

# PHYSICS DEPARTMENT COLLOQUIUM

"A NEW KIND OF CRITICAL PHENOMENA OF BLACK HOLE  
SINGULARITIES, AND THE FATE OF THE UNIVERSE"

BY

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The two great mysteries of gravitational physics are the fate of the Universe, and the fate of an astronaut who falls into a black hole. Whereas significant progress has been made recently towards resolving the former mystery (the runaway Universe), the latter suffers from an inherent difficulty: by definition, no observations of the interior of a black hole can be made! I will use Einstein's general relativity to argue that the two seemingly unrelated mysteries are intimately linked. In particular, the question of whether black holes can be used as portals for hyperspace travel (allowing particles – and astronauts - to reemerge from a black hole into a remote part of the Universe, or even another Universe) depends on the cosmological parameters, and in particular on the nature of dark energy. I will also argue that the quantum gravity description of the singularity inside the black hole is perhaps not as crucial for this question, and that emergent classical phenomena might be sufficient to determine the fate of an astronaut embarking on this singular odyssey.

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