



Theory Colloquium

Prof. Dr. Tanja Schilling, Université du Luxembourg

“Pacman and Chess as Physics Problems”

In the first part of the talk, we discuss chemotaxis in a porous medium using as a model a biased (“hungry”) random walk on a percolating cluster. Incidentally, the model closely resembles the 1980s arcade game Pac-Man. We observe that, on the percolating cluster, the hungry random walker’s mean-squared displacement shows anomalous dynamics that follow a power law with a dynamical exponent different from both that of a selfavoiding random walk as well as that of an unbiased random walk. The change in dynamics with the propensity to move towards food is well described by a dynamical exponent that depends continuously on this propensity.

In the second part we apply a similar, physics-based approach to a more complex game, the game of chess. The complexity of a game is usually estimated in terms of the size of its state space (i.e. the number of possible configurations) and the size of its game tree (i.e. the number of distinct possible games). For chess these have been estimated to be on the order of 10^{42} resp 10^{120} . A chess player’s experience however, shows that many possible configurations never occur in real play. The connectivity of state-space seems to matter significantly for the complexity. Using transition path sampling we show that the state space of chess consists of ca. 10^{20} pockets that are only weakly connected. The pockets are distinguished mainly by their pawn structure. Real games take place only in a few of these pockets. That chess is still highly complex can be attributed to the fact that 10^{22} – although considerably smaller than the entire set of states – still a very large number.

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SR 1 | ICT building