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Analyzing the Large-Scale Bulk Flow using CosmicFlows4: Increasing Tension with the Standard Cosmological Model

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We present an estimate of the bulk flow in a volume of radii 150 200h−1Mpc using the minimum variance (MV) method with data from the CosmicFlows4 (CF4) catalog. The addition of new data in the CF4 has resulted in an increase in the estimate of the bulk flow in a sphere of radius 150h−1Mpc relative to the CosmicFlows3 (CF3). This bulk flow has less than a 0.03% chance of occurring in the Standard Cosmological Model (ΛCDM) with cosmic microwave background derived parameters. Given that the CF4 is deeper than the CF3, we were able to use the CF4 to accurately estimate the bulk flow on scales of 200h−1Mpc (equivalent to 266 Mpc for Hubble constant Ho = 75 km/s/Mpc) for the first time. This bulk flow is in even greater tension with the Standard Model, having less than 0.003% probability of occurring.

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