

# On uniqueness of solutions of SDEs related to infinite particle systems with jumps

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In this talk we study an infinite particle system with interaction in which each particle is undergoing the jump type process on  $\mathbb{R}^d$  with rate function  $p_x(y) = p(|x - y|)$  from  $x$  to  $y$  satisfying conditions (p.1)–(p.2):

(p.1)  $p(r) = O(r^{-(d+\alpha)})$  as  $r \rightarrow \infty$  for some  $\alpha > 0$ .

(p.2)  $p(r) = O(r^{-(d+\beta)})$  as  $r \rightarrow +0$  for some  $0 < \beta < 2$ .

We consider the case the system is represented by a Markov process on the configuration space  $\mathfrak{M} = \{\xi = \sum_i \delta_{x_i}; \xi(K) < \infty \text{ for all compact sets } K \subset \mathbb{R}^d\}$ , where

$\delta_a$  stands for the delta measure at  $a$ , and the process has a reversible measure  $\mu$  with the first order correlation function  $\rho^1(\cdot)$  and the reduced Palm measure  $\mu_x$ .

Under appropriate conditions on the measure  $\mu$ , such a Markov process can be constructed by Dirichlet form technique [1]. Moreover, by generalizing the method in [2], it can be proved that the labeled process  $(X_j(t))_{j \in \mathbb{N}}$  solves the following ISDE:

$$X_j(t) = X_j(0) + \int_0^t \int_{\mathbb{R}^d} \int_0^\infty u a \left( u, r, X_j(s-), \sum_{i \neq j} \delta_{X_i(s-)} \right) N_j(ds dudr), \quad (\text{I})$$

where  $a(u, r, \xi, x) = \mathbf{1}(r \leq c(\xi, x; x + u))$ , and  $N_j$ ,  $j \in \mathbb{N}$  are independent Poisson random point fields on  $[0, \infty) \times \mathbb{R}^d \times \mathbb{R}^d$  whose intensity measure is the Lebesgue measure  $ds dudr$ . Here,  $c$  is the jump rate from  $x$  to  $y$  in the environment  $\xi$  :

$$c(\xi, x; y) = p(|x - y|) \left( 1 + \frac{d\mu_y(\xi)}{d\mu_x(\xi)} \frac{\rho^1(y)}{\rho^1(x)} \right).$$

The main purpose of this talk is to discuss the uniqueness of solutions of ISDE (I) by applying the argument in [3], where systems of interacting Brownian motions are studied. This is a part of collaborations with Syota Esaki (Kyushu University).

## References

- [1] Esaki, S., Infinite particle systems of long range jumps with long range interactions. to appear in Tohoku Journal of mathematics arXiv:1508.06795 [math.PR].
- [2] Osada, H., Infinite-dimensional stochastic differential equations related to random matrices. Probab. Theory Related Fields **153** (2012), 471–509.
- [3] Osada, H. and Tanemura, H., Infinite dimensional stochastic differential equations and tail  $\sigma$ -fields, (preprint) arXiv:1412.8674 [math.PR].