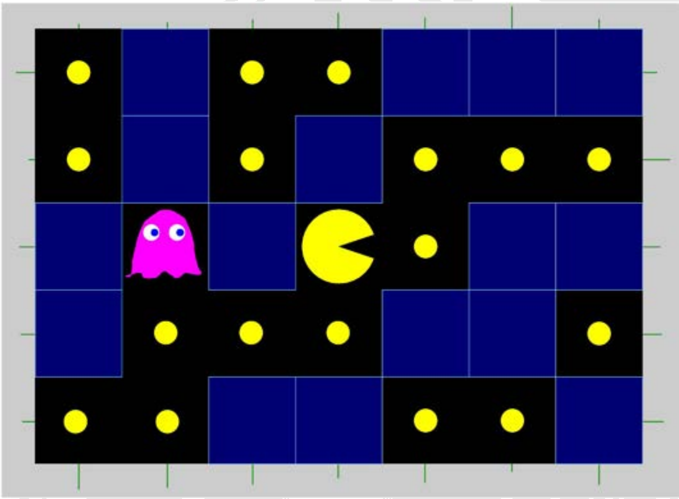
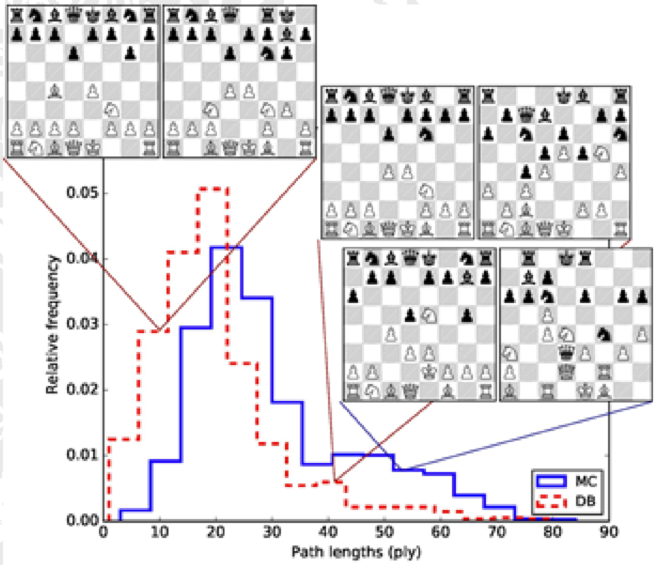
PHYSIKALISCHES KOLLOQUIUM

ANTRITTSVORLESUNG

AM 22. MAI 2017 UM 17 UHR C.T.

IM HÖRSAAL I, PHYSIKHOCHHAUS





PLAYFUL PHYSICS

PROF. DR. TANJA SCHILLING

PHYSIKALISCHES INSTITUT, UNIVERSITÄT FREIBURG

This colloquium introduces the research group for "Statistical Physics of Soft Matter and Complex Systems" (Soφt), which has recently joined the Institute of Physics. We will give an overview over our current research activities[1] and then focus on two recent projects[2]:

Chemotactic motion is the motion of living organisms in response to chemical signals as e.g. motion of bacteria towards sources of food. 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 the1980s 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 self-avoiding 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.

After the colloquium there will be a party in the common room. All colloquium guests are cordially invited to join the party and get to know the new research group.

1 Which are mostly serious
2 Which are slightly less so