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Understanding the role of peculiar velocities in void cosmology

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Cosmic voids, large under-dense regions in the Universe, serve as promising laboratories for extracting cosmological information. They offer opportunities to explore deviations from ΛCDM and provide insights into dark energy and modification of gravity. Upcoming surveys will enable detailed void analyses, allowing access to a huge number of voids. Voids' significance lies in their spherically symmetric property when stacked, becoming standard spheres. However, observationally, they exhibit two types of distortions crucial for extracting cosmological information: redshift-space distortions (RSD), caused by galaxy peculiar velocities, and geometrical distortions, arising from the use of incorrect cosmological models when converting observed redshifts into distances (Alcock-Paczynski test). Modeling RSD requires the challenging task of accounting for peculiar velocities, and current models have proven insufficient for accurately describing smaller voids. This limitation can be addressed by reconstructing the velocity field. In this work, I present improvements in performing the Alcock-Paczynski test on voids after applying a Zeldovich reconstruction to model RSD. This approach allows for the inclusion of smaller voids in the analysis and significantly enhances the precision of cosmological parameter constraints.

Author: DEGNI, Giulia

Presenter: DEGNI, Giulia

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