Authors’ abstract: Consider a system of particles performing branching Brownian motion with negative drift $\mu = \sqrt{2 - \varepsilon}$ and killed upon hitting zero. Initially there is one particle at $x > 0$. H. Kesten [Stochastic Processes Appl. 7, 9–47 (1978; Zbl 0383.60077)] showed that the process survives with positive probability if and only if $\varepsilon > 0$. Here we are interested in the asymptotics as $\varepsilon \to 0$ of the survival probability $Q_\mu(x)$. It is proved that if $L = \pi/\sqrt{\varepsilon}$ then for all $x \in \mathbb{R}$, $\lim_{\varepsilon \to 0} Q_\mu(L + x) = \theta(x) \in (0,1)$ exists and is a traveling wave solution of the Fisher-KPP equation. Furthermore, we obtain sharp asymptotics of the survival probability when $x < L$ and $L - x \to \infty$. The proofs rely on probabilistic methods developed by the authors in “The genealogy of branching Brownian motion with absorption”, arxiv:1001.2337 (2010)]. This completes earlier work by J. W. Harris, S. C. Harris and A. E. Kyprianou [Ann. Inst. Henri Poincaré, Probab. Stat. 42, No. 1, 125–145 (2006; Zbl 1093.60059)] and confirms predictions made by B. Derrida and D. Simon [Europhys. Lett. 78, Article ID 60006, 6 p. (2007; Zbl 1244.82071)], which were obtained using nonrigorous PDE methods.

Reviewer: Victor V. Goryainov (Volzhsky)

MSC:
60J80 Branching processes (Galton-Watson, birth-and-death, etc.)
60K35 Interacting random processes; statistical mechanics type models; percolation theory

Keywords:
branching Brownian motion; survival probability; extinction probability

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References:


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