Abstract Submitted
for the APR12 Meeting of
The American Physical Society

Tendex and Vortex Lines of Perturbed Schwarzschild and Kerr Black Holes DAVID NICHOLS, California Institute of Technology, JEANDREW BRINK, National Institute of Theoretical Physics, YANBEI CHEN, JEFFREY KAPLAN, California Institute of Technology, GEOFFREY LOVELACE, Cornell University, KEITH MATTHEWS, California Institute of Technology, ROBERT OWEN, Cornell University, MARK SCHEEL, KIP THORNE, FAN ZHANG, AARON ZIMMERMAN, California Institute of Technology — As part of a program to use tendex and vortex lines to visualize binary-black-hole spacetimes and to provide simplified models of their dynamics, we focus in this talk on the late stages of binary-black-hole coalescence, when the post-merger black hole can be treated as a stationary black hole plus small gravitational perturbations. Specifically, we calculate the complete perturbative Riemann tensor of both Schwarzschild and Kerr black holes, which have been perturbed by the least-damped $l = 2$, $m = 2$ quasinormal modes of even and odd parities. From this perturbative curvature tensor, we compute its electric and magnetic parts, and then its vortex and tendex lines. We perform our analysis in an outgoing-radiation gauge, first found by Chrzanowski, which allows us to compare Schwarzschild and Kerr perturbations in similar gauges and to highlight the qualitative differences produced by the spin of the black hole. To investigate the slicing dependence of the vortex and tendex lines, we compare the results of our analytical calculations with those of the end stages of a numerical-relativity simulation. The qualitative agreement is good between these very different calculations.

David Nichols
California Institute of Technology

Date submitted: 06 Jan 2012 Electronic form version 1.4