098418 PROBABILITY AND STOCHASTIC PROCESSES

Large Scale Dynamics of Interacting Particles

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Time	Thursday 9:30 - 12:30
Place	Room 527 IE

The field of interacting particle systems has its roots in statistical mechanics and biology. The fundamental issue is to develop a rigorous theory explaining how chaotic random motion of very many (microscopic) particles leads to a deterministic evolution of large scale (macroscopic) quantities, such as mass density.

For the most of the course we shall be concerned with systems of particles which live on vertices of the integer lattice $\mathbb{Z}^d$. Accordingly, the stochastic evolution will be described in terms of continuous time Markov chains.

Principal references for the main body of the course are lecture notes [6, 1] and monographs [2, 5]. First several weeks, however, will be devoted to a preliminary material including:

(1) Stochastic calculus of continuous time Markov chains [4].
(2) Elements of interacting particle systems [3].

I shall assume some elementary knowledge of Probability theory, specifically basic fact about martingales, weak convergence and limit theorems.

Grading policy: Take home assignment - either an exam problem or reading a paper related to the course material.

REFERENCES

[1] L. Jensen, H-T. Yau, *Hydrodynamical scaling limits of simple exclusion models*, Probability theory and applications (Princeton, NJ, 1996), 167–225, IAS/Park City Math. Ser. **6**, Amer. Math. Soc., Providence, RI (1999).
[2] C. Kipnis, C. Landim, *Scaling limits of interacting particle systems*, Springer (1999).
[3] T. Liggett, *Interacting Particle Systems*, Chpt. 1,2,8, Springer (1985).
[4] L.C.G. Rogers, D. Williams, *Diffusions, Markov Processes and Martingales*, Vol II, Chtp. 3, Cambridge Univ. Press (2000).
[5] H. Spohn, *large Scale Dynamics of Interacting Particles*, Springer (1991).
[6] S.R.S. Varadhan, *Lectures on hydrodynamic scaling*, Hydrodynamic limits and related topics (Toronto, ON, 1998), 3–40, Fields Inst. Commun. **2**, Amer. Math. Soc., Providence, RI (2000).