71	+07:11:01.3	0.6	-	-	-	MeerKAT
58398.04	18:20:21.93	+07:11:07.1	0.9	18:20:21.70	+07:11:01.5	0.9	-	-	-	VLA
58398.73[e]	18:20:21.939	07:11:07.17	0.02	18:20:21.715	+07:11:00.60	0.03	-	-	-	eMERLIN
58399.99	18:20:21.94	+07:11:07.3	0.9	18:20:21.75	+07:11:00.9	0.9	-	-	-	VLA
58402.85	18:20:22.00	+07:11:07	1	18:20:21.73	+07:11:00	1	-	-	-	VLA
58403.66	18:20:21.92	+07:11:07.9	0.6	18:20:21.68	+07:11:01.2	0.6	-	-	-	MeerKAT
58403.91	18:20:21.93	+07:11:07.3	0.9	18:20:21.70	+07:10:59.8	0.9	-	-	-	VLA
58405.67	18:20:21.91	+07:11:07.9	0.5	18:20:21.68	+07:11:01.2	0.5	-	-	-	MeerKAT
58405.90	18:20:21.93	+07:11:07	1	18:20:21.66	+07:11:01	1	-	-	-	VLA
58410.62	18:20:21.94	+07:11:08.0	0.6	18:20:21.67	+07:11:01.3	0.6	-	-	-	MeerKAT
58417.79	18:20:21.938	+07:11:7.17	0.02	-	-	-	-	-	-	eMERLIN
58419.73	18:20:21.939	+07:11:7.17	0.02	-	-	-	-	-	-	eMERLIN
58418.54	18:20:21.91	+07:11:08.3	0.6	18:20:21.67	+07:11:00.8	0.6	-	-	-	MeerKAT
58418.85	18:20:21.96	+07:11:06.8	0.8	18:20:21.72	+07:10:59.6	0.8	18:20:22.10	+07:11:10.7	0.8	VLA
58425.50	18:20:21.91	+07:11:08.1	0.6	18:20:21.65	+07:11:01.1	0.6	18:20:22.02	+07:11:12.3	0.7	MeerKAT
58432.48	18:20:21.91	+07:11:07.8	0.6	18:20:21.66	+07:11:00.1	0.7	18:20:22.00	+07:11:11.4	0.6	MeerKAT
58435.67	18:20:21.90	+07:11:07.4	0.5	18:20:21.67	+07:10:59.8	0.7	18:20:22.01	+07:11:11.1	0.5	MeerKAT
58439.48	18:20:21.95	+07:11:09.0	0.6	18:20:21.63	+07:11:00	1	18:20:22.09	+07:11:12.7	0.6	MeerKAT
58440.90	18:20:21.94	+07:11:07.2	0.2	18:20:21.69	+07:10:59.2	0.2	18:20:22.06	+07:11:11.0	0.3	VLA
58446.45	18:20:21.89	+07:11:06.5	0.8	18:20:21.55	+07:10:57	1	18:20:22.03	+07:11:12	1	MeerKAT
58454.43	18:20:21.95	+07:11:09	1	18:20:21.53	+07:11:00	2	18:20:22.06	+07:11:13.4	1	MeerKAT
58473.68	18:20:21.94	+07:11:07.0	0.3	-	-	-	18:20:22.08	+07:11:11.6	0.3	VLA

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	Core			Approaching ejection			Receding ejection			
Date	RA	Dec	Error[a]	RA	Dec	Error[a]	RA	Dec	Error[a]	Facility
[MJD]	[hh:mm:ss.s]	[dd:mm:ss.s]	[$''$]	[hh:mm:ss.s]	[dd:mm:ss.s]	[$''$]	[hh:mm:ss.s]	[dd:mm:ss.s]	[$''$]	
58479.64	18:20:21.93	+07:11:07.1	0.4	-	-	-	18:20:22.10	+07:11:12.3	0.4	VLA
58484.75	18:20:21.96	+07:11:07.0	0.3	-	-	-	18:20:22.09	+07:11:12.0	0.3	VLA

[a] When only the core is detected the reported error is the statistical one reported by the CASA task IMFIT (RA and Dec error combined in quadrature). Otherwise it represents the uncertainty in the position along the angle connecting the components to the core (and the core to the components), further described in the Methods section.

[b] The position error reported for the VLBA observation is that along the jet axis, as described in the text. We use a core position measurement from the hard state, with a proper motion correction[20], when calculating the separation of the ejection components.

[c] This observation occurred when the source was not in the hard X-ray state, and as such the core was not detected.

[d] These observations were not included in our proper motion fits.

[e] While we detect the core in this observation, for the purpose of calculating the separation (Supplementary Table 1) we use the bright core observation made on MJD 58201, see Supplementary Table 2.

