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Black Hole Superradiance FRANS PRETORIUS, Princeton University, WILLIAM EAST, Kavli Institute for Particle Astrophysics and Cosmology, FETHI RAMAZANOGLU, Princeton University — I will present results from a numerical study of the superradiant scattering of gravitational waves by a nearly extremal black hole. The full vacuum Einstein equations are solved, thus allowing us to study the back-reaction of the interaction on the black hole, and confirming that the amplification of the wave is balanced by energy and angular momentum loss of the black hole. To explore the nonlinear phase of the interaction we consider gravitational wave packets with initial energies up to 10 percent that of the mass of the black hole. We find that as the incident wave energy increases, the amplification of the scattered waves, as well as the energy extraction efficiency from the black hole, is reduced. During the interaction the apparent horizon geometry undergoes sizable non-axisymmetric oscillations. The largest amplitude excitations occur when the peak frequency of the incident wave packet is above where superradiance occurs, but close to the dominant quasi-normal mode frequency of the black hole.

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