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Geometric Inequalities for Quasi-Local Masses

We will describe lower bounds for quasi-local masses in terms of charge, angular momentum, and horizon area. In particular we treat three quasi-local masses based on a Hamiltonian approach, namely the Brown-York, Liu-Yau, and Wang-Yau masses. The geometric inequalities are motivated by analogous results for the ADM mass. They may be interpreted as localized versions of these inequalities, and are also closely tied to the conjectured Bekenstein bounds for entropy of macroscopic bodies. In addition, we give a new proof of the positivity property for the Wang-Yau mass which is used to remove the spin condition in higher dimensions. Furthermore, we generalize a recent result of Lu and Miao to obtain a localized version of the Penrose inequality for the static Wang-Yau mass. This is joint work with A. Alaee and S.-T. Yau.