Abstract Submitted
for the APR16 Meeting of
The American Physical Society

Multi-stream portrait of the Cosmic web NESAR RAMACHANDRA, SERGEI SHANDARIN, University of Kansas — We report the results of the first study of the multi-stream environment of dark matter haloes in cosmological N-body simulations in the ΛCDM cosmology. The full dynamical state of dark matter can be described as a three-dimensional sub-manifold in six-dimensional phase space - the dark matter sheet. In our study we use a Lagrangian sub-manifold $\mathbf{x} = \mathbf{x}(\mathbf{q}, t)$ (where $\mathbf{x}$ and $\mathbf{q}$ are co-moving Eulerian and Lagrangian coordinates respectively), which is dynamically equivalent to the dark matter sheet but is more convenient for numerical analysis. Our major results can be summarized as follows. At the resolution of the simulation, the cosmic web represents a hierarchical structure: each halo is embedded in the filamentary framework of the web predominantly at the filament crossings, and each filament is embedded in the wall like fabric of the web at the wall crossings. Locally, each halo or sub-halo is a peak in the number of streams field. The number of streams in the neighbouring filaments is higher than in the neighbouring walls. The walls are regions where number of streams is equal to three or a few. Voids are uniquely defined by the local condition requiring to be a single-stream flow region.

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Date submitted: 08 Jan 2016 Electronic form version 1.4