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Milliarcsecond Core Size Dependence of the Radio Variability of Blazars

ABSTRACT

Studying blazar radio variability on timescales of months to years enables us to better understand the physical structure of blazar on sub-parsec scales, and the physics of super-massive-black-holes. In our study, we focus on the radio variability of 1158 blazars observed at 15 GHz through the Owens Valley Radio Observatory (OVRO) Blazar Monitoring Program, where these sources have been observed about twice a week for over a decade. We investigate why some blazar sources are more variable than others, by examining the dependence of the variability amplitudes and timescales on the milliarcsecond source size measured by Very Long Baseline Interferometry. We use the structure function analysis and model fitting to characterize the variability amplitude and timescale. We find that the most compact sources at milliarcsecond scales exhibit stronger variability amplitudes and shorter variability timescales than more extended sources; this result can be explained by light travel-time effects. For sources with measured redshifts, the correlation between linear source size against variability amplitude and timescales become even more significant. Furthermore, we find that the variability amplitude also shows significant dependence on source radio spectral index, which is related to the core dominance of the blazars.