Geometric Inequalities for Axially Symmetric Initial Data

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The current model of gravitational collapse asserts that a series of inequalities may hold, between physical quantities such as mass, angular momentum, and charge of the initial data set for the Einstein-Maxwell equations. A major breakthrough in the study of these geometric inequalities was made by Dain et al. [1], proving the mass-angular momentum inequality for a large class of 3 dimensional, axially symmetric, maximal initial data for the Einstein equations. Recently, Alaee, Khuri, Kunduri showed that the analogous inequalities hold for 4 dimensional, bi-axisymmetric, maximal initial data [2]. In this talk, I will present the recent progress to extend these results for near maximal initial data [3-4], and discuss the remaining open problems in this topic.

References

[1] S. Dain, Proof of the angular momentum-mass inequality for axisymmetric black hole, *J. Differential Geom.* **79** (2008), pp.33–67.

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[3] Y.-S. Cha, and M. Khuri, Deformations of charged axially symmetric initial data and the mass-angular momentum-charge inequality, *Ann. Henri Poincare* **16** (2015), pp. 2881–2918.

[4] Y.-S. Cha, On Geometric Inequalities for Near Maximal Axially Symmetric Initial Data (Work in Progress)