Branching random walks in random environment and stochastic heat equation.

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Super-Brownian motion is a measure-valued process which appears as the scaling limit of critical branching process with spatial motion. It is known that one-dimensional super-Brownian motion $\{X_t(\cdot) : t \geq 0\}$ is absolutely continuous with respect to Lebesgue measure for any $t > 0$ a.s. and its density $\{X_t(x) : (t, x) \in (0, \infty) \times \mathbb{R}\}$ is the unique nonnegative solution to the stochastic heat equation:

$$\begin{aligned} &\frac{\partial}{\partial t} X_t(x) = \frac{1}{2} \Delta X_t(x) + \sqrt{\gamma X_t(x)} \dot{W}(t, x), \\ &\lim_{t \to 0} X_t(x) dx = X_0(dx), \end{aligned}$$

where $\gamma > 0$ and W is time-space white noise.

In this talk, we consider the scaling limit of a "critical" branching system in time-space random environment and its characterization by using stochastic heat equation.