Transitions between dynamics of infinite particle systems associated with universal random point fields related to random matrices

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Laguerre ensembles are a class of random point fields with finite particles on $[0, \infty)$ interacted by the logarithmic potential, which appear as eigenvalue distributions of certain non-negative definite random matrices with symmetry. A macroscopic scale limit for this ensembles as the number of particle to infinity is the Marchenko-Pastur distribution. There are three microscopic scale limits according to positions on the Marchenko-Pastur distribution where we focus on, that is, bulk, soft-edge and hard-edge scaling limit. Bulk, soft-edge and hard-edge scaling limit yield sine, Airy and Bessel random point field respectively, and the limit infinite particle systems have universality in long-range interacting systems. In fact, these random point fields are obtained as scaling limits of eigenvalues for quite general class of random matrices or log-gases with quite general class of free potential.

Furthermore transition relations between these universal random point fields are known. For example, consider a suitable scaling of the Airy random point field, then the scaled Airy random point field converges to the sine random point field as the scaling parameter to infinity. Similarly both the sine and the Airy random point field are obtained as suitable scaling limits of the Bessel random point field respectively.

We focus on a dynamical version of the transitions in this talk. Equilibrium dynamics associated with the sine, Airy and Bessel random point fields are constructed through Dirihclet form theory, and infinite dimensional stochastic differential equation representation are also known. We show that the transitions between universal random point fields derives the transitions between corresponding dynamics.

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