

JOINT TUFTS/MIT COSMOLOGY SEMINAR

A semiclassical singularity theorem

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The original singularity theorems of Penrose and Hawking were proved for matter obeying the Null Energy Condition or Strong Energy Condition respectively. However, some classical and all quantum fields violate these pointwise energy conditions. Therefore there is a need to develop theorems with weaker restrictions; namely energy conditions averaged over an entire geodesic, and quantum energy inequalities (QEIs) which are weighted local averages of energy densities. Various authors have proved versions of these results under weakened hypotheses, by considering the Riccati inequality obtained from Raychaudhuri's equation. Here, I will give an alternative derivation that avoids the Raychaudhuri equation and instead makes use of index form methods. I will discuss how our results improve over existing methods and how they can be applied to hypotheses inspired by QEIs. In the timelike case I will present such a QEI bound and use it as a hypothesis for a semiclassical singularity theorem. Finally, I will present estimates of the initial contraction required for a Cauchy surface in order to guarantee future timelike geodesic incompleteness and discuss compatibility with cosmological data. Based on ArXiv 1907.13604 and a manuscript in preparation.

Tuesday, October 22, 2019, 2:30 pm
574 Boston Ave, Room 316
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Refreshments at 2:00 outside room 304