



# The mass function of black holes at $1 < z < 4.5$ : comparison of models with observations

Priyamvada Natarajan, Marta Volonteri

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In this paper, we compare the observationally derived black hole mass function (BHMF) of luminous broad-line quasars (BLQSOs) at  $1 < z < 4.5$  drawn from the Sloan Digital Sky Survey (SDSS) presented in Kelly et al. (2010), with models of merger driven BH growth in the context of standard hierarchical structure formation models. In the models, we explore two distinct black hole seeding prescriptions at the highest redshifts: "light seeds" - remnants of Population III stars and "massive seeds" that form from the direct collapse of pre-galactic disks. The subsequent merger triggered mass build-up of the black hole population is tracked over cosmic time under the assumption of a fixed accretion rate as well as rates drawn from the distribution derived by Merloni & Heinz. Our model snapshots are compared to the SDSS derived BHMFs of BLQSOs. Our key findings are that the duty cycle of SMBHs powering BLQSOs increases with increasing redshift for all models and models with Pop III remnants as black hole seeds are unable to fit the observationally derived BHMFs for BLQSOs, lending strong support for the massive seeding model (abridged).

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