Seminar

Institute for Plasma Research

Title : Investigation of Granular and Cognitive Complex Systems

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Date : 21st August 2015 (Friday)

Time : 02.00 – 3.15 PM

Venue : Committee Room 3(New Building), IPR

Abstract:

We examine the emergent dynamics of granular and cognitive complex systems subjected to applied protocols. We use a Monte Carlo algorithm to simulate the shaking of granular spheres at various amplitudes. Several spontaneous crystallizing transitions are typically observed, leading to end states which can be fully or partially ordered, depending on the shaking amplitude, which we investigate using metrics of global and local orders. The crystallization is incomplete at low amplitudes, at least for our times of observation. For amplitude ranges where crystallization is complete, there is typically a competition between hexagonal close packed (hcp) and face-centered cubic (fcc) ordering. It is seen that fcc ordering typically predominates. We perform the Delaunay tessellations of granular packings at various packing densities. The volumes of Delaunay simplices follow a gamma distribution; the volume fluctuations and entropy have shown drastic change at packing densities 0.62, 0.64 and 0.68.

Human eye movements involve in semantic search subjected to visual and aural inputs in a cognitive task. The probability distributions of saccades and fixations are obtained and analyzed. Scale-invariance is observed in the saccadic distributions, while the fixation distributions reveal the presence of a characteristic time scale for literate participants. A detailed analysis of Euclidean distance time series suggests that saccadic eye motions are an example of Levy, rather than Brownian, dynamics. We calculate the log-likelihood and Akaike weights to select the best fitting model for the saccade times. Power-law distribution has higher log-likelihood and Akaike weights against other probability models. We perform simulation of two-dimensional Levy random walks. The results of this model suggest the superdiffusive dynamics of Levy walker, which further find analogous to that of saccadic motion.