**Dr. S. Molchanov (UNC Charlotte, USA)**

 Mini- course “Mathematical models in population dynamics”

 1) The goal of the population dynamics theory is to describe the evolution of the particle field $N\left(t,y\right)=⋕(particles at the moment t\geq 0 in the site y\in Z^{d}$ ). We assume that for $t=0 N(0,y)$ be the sequence of i.i.d.r.v., say, $N\left(0,y\right)=n\_{0}, (n\_{0}=1,2,…)$. The evolution of the system includes the migration of the particles given by underlying random walk, the birth and death processes, the immigration of the particles from outside and (in the more difficult models) the interaction between particles (say, the competition effect on the death rate if the density of the population is high).

The central problem of this theory is the study of the ergodic models, which demonstrate the convergence to statistical equilibrium (steady state) and the analysis of stability (or instability) of this.

 The lectures will be based on the recent results in the area. I’ll give the students the Lecture Notes (using the part of the recent book: S. Molchanov, J. Whitmeyer, “Markov models in the social sciences”, AMS (2017)).

2) The course will contain 10-12 lectures (in Russian or English). The preliminary program:

1) Random walk on $Z^{d}$ with continuous time. Central limit theorem and the large deviations.

2) Random walks on $Z\_{+}^{1}$. Ergodicity, recurrence, etc.

3) Non - spatial Galton-Watson problem. Classification of the branching processes.

4) Non - spatial Galton – Watson with immigration. Ergodicity and Stability.

5) Bolker – Pakala model in the mean field approximation and its expansions.

6) Non - spatial immigration and Bolker-Pakala models in random environment.

7)-9) Convergence to the steady state in the spatial contact model in the critical regime.

10) Instability of the contact model on the small random perturbation.

11) Branching random walk with immigration, convergence to the steady state and its

 stability.

12) Similar problem for Bolker –Pakala spatial model.