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**A study of non-linear effect in the ringdown of black holes in binary collisions** MANUEL TIGLIO, University of Maryland, DAVID BRIZUELA, University of Jena, FRANK HERRMANN, University of Maryland, JOSE MARIA MARTIN-GARCIA, Univ. Paris Diderot, Univ. Pierre et Marie Curie, ENRIQUE PAZOS, University of Maryland — A complete gauge invariant formalism for arbitrary second order perturbations of Schwarzschild black holes will be presented. We will then discuss numerical simulations using that formalism to study non-linear effects in the ringdown of Schwarzschild black holes due to mode-mode coupling and the dependence of these effects on the type and shape of initial perturbation. Finally we will compare results with numerical simulations of colliding binary black holes in their late stage (ringdown) phase.

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