Determinantal Interacting Particle Systems

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Eigenvalue distributions of random matrices provide typical examples of *determinantal (fermion) point processes* on a line (*e.g.*, the Gaussian unitary ensemble) or on a plane (*e.g.*, the Ginibre ensemble). Corresponding to that Dyson introduced models of interacting Brownian motions as dynamical extensions of random matrix ensembles, the notion of determinantal point processes has been dynamically extended; for a set of observables, if all spatio-temporal correlation functions are given by determinants specified by a single integral kernel (the correlation kernel), then the process is said to be *determinantal* [1].

Recently a sufficient condition for determinantal processes was proved by using probability theory concerning harmonic transforms, martingales, and conformal invariance of the complex Brownian motion [2].

In the present talk, I show a variety of examples satisfying the condition, that is, the interacting particle systems having the *determinantal martingale representations (DMR)*. There some systems related with the Chern–Simons theory and with the Kardar–Parisi–Zhang (KPZ) equation are discussed. The solvability of determinantal interacting particle systems is characterized by the *entire function* which defines the conformal transform of a complex Brownian motion and determines the DMR.

[1] M. Katori : *Bessel Processes, Schramm–Loewner Evolution, and the Dyson Model*, Springer Briefs in Mathematical Physics, Vol.11, Springer (2016).

[2] M. Katori : Determinantal martingales and noncolliding diffusion processes, Stochastic Process. Appl. **124** (2014) 3724-3768.