Supplementary Data Table 2 | Flux evolution of the core, approaching ejection, and receding ejection from the 2018 outburst J1820. Flux density of the approaching jet, receding jet, and core components for observations with eMERLIN, MeerKAT and the VLA. To calculate the flux density we use an unconstrained elliptical Gaussian and report the peak flux density. The error is the statistical one only, and was combined with a 5% calibration error for calculations. Upper limits are 3σ, although at early times when we cannot resolve the receding ejection component these may not reflect the true upper limit of the emitting region. We do not report upper limits before the launch date of the ejections. Dates report the observation mid-point.

	Core		App. ejection		Rec. ejection			
Date	Flux density	Error	Flux density	Error	Flux density	Error	Frequency	Facility
[MJD]	[mJy]	[mJy]	[mJy]	[mJy]	[mJy]	[mJy]	[GHz]	
58193.42	23.2	0.4	-	-	-	-	5.07	eMERLIN
58194.40	26.6	0.4	-	-	-	-	5.07	eMERLIN
58199.41	38	1	-	-	-	-	5.07	eMERLIN
58201.27	56.7	0.8	-	-	-	-	5.07	eMERLIN
58202.31	23	1	-	-	-	-	5.07	eMERLIN
58203.26	26	1	-	-	-	-	5.07	eMERLIN
58206.27	33.5	0.4	-	-	-	-	5.07	eMERLIN
58308.98	< 0.08	-	0.24	0.02	< 0.08	-	5.07	eMERLIN
58308.98	< 0.08	-	0.25	0.02	< 0.08	-	5.07	eMERLIN
58310.02	< 0.13	-	0.52	0.04	< 0.13	-	5.07	eMERLIN
58316.96	< 0.07	-	0.13	0.02	< 0.07	-	5.07	eMERLIN
58329.00	< 0.10	-	0.35	0.04	< 0.10	-	5.07	eMERLIN
58389.75	3.47	0.05	2.26	0.05	< 0.13	-	1.28	MeerKAT
58396.70	11.8	0.1	2.0	0.1	< 0.19	-	1.28	MeerKAT
58398.04	16.99	0.03	0.63	0.03	< 0.05	-	5.87	VLA
58398.73	5.26	0.08	0.31	0.02	< 0.41	-	1.51	eMERLIN
58399.99	7.46	0.05	0.50	0.04	< 0.06	-	6	VLA
58402.85	5.12	0.03	0.33	0.03	< 0.08	-	6	VLA
58403.66	2.62	0.04	1.06	0.04	< 0.11	-	1.28	MeerKAT
58403.91	4.20	0.04	0.33	0.04	< 0.13	-	6	VLA
58405.67	2.41	0.03	0.96	0.03	< 0.07	-	1.28	MeerKAT
58405.90	3.59	0.05	0.28	0.05	< 0.12	-	6	VLA

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	Core		App. ejection		Rec. ejection			
Date	Flux density	Error	Flux density	Error	Flux density	Error	Frequency	Facility
[MJD]	[mJy]	[mJy]	[mJy]	[mJy]	[mJy]	[mJy]	[GHz]	
58410.62	1.52	0.06	0.77	0.06	< 0.016	-	1.28	MeerKAT
58417.79	0.93	0.04	< 1.05	-	< 1.05	-	1.51	eMERLIN
58419.73	1.15	0.03	< 0.21	-	< 0.21	-	1.51	eMERLIN
58418.54	1.61	0.05	0.55	0.05	< 0.14	-	1.28	MeerKAT
58418.85	2.49	0.03	0.17	0.01	0.15	0.03	6	VLA
58425.50	1.15	0.04	0.41	0.04	0.36	0.04	1.28	MeerKAT
58432.48	0.82	0.04	0.29	0.04	0.61	0.04	1.28	MeerKAT
58435.67	0.75	0.02	0.25	0.02	0.55	0.02	1.28	MeerKAT
58439.48	0.79	0.05	0.29	0.05	0.33	0.05	1.28	MeerKAT
58440.90	1.162	0.007	0.071	0.007	0.22	0.007	6	VLA
58446.45	0.36	0.05	0.25	0.05	0.35	0.05	1.28	MeerKAT
58454.43	0.34	0.06	0.18	0.06	0.22	0.06	1.28	MeerKAT
58473.68	0.138	0.008	< 0.02	-	0.13	0.008	6	VLA
58479.64	0.153	0.008	< 0.03	-	0.10	0.008	6	VLA
58484.75	0.147	0.008	< 0.02	-	0.10	0.008	6	VLA

Supplementary Data Table 3 | Summary of our eMERLIN observations of MAXI J1820+070.

