The spatial critical points not moving along the heat flow

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Abstract

We consider solutions of the heat equation, in domains in R^N, and their spatial critical points. In particular, we show that a solution u has a spatial critical point not moving along the heat flow if and only if u satisfies some balance law. Furthermore, in the case of Dirichlet, Neumann, and Robin homogeneous initial-boundary value problems on bounded domains, we prove that if the origin is a spatial critical point never moving for sufficiently many compactly supported initial data satisfying the balance law with respect to the origin, then the domain must be a ball centered at the origin.