ID de Contribution: **8**   Type: **Non spécifié**

Galaxy formation without cosmic variance: exploring the universe through the Sibelius-Dark simulation

jeudi 5 mai 2022 14:30 (15 minutes)

Cosmic variance poses limits to the analyses of the physics of the nearby Universe, notably to establish an accurate observational link between halo formation history and galaxy properties. The BORG framework offers a way out by generating constrained initial conditions which reproduce all the Large scale structures in a simulated environment with minimal effects due to cosmic variance. By relying on the physics of gravitational interaction and our knowledge of the Universe on large scales, it can generate an ensemble of plausible samples of the initial conditions of our Universe. That framework unlocks the possibility of studying different models of galaxy formation and their impact on different observed environments. The physical environment is notably responsible for the specific mass accretion history on small-scale structures. The Sibelius-Dark simulation is an effort in that direction. I will showcase some of the results on the mean galaxy properties based on the GALFORM semi-analytic model.

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Classification de Session: Galaxy-halo connection for cosmology