Imed Bachar

On exit laws for semigroups in weak duality

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Abstract: Let $\mathbb{P} := (P_t)_{t>0}$ be a measurable semigroup and m a σ-finite positive measure on a Lusin space X. An m-exit law for $\mathbb{P}$ is a family $(f_t)_{t>0}$ of nonnegative measurable functions on X which are finite m-a.e. and satisfy for each $s, t > 0$ $P_s f_t = f_{s+t}$ m-a.e. An excessive function u is said to be in $\mathcal{R}$ if there exits an m-exit law $(f_t)_{t>0}$ for $\mathbb{P}$ such that $u = \int_0^\infty f_t dt$, m-a.e.
Let $\mathcal{P}$ be the cone of m-purely excessive functions with respect to $\mathbb{P}$ and $\mathcal{I}mV$ be the cone of m-potential functions. It is clear that $\mathcal{I}mV \subseteq \mathcal{R} \subseteq \mathcal{P}$. In this paper we are interested in the converse inclusion. We extend some results already obtained under the assumption of the existence of a reference measure. Also, we give an integral representation of the mutual energy function.

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