Numerical Relativity (NR) uses advanced numerical techniques in supercomputers to simulate the relativistic, strong-field dynamics and radiation of merging compact binaries, such as black holes and neutron stars, and other similar phenomena that are governed by Einstein's theory of General Relativity (GR). Analytical relativity (AR) methods, based on Post-Newtonian expansions of the GR equations and black-hole perturbation theory, are also used to study respectively the early phases of the inspiral of compact object binaries and the resulting black-hole remnant.

The RIT's Numerical Relativity group is one of the largest and internationally renown group in the modeling and simulation of inspiral and black-hole mergers. They have made fundamental contributions, such as the moving puncture approach. You can download some of the associated movies and waveforms data here [3].

Contributors: Carlos Lousto [4], James Healy, Yosef Zlochower [5], Manuela Campanelli [4], Joshua Faber [6]

Projects and Collaborations:

- The NR has lead the field of NR throught a number of projects funded by the NASA ATPF 07-ATFP07-0158 [7], and NSF PHY-0722315 [8], PHY-0653303 [9], PHY-0714388 [10], PHY-0722703 [11], OCI-0832606 [12], PHY-0903782 [13], PHY-0969855 [14], PHY-1305730 [15].

- The group participates in the Numerical Injection Analysis NINJA Project [16] to bring the numerical relativity and data analysis communities together to pursue projects of common interest in the areas of gravitational?wave detection, astrophysics and astronomy.

- The group is part of the Einstein Toolkit Consortium [17] which actively develop and support open software for relativistic astrophysics to take advantage of emerging petascale computers and advanced cyber infrastructure. This consortium is funded by NSF PHY 0903973/0903782 [13]/0904015 (CIGR [13]), NSF PHY 0653303 (XiRel [18]).

- The CCRG numerical relativity group is collaborating with the Blue Waters Team [19] at the National Center for Supercomputing Applications (NCSA) through a series of NSF Petascale Resource Allocation (PRAC [12]) awars OCI-0832606 [12] and OCI-1516125 [20]. Blue Waters is one of the most powerful supercomputers in the world with a peak performance of 10 petaflops (10 quadrillion calculations every second). It can achieve a sustained performance of 1 petaflop running a range of science and engineering codes.

Source URL: https://ccrg.rit.edu/research/numerical-relativity

Links:
[16] https://www.ninja-project.org/
[19] http://www.ncsa.illinois.edu/BlueWaters/