ICTS | INTERNATIONAL CENTRE for THEORETICAL SCIENCES

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS Statistical Physics Journal Club Seminar

Title : Chase-Escape Percolation on the Square Lattice

Speaker : Deepak Dhar (Indian Institute of Science Education and Research, Pune)

Date : Wednesday, 16th December 2020

Time : 03:00 pm (IST)

Abstract : Chase-escape percolation is a variation of the standard epidemic spread models. In this model, each site can be in one of three states: unoccupied, occupied by a single prey, or occupied by a single predator. Prey particles spread to neighbouring empty sites at rate p, and predator particles spread only to neighbouring sites occupied by prey particles at rate 1, killing the prey particle that existed at that site. It is found that the prey can survive with non-zero probability, if $p>p_c$ with $p_c<1 $. Earlier simulations showed that $ p_c$ is very close to $1/2$. Using Monte Carlo simulations, we estimate the value of p_c to be 0.49453 ± 0.00003 and the critical exponents are consistent with the $2D$ undirected percolation universality class. We further show that for all $p < p_c$ on a $D-$dimensional hypercubical lattice, the probability that the number of predators in the absorbing configuration is greater than s is bounded from below by $ \exp(-K p^{-1} s^{1/D)$, where K is some p-independent constant, in contrast to the exponentially decaying cluster size distribution of the isotropic percolation problem. Even so, the scaling function for the cluster size distribution for p near p_c decays exponentially, and the stretched exponential behavior dominates for $ s \gg s^*$, and s^* diverges near p_c. We also study the problem starting from an initial condition with predator particles on all lattice points of the line $y=0$ and prey particles on the line $y=1$. In this case, for $p_c<p < 1$, the center of mass of the fluctuating prey and predator fronts travel at the same speed. We find that the speed of the pinned Chase-Escape front is strictly smaller than the speed of the Eden front when its spreading rate is equal to p and show that it is caused by the prey sites at the leading edge being eaten up by the predator. The fluctuations seem to follow KPZ scaling across the depinning transition.

Venue : Please click on the below link to join the seminar

https://zoom.us/j/92952046040?pwd=enpMYm84MEhpWE9wd3pZZU95eGtlZz09
Meeting ID: 929 5204 6040
Passcode: 859958