

The long-term millimeter activity of active galactic nuclei

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We analyze the long-term evolution of the fluxes of six active galactic nuclei (AGN) - 0923+392, 3C 111, 3C 273, 3C 345, 3C 454.3, and 3C 84 - in the frequency range 80-267 GHz using archival calibration data of the IRAM Plateau de Bure Interferometer. Our dataset spans a long timeline of ~14 years with 974-3027 flux measurements per source. We find strong (factors ~2-8) flux variability on timescales of years for all sources. The flux density distributions of five out of six sources show clear signatures of bi- or even multimodality. Our sources show mostly steep ($\alpha \sim 0.5-1$), variable spectral indices that indicate outflow dominated emission; the variability is most probably due to optical depth variations. The power spectra globally correspond to red-noise spectra with five sources being located between the cases of white and flicker noise and one source (3C 111) being closer to the case of random walk noise. For three sources the low-frequency ends of their power spectra appear to be upscaled in spectral power by factors ~2-3 with respect to the overall powerlaws. In two sources, 3C 454.3 and 3C 84, the 1.3-mm emission precedes the 3-mm emission by ~55 and ~300 days, respectively, probably due to (combinations of) optical depth and emission region geometry effects. We conclude that the source emission cannot be described by uniform stochastic emission processes; instead, a distinction of "quiescent" and (maybe multiple) "flare" states of the source emission appears to be necessary.

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