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## (I) Faster-Than-Light Travel and Time Travel: Science or Science Fiction?

*Tuesday, June 7, 2022 11:15 AM (30 minutes)*

Time and causality are two of the most fundamental concepts in physics, and yet they remain ill-understood. In my research I use general relativity and quantum mechanics, two cornerstone theories of physics with great theoretical and experimental success, to investigate one of the most exciting and thought-provoking questions about time and causality: whether causality can be violated.

The two most commonly known manifestations of causality violation are faster-than-light (FTL) travel and time travel. In time travel, the traveler directly violates causality by traveling to their own past. In FTL travel, the traveler merely travels so fast that they can causally influence events they could not have otherwise - but as it turns out, FTL travel can often be used to facilitate time travel.

Can these concepts be transformed from science fiction into real science, even just in principle? The answer to this question is currently unknown, and this indicates a major deficiency in our understanding of the universe. A positive answer would revolutionize physics and require substantial rewriting of our existing theories. A negative answer would provide valuable insights into the inner workings of our theories, by figuring out the mechanisms by which our universe protects causality, as first conjectured by Stephen Hawking.

In this talk I will discuss the possibility of FTL travel and time travel within the established framework of general relativity and quantum mechanics, including recent progress made by myself and my students.

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