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Blowup solutions of Jang's equation near a spacetime singularity

Jang's equation is a semilinear elliptic equation defined on an initial data set. It was shown by Schoen and Yau that the (non)existence of global solutions is closely related to the presence of apparent horizons, which are quasi-local analogues of black hole boundaries. As a result, Jang's equation can be used to prove the existence of apparent horizons by imposing appropriate geometric conditions on the initial data set. These proofs proceed by contradiction: one assumes there is a global solution, then proves that its existence is not compatible with the given geometric assumptions.

In this talk I will outline a constructive approach to proving the existence of apparent horizons. In particular, I will consider a distinguished family of spacelike hypersurfaces in the maximally extended Schwarzschild spacetime, and prove that Jang's equation admits no global solutions once the hypersurfaces become sufficiently close to the r=0 singularity. This suggests a general strategy for relating spacetime singularities to apparent horizons. This is joint work with Amir Aazami.