

Minimally invasive surgery for Ricci flow singularities

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If a solution $(M, g(t))$ of Ricci flow develops a local singularity at a finite time T , then there is a proper subset S of M on which the curvature becomes infinite as time approaches T . Existing approaches to Ricci-flow-with-surgery, due to Hamilton and Perelman, require one to modify the solution in a small neighborhood of S by gluing in a highly curved but nonetheless nonsingular solution. This must be done with careful regard to the surgery parameters in order to preserve critical a priori estimates. In case the local singularity is a rotationally-symmetric neckpinch (in any dimension $n > 2$), we show that it is possible to restart Ricci flow (modified by diffeomorphisms) directly from the singular limit $g(T)$, without performing an intervening surgery or requiring ad hoc choices. The solution we obtain in this manner is, up to diffeomorphism, the unique rotationally-symmetric forward evolution of $g(T)$ by Ricci flow, and we describe its asymptotics as it emerges from the singularity. (This is joint work with Sigurd Angenent and Cristina Caputo.)