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A Brief Remark on Energy Conditions and the Geroch-Jang Theorem

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The status of the geodesic principle in General Relativity has been a topic of some interest in the recent literature on the foundations of spacetime theories. Part of this discussion has focused on the role that a certain energy condition plays in the proof of a theorem due to Bob Geroch and Pong-Soo Jang ["Motion of a Body in General Relativity." Journal of Mathematical Physics 16(1), (1975)] that can be taken to make precise the claim that the geodesic principle is a theorem, rather than a postulate, of General Relativity. In this brief note, I show, by explicit counterexample, that not only is a weaker energy condition than the one Geroch and Jang state insufficient to prove the theorem, but in fact a condition still stronger than the one that they assume is necessary.

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