The Variability Timescale -- Accretion Rate Relation of Active Galactic Nuclei

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We study the long-term (>30 years) radio variability of 43 radio-bright active galactic nuclei (AGNs) by exploiting the database of the University of Michigan Radio Astronomy Observatory monitoring program. We model the periodograms (temporal power spectra) of the observed light curves as simple power-law noise (red noise) using Monte Carlo simulations, taking into account windowing effects (red-noise leak, aliasing). The power spectra of 39 (out of 43) sources are in good agreement with the models, yielding a range in power spectral index (β) from $\approx$1 to $\approx$3. We use the derivative of a light curve to obtain a characteristic variability timescale, which does not depend on the assumed functional form of flux peaks, incomplete fitting, and so on. We find that, once the effects of relativistic Doppler boosting are corrected for, the variability timescales of our sources are proportional to the accretion rate to the power of 0.25 ± 0.03 over five orders of magnitude in accretion rate, regardless of source type. As yet, we have not found the origin of the specific power law slope of 1/4.