The Abdus Salam
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Advanced Workshop on
"Anderson Localization, Nonlinearity and Turbulence: A Cross-Fertilization"

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TITLE:
``Inertial particle clustering and random walks in random environments"

ABSTRACT:

I will introduce a simple model that accounts for the ejection of heavy inertial particles from the vortical structures of a turbulent flow. This model involves a space and time discretization of the dynamics and depends on only two parameters: the fraction of space-time occupied by rotating structures of the carrier flow and the rate at which particles are ejected from them. The latter can be heuristically related to the response time of the particles and hence measures their inertia. Such a model reproduces qualitatively most aspects of the spatial distribution of heavy particles transported by realistic flows. In particular the probability density function of the mass m in a cell displays a power-law behavior at small values and decreases faster than exponentially at large values. The dependence of the exponent of the first tail upon the parameters of the dynamics is explicitly derived for the model. The right tail is shown to decrease as $\exp (-C m \log m)$. Finally I will show how such models can be re-interpreted in terms of the instantaneous probability of occupancy of a random walk in a random environment. This approach allows one to formulate clustering as trapping events in non-diffusing regions of the environment.