Condensed Matter & Biophysics Seminar

Graduate Student Talks

THURSDAY

APRIL 7

4:00 P.M.

RM 184 NSH

Imaging the Electronic States of a Two-Dimensional Assembled Quasicrystal, Laura Collins

The behavior of electrons in a periodic lattice is well understood, but how do electrons move in quasicrystals, which are ordered but aperiodic? We used scanning tunneling microscopy and atomic manipulation to assemble a quasicrystal based on the Penrose tiling and we carried out scanning tunneling spectroscopy to study its electronic properties. We measured the differential conductance maps to visualize the electronic density of states of the assembled quasicrystal. The statistical analysis of these maps has been used to characterize the electronic behavior.

Low energy electron-induced fragmentation of peptide model molecules, Zhou Li

The dissociative electron attachment (DEA) to analogues of peptides/proteins, i.e., compounds containing a peptide bond or carboxyl and amino groups are crucial for development of understanding of DEA to larger cellular biocomplexes, thus are valuable in many fields, specifically radiation therapy research and biochemical modeling. In this project, we have used our recently constructed experimental set-up to measure the anion yields resulting from DEA to formamide, N-methylformamide, and dimethylformamide, simplest molecules containing a peptide linkage. DEA to these molecules produces several anionic fragments, which were confirmed by isotopic studies. Moreover, our results suggest that peptide bond (O=C-N-H) cleavage was one of dissociation channel, requiring higher energies (> 5 eV) to occur. In addition, our experimental data was supported by theoretical calculations of DEA resonances.

Order-to-chaos transition in the hardness of random Boolean satisfiability problems, Melinda Varga

Transient chaos is a phenomenon characterizing the dynamics of phase space trajectories evolving towards an attractor in physical systems. We showed that transient chaos also appears in the dynamics of certain algorithms searching for solutions of constraint satisfaction problems (e.g., Sudoku). I will present a study of the emergence of hardness in Boolean satisfiability (k-SAT) using an analog deterministic algorithm. I will show that when increasing the density of constraints, hardness appears through a second-order phase transition similar to the one in the Ising model and that this transition is generated by the appearance of non-solution basins in the solution space.