

**TATA INSTITUTE OF FUNDAMENTAL RESEARCH**  
**DEPARTMENT OF ASTRONOMY & ASTROPHYSICS**

***ASTRONOMY SEMINAR***

December 20, 2011

Speaker : Dr. Aseem Paranjape  
ICTP, Trieste, Italy

Title : Large scale structure and first-passage problems

Day, Date & Time : Tuesday, 04 January, 2011 at 16.00 hrs

Venue : Lecture Theatre (AG-66)

(J.S. Yadav)

***Abstract***

*The excursion set formalism is a well known way of statistically mapping the early time linear cosmological density perturbations into the highly nonlinear large scale structure we observe today. The formalism relies on simplified models of nonlinear evolution such as spherical collapse, combined with the ansatz that a collapsed object forms today provided the \*initial\* density field smoothed on a given length scale is above a threshold determined by the spherical collapse model. One then deals with the random walk performed by the smoothed initial density field as the smoothing scale is changed, and the problem maps on to a well known 1-dimensional first-passage problem in statistical physics which has a simple analytic solution. The predictions of this formalism for Gaussian initial conditions are known to be qualitatively in agreement with N-body simulations.*

*In this talk I will first give a pedagogical review of the above. Recent interest has focused on initial perturbations that are weakly non-Gaussian, which introduces an interesting technical challenge, and I will discuss some recent results in this context. Finally, I will discuss some ongoing work to improve the statistical ansatz mentioned above, by explicitly accounting for correlations between random walks separated by a finite distance. I will show that after some approximations this problem also maps to a first-passage problem, this time in 2 dimensions, which can be solved analytically.*