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Tracing the environmental history of observed galaxies via extended fast Action Minimization Method

We present a novel application of the extended Fast Action Minimization method (eFAM, Sarpa et al 2019, 2021) aimed at assessing the role of the environment in shaping galaxy evolution. We apply eFAM to a simulated galaxy catalogue at z=0 extracted from the Magneticum hydrodynamical simulation to retrieve the past, non-linear trajectories of "observed" galaxies (positions and velocities as a function of time) and simultaneously estimate the past density field at different redshifts. We then use the density information to infer the evolution of the large scale cosmic web.

To study the effect of the environment on the observed galaxy properties we reconstruct the environmental history of individual galaxies by tracing their trajectories through cosmic structures. Focusing on the gas fraction, f_gas, we find that in cluster members f_gas decreases as a function of the redshift of accretion, suggesting, in agreement with simulations, that galaxies keep losing their gas content as they orbit within the cluster. Filament galaxies show a similar trend, proving that eFAM successfully traces the galaxy's gas depletion in filaments as in clusters. Our results establish eFAM as a valuable tool for studying the environmental dependence of observed galaxy properties, offering a complementary approach to that based on light-cone observations.

Serdecznie zapraszam,

Agnieszka Majczyna