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A Direct Measurement of the Mean Occupation Function of Quasars: Breaking Degeneracies between Halo Occupation Distribution Models

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Recent work on quasar clustering suggests a degeneracy in the halo occupation distribution constrained from two-point correlation functions. To break this degeneracy, we make the first empirical measurement of the mean occupation function (MOF) of quasars at z ˜ 0.2 by matching quasar positions with groups and clusters identified in the MaxBCG sample. We fit two models to the MOF, a power law and a four-parameter model. The number distribution of quasars in host halos is close to Poisson, and the slopes of the MOF obtained from our best-fit models (for the power-law case) favor an MOF that monotonically increases with halo mass. The best-fit slopes are 0.53 ± 0.04 and 1.03 ± 1.12 for the power-law model and the four-parameter model, respectively. We measure the radial distribution of quasars within dark matter halos and find it to be adequately described by a power law with a slope -2.3 ± 0.4. We measure the conditional luminosity function (CLF) of quasars and show that there is no evidence that quasar luminosity depends on host halo mass, similar to the inferences drawn from clustering measurements. The lack of halo mass dependence in the CLF shows that quasars residing in galaxy clusters have a characteristic luminosity scale.

Primary author: Dr CHATTERJEE, Suchetana (Assistant Professor)

Co-authors: Prof. MYERS, Adam (Assistant Professor); Ms NGUYEN, My (Graduate Student); Prof. ZHENG, Zheng (Assistant Professor)

Presenter: Dr CHATTERJEE, Suchetana (Assistant Professor)

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