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Neutrino mass constraint from an Implicit Likelihood Analysis of BOSS voids

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Cosmic voids identified in the spatial distribution of galaxies provide complementary information to two-point statistics. In particular, constraints on the neutrino mass sum, $\sum m_\nu$, promise to benefit from the inclusion of void statistics. We perform inference on the CMASS NGC sample of SDSS-III/BOSS with the aim of constraining $\sum m_\nu$. We utilize the void size function, the void-galaxy cross power spectrum, and the galaxy auto power spectrum. To extract constraints from these summary statistics we use a simulation-based approach, specifically implicit likelihood inference. We populate approximate gravity-only, particle neutrino cosmological simulations with an expressive halo occupation distribution model. With a conservative scale cut of $k_{\rm max} = 0.15\,h{\rm Mpc}^{-1}$ and a Planck-inspired ΛCDM prior, we find upper bounds on $\sum m_\nu$ of 0.43 and $0.35\,$eV from the galaxy auto power spectrum and the full data vector, respectively ($95\,\%$ credible interval). We observe hints that the void statistics may be most effective at constraining $\sum m_\nu$ from below. We also substantiate the usual assumption that the void size function is Poisson distributed.

Primary author: THIELE, Leander (Princeton University)

Co-authors: PISANI, Alice; WANDELT, Benjamin; HAHN, ChangHoon; SPERGEL, David; MASSARA, Elena; HO, Shirley

Presenter: THIELE, Leander (Princeton University)

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