Contributed Talk

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Title: Linking: causality and black holes; and cosmic censorship of smooth structures

Abstract: Two events in a spacetime are called causally related if the information can get from one event point to the other. In the joint works with Stefan Nemirovski we established that Legendrian linking of the spheres of light rays passing through the two points completely determines causality for spacetimes of dimensions greater or equal than 4. For the spaces times of dimension 3 causal structure is completely determined by topological linking. These results settle the conjectures of Robert Low and of Jose Natario and Paul Todd. They also give an answer to the problem on the Vladimir Arnold problem list communicated by Roger Penrose. We will discuss these results and some ideas about how to apply the link theory to the study of black holes. If time permits we will explain why exotic smooth structures are likely not useful in general relativity, since the natural physical assumption impose strong censorship (similar in spirit to the one of Penrose's cosmic censorship conjecture) on the class of possible smooth structures on a spacetime. The resulting smooth structure is unique and natural.