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Profile likelihoods for the neutrino mass, using latest cosmological datasets

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We derive constraints on the neutrino mass using a frequentist approach based on likelihood profiles. Our analysis leverages the latest cosmological datasets, including DESI DR2 BAO and DR1 full-shape likelihoods, CMB and CMB lensing from Planck and ACT, recent Lyman-alpha 1D power spectrum emulation applied to eBOSS, and supernovae data.

Profile likelihoods offer several advantages when working on the neutrino mass. First, as current constraints are getting closer and closer to the $\sum m = 0$ limit, profile likelihoods interrupted by this limit can easily be extrapolated to infer the statistical power of the data and compare data combinations. Secondly, they are not subject to any of the prior effects that might arise in Bayesian methods for inference.

Our analysis features exciting advancements such as the full-shape likelihood from DESI DR1, which enable precise measurements of small-scale suppression independently of CMB lensing. This provides a valuable point of comparison and offers a fully LSS-based measurement when combined with the Lyman-alpha forest data.

Finally, we discuss the constraints on the minimal sums of neutrino mass that arise from mass ordering and oscillation measurements of solar and atmospheric neutrinos.

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