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Ergodicity for an infinite particle system in $\boldsymbol{R}^d$ of jump type with hard core interaction

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§ 0. Introduction.

In this paper, we consider a system of infinitely many hard balls with the same diameter r moving discontinuously in $\boldsymbol{R}^d$. We denote the configuration space of hard balls by $\mathscr{X}$:

$$\mathscr{X}=\{\xi=\{x_i\}:\ |x_i-x_j|\geqq r,\ i\neq j\}, \tag{1}$$

the position of a ball being represented by its center.

The ball of the system moves by random jump under the hard core condition. The system is completely specified by the measure $c(x, dy, \xi)$ which gives the rate of the movement of the ball at the position x to the position y when the entire configuration is ξ. We shall consider the case where $c(x, dy, \xi)$ is given by

$$c(x, dy, \xi)=\exp\{-\sum_{z\in\xi\setminus\{x\}}\Phi(|y-z|)\}p(|x-y|)dy,$$

where $p(\cdot)$ is a non-negative function on $[0, \infty)$ such that $\int_{\boldsymbol{R}^d}p(|x|)dx=1$ and $p(\cdot)>0$ on $[0, 2h)$ for some $h>0$ and Φ is a measurable function on $[0, \infty)$ satisfying the following properties:

(Φ.1) $\quad \Phi(\cdot)\geqq -C$ for some constant $C\geqq 0$;

(Φ.2) $\quad \Phi(a)=\infty$ if and only if $a\in[0, r)$;

(Φ.3) $\quad \Phi(\cdot)=0$ on $[\hat{r}, \infty)$ for some constant $\hat{r}\geqq r$.

Φ is regarded as a hard pair potential which is rotation invariant, stable and of finite range.

In the previous paper [8] we studied the case where $r=\hat{r}$.

We construct the Markov process ξ_t which describes our system. This process has the Gibbs state μ associated with the potential Φ as a reversible measure.

The purpose of this paper is to show the ergodicity of the stationary Markov