Contribution ID: **12** Type: **not specified**

The Velocity Field Olympics: Assessing velocity field reconstructions with direct distance tracers

Tuesday 4 February 2025 11:20 (20 minutes)

The peculiar velocity field of the local Universe provides direct insights into its matter distribution and the underlying theory of gravity, and is essential in cosmological analyses for distinguishing systematic deviations from the Hubble flow. Numerous methods have been developed to reconstruct the local density and velocity fields (at z
$lesssim 0.05$), typically constrained by redshift-space galaxy positions (e.g., 2M++) or by direct distance tracers such as the Tully-Fisher relation, the fundamental plane, and supernovae (e.g., CosmicFlows). We introduce a comprehensive validation framework to evaluate the accuracy of these reconstructions against catalogues of direct distance tracers and examine their relative ability to explain the peculiar velocities of objects within these catalogues. Our framework assesses the goodness-of-fit of each reconstruction using Bayesian evidence, residual redshift discrepancies, velocity scaling, and the need for external bulk flows. Applying this framework to a suite of reconstructions—including those derived from the Bayesian Origin Reconstruction from Galaxies (BORG) algorithm and from linear theory—we find that non-linear BORG reconstructions consistently outperform others. However, the efficacy of these comparisons is strongly influenced by the resolution at which the reconstructions are constrained, and our conclusions are based only on "average" goodness-of-fit of the reconstructions, rather than the velocities of individual objects or specific regions.

Author: STISKALEK, Richard (University of Oxford)

Presenter: STISKALEK, Richard (University of Oxford)

Session Classification: Session 5