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# On the Penrose Conjecture for Arbitrary Slices of a Spacetime

*Tuesday 8 April 2008 11:30 (1 hour)*

The proofs of the Riemannian Penrose Conjecture by Huisken-Ilmanen in 1997 (for one black hole) and by the speaker in 1999 (for any number of black holes) describe the geometric relationships between the total mass of a slice of a spacetime and the size and number of black holes in the slice, in the special case that the slice has zero second fundamental form in the spacetime. However, Penrose's original 1973 conjecture concerns any asymptotically flat, space-like slice of a spacetime and, consequently, is still open in its most general form. In this talk, the speaker will describe a joint effort with Marcus Khuri to reduce the general case of the Penrose Conjecture to the known case using a generalization of Jang's equation (used to prove the general case of the positive mass theorem) and a new geometric identity, which we are calling the generalized Schoen-Yau identity, which is designed to recognize arbitrary space-like slices of static spacetimes (like the Schwarzschild spacetime, which is the case of equality of the Penrose Conjecture), and hence is ideally suited for our purposes. We will then discuss three different systems of p.d.e.s whose solutions, when they exist, imply the Penrose Conjecture.

**Presenter:** BRAY, Hubert (Duke)