Date	Start time[a] [UT]	Start date[a] [MJD]	Frequency [GHz]	Obs. length[b] [hrs.]	Antennas[c]	RMS noise[d] [μJy beam^{-1}]
16/03/2018	07:39:56.5	58193.31943	5.07	4.71	Mk2, Kn, De, Pi	319
17/03/2018	07:39:56.5	58194.31943	5.07	4.21	Mk2, Kn, De, Pi, Da, Cm	410
22/03/2018	07:09:56.5	58199.29859	5.07	4.83	Mk2, Kn, De, Pi, Da, Cm	766
24/03/2018	01:00:26.5	58201.04200	5.07	10.96	Mk2, Kn, De, Pi, Da, Cm	325
25/03/2018	02:53:02.5	58202.12019	5.07	9.08	Mk2, Kn, De, Pi, Da, Cm	1059
26/03/2018	01:07:56.5	58203.04720	5.07	10.27	MK2, Ln, De, Pi, Da, Cm	868
29/03/2018	01:07:56.5	58206.04720	5.07	10.83	Mk2, Kn, De, Pi, Da	217
09/07/2018	18:10:01.5	58308.75073	5.07	10.95	Mk2, Kn, De, Pi, Da, Cm	26
10/07/2018	20:03:01.5	58309.83546	5.07	8.95	Mk2, Kn, De, Pi, Cm	38
17/07/2018	17:01:00.5	58316.70906	5.07	11.95	Kn, De, Pi, Da, Cm	24
29/07/2018	20:05:01.5	58328.83685	5.07	7.95	Mk2, Kn, De, Cm	37
07/10/2018	12:01:02.0	58398.50073	1.51	10.95	Mk2, Kn, De, Da, Cm	69
26/10/2018	16:05:01.6	58417.67018	1.51	5.88	Mk2, Kn, De, Pi, Da, Cm	79
28/10/2018	13:31:02.0	58419.56323	1.51	7.95	Mk2, Kn, De, Pi, Da, Cm	42

[a] Start time and Start data columns refer to the beginning on of the first scan on MAXI J1820.

[b] Observations length refers to the difference in time between the start of the first and end of the last scan on MAXI J1820. Roughly $\sim 9\%$ of this time was spent observing the interleaved phase calibrator.

[c] Mk2 = Mark II, Kn = Knockin, De = Defford, Pi = Pickmere, Da = Darnhall, Cm = Cambridge.

[d] RMS calculated from a region near the image phase centre. When the core was bright observations were dynamic range limited.

Supplementary Data Table 4 | Summary of our VLA observations of MAXI J1820+070.

Date	Start time [UT]	Start date]MJD]	Frequency [GHz]	Obs. length [hrs.]	Array config.	RMS noise[a] [μJy beam^{-1}]
07/10/2018	00:55:22	59398.03845	5.87	0.19	D[b]	17
08/10/2018	00:05:38	58399.00391	6.00	0.06	D	19
11/10/2018	20:47:47	58402.86652	6.00	0.06	D	26
12/10/2018	22:06:17	58403.92103	6.00	0.02	D	39
14/10/2018	21:58:18	58405.91549	6.00	0.02	D	40
27/10/2018	20:24:57	58418.85066	6.00	0.05	D	23
18/11/2018	21:31:22	58440.89678	6.00	0.60	C[c]	7
21/12/2018	16:22:22	58473.68220	6.00	0.31	C	8
27/12/2018	20:24:57	58479.85966	6.00	0.31	C	9
01/01/2019	18:14:32	58484.76009	6.00	0.31	C	8

[a] RMS calculated from a region near the image phase centre.

[b] Maximum and minimum baseline length of 1.03 km and 0.035 km, respectively.

[c] Maximum and minimum baseline length of 3.4 km and 0.035 km, respectively.

Supplementary Data Table 5 | Summary of our MeerKAT observations of MAXI J1820+070.

Date	Start time[a] [UT]	Start date[a] [MJD]	Frequency [GHz]	Obs. length[b] [hrs.]	RMS noise[c] [μJy beam^{-1}]
28/09/2018	17:46:40.5	58389.74075	1.28	0.25	41
05/10/2018	16:33:42.5	58396.69008	1.28	0.24	72
12/10/2018	15:46:24.9	58403.65723	1.28	0.24	37
14/10/2018	15:15:56.8	58405.63607	1.28	1.71	24
19/10/2018	14:44:16.0	58410.61407	1.28	0.25	50
27/10/2018	12:49:17.8	58418.53423	1.28	0.25	45
03/11/2018	11:54:36.7	58425.49626	1.28	0.25	42
10/11/2018	11:26:18.6	58432.47660	1.28	0.25	44
13/11/2018	15:46:12.4	58435.65709	1.28	0.84	26
17/11/2018	11:26:41.8	58439.47687	1.28	0.25	53
24/11/2018	10:39:27.1	58446.44406	1.28	0.25	45
02/12/2018	10:05:03.5	58454.42018	1.28	0.25	57

[a] Start time and Start data columns refer to the beginning on of the first scan on MAXI J1820.

[b] Observations length refers to the difference in time between the start of the first and end of the last scan on MAXI J1820. For observations of length 0.24 or 0.25 hours this was a single scan and thus the entire time was spent on source. For longer observations $\sim$ 12% of this time was spent observing an interleaved phase calibrator.

[c] RMS calculated from a region near the image phase centre.