# Hour–long time scale radio variability in M31* and Sgr A*

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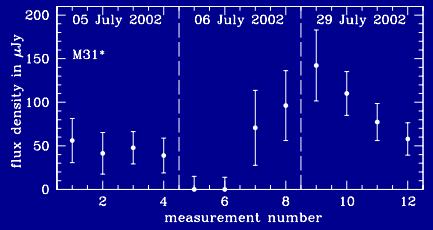
Since the discovery of a central, nuclear source in Andromeda by Crane et al. (1992), it has been seen as an analogue to the nuclear radio source in the center of the Milky Way, the black hole Sgr A*. Melia (1992) first coined the name, M31*, and models for the source, while Crane et al. (1993) showed that the source showed variability on time scales of several months in the radio emission at 3.6 cm.

Recently we have obtained 6 cm observations with the VLA in its B–array, i.e. with a resolution of 1.2 arcseconds in three 8–hour runs. M31* seems a bit brighter at 6 cm (around 50 uJy, versus 30 uJy at 3.6 cm), with a peak of about 100 uJy in one of the runs. This level is just enough to obtain 2–4 sigma detections with part of the data. We split up the data in four–hour and even two–hour intervals and measured the flux density of M31* in the individual intervals:




Pseudo radio light curve of M31*. Two–hour average integrated flux densities, with one–sigma error bars (20–30 uJy). The source is clearly variable with respect to other sources.

Assuming that the radio emission of M31* is indeed associated with a nuclear black hole, some interesting observations can be extracted:

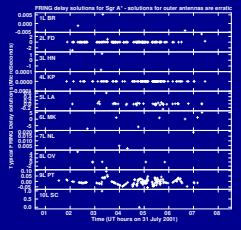
- On July 5th 2002, the source seems to be quiescent at 50 uJy.
- 24 hours later, on July 6th 2002, the source is undetectable for four hours, after which it returns almost twice as bright.
- Three weeks later (July 29th) the source seems to return to the 'quiescent flux density' (July 5th), speculatively after a flare.

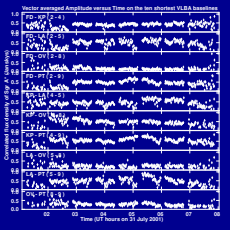
Several possible explanations other than intrinsic variability can likely be excluded, among which poor calibration, interstellar scattering, an unrelated nearby source, micro–lensing or, e.g., an emerging blob.

Please, come and see/talk to me if you are interested in more detail.

The radio and infrared variability of Sgr A* will be discussed in great detail at this meeting. However, here we will comment on the 3–hour 43 GHz VLBA "flare" on 31 July 2001, reported at several recent occasions by Miyoshi et al. (Galactic center, VLBA 10th, IAU). The reason for this is the time scale of the "event" (3 hours), which is similar to the time scale of the variability seen in M31* with the VLA.

We have retrieved the VLBA data taken by Miyoshi et al. from the archive and re–reduced the data in several different ways. in an attempt to recreate the result of Miyoshi et al. – a genuine flare of Sgr A*, including the claimed appearance of a symmetric jet on this date. And to be honest, we were able to recreate the Miyoshi results by blindly calibrating and imaging the data with standard procedures. The standard calibration obtained in this way was carefully analyzed.





Left: Delays using all antennas. The marginal solutions mess up the calibration. Right: using only the short baselines – there is no increase in flux due to a jet/flare.

From this, it was clear that some data and calibration results are very suspicious, especially apparent on the antennas making up the longer baselines, and some amplitude calibration problems with a key antenna. Due to the severe scattering, only the inner 5–6 antennas are useful, which are also the antennas with the shorter baselines on which the factor of three in increased flux density due to an emerging jet should be most visible. Amplitude calibration was improved using a calibrator.

With only the five central antennas, transferring the calibration of the calibrator to Sgr A*, and using CALIB (instead of FRING to obtain a higher signal–to–noise), we do not reproduce Miyoshi et al.'s results.

We conclude that there was no 43 GHz "flare" or "jet" on 31 July 2001.