Nuclear Activity in Galaxies Across Cosmic Time
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The spins of supermassive black holes

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Abstract. We present 1-second cadence, precise optical observations from SOFIA and Palomar of a sample of nearby supermassive black holes. The observations were taken to identify the shortest timescale variability in the nuclear photometry which may be associated with instabilities in the accretion flow in the immediate vicinity of the black hole. The shortest timescale variability, if associated with the radius of the innermost stable circular orbit (ISCO), can then be used to estimate the spin of the black hole. Despite 1% precision photometry, we obtained a non-detection of any significant variability in the nucleus of M32 ($M_{BH} \sim 2.5 \times 10^6\, M_\odot$). Given the density of the stellar cusp, this argues for a scenario where 1000 Msun seed black holes formed from the coalescence of less massive black holes, which then accrete the gas produced by stellar interactions/winds. In more luminous systems however, we find a significant deection of variability and present hypotheses to explain the signal and thereby the origin of supermassive black holes.

Keywords. galaxies: active, galaxies: properties, active: supermassive black holes