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Ricci flow problems arising in and from physics

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Abstract

Given the recent interest in the Ricci flow equation, it is inevitable that physicists would seek applications to that subject. Indeed, the first known occurrence of the Ricci flow was in Friedan's 1980 Physics PhD thesis.

I will briefly describe Friedan's application, which leads to a conjecture concerning the behaviour of mass under Ricci flow, first confirmed by the discovery by physicists of a 2-dimensional Ricci soliton exhibiting the conjectured behaviour. This soliton exhibited constant mass at all finite time and convergence to zero mass (flat space) in the limit.

In higher dimensions, mass constancy is easy to confirm in general, but convergence is not. Oliynyk and I studied the question under the assumption of rotational symmetry. We find convergence to flat space.

Time permitting, I will discuss steps taken toward the study of similar problems for static and stationary metrics in general relativity, which unlike arbitrary metrics of Lorentzian signature, have a well-posed Ricci flow IVP.