Principal Null Directions and Symmetries of Black Holes in Dynamical Chern-Simons Gravity[1] CAROLINE OWEN, NICOLS YUNES, University of Illinois at Urbana-Champaign — The gravitational waves emitted when a small compact object falls into a supermassive black hole depend sensitively on the orbital trajectory of the small object, which in turn depends on the properties of the spacetime generated by the supermassive black hole. The ability to test general relativity in this extreme gravity regime using gravitational waves motivates the mathematical study of the symmetries of black holes in modified theories of gravity. While the Kerr metric for a spinning black hole in general relativity possesses two distinct principal null directions, the still unknown analogous exact solution in dynamical Chern Simons gravity is thought to possess four. In this talk, I will present all principal null directions of such modified black holes in the slow rotation approximation. These directions will then allow us to write the metric in Kerr-Schild coordinates, discuss its Carter type, and investigate the existence of a new Killing tensor that would generate a fourth constant of the motion.

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