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## Reduced Order Modeling in General Relativity

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Reduced Order Modeling is an emerging yet fast developing filed in gravitational wave physics. The main goals are to enable fast modeling and parameter estimation of any detected signal, along with rapid matched filtering detecting. I will focus on the first two. Some accomplishments include being able to replace, with essentially no lost of physical accuracy, the original models with surrogate ones (which are not effective ones, that is, they do not simplify the physics but go on a very different track, exploiting the particulars of the waveform family under consideration and state of the art dimensional reduction techniques) which are very fast to evaluate. For example, for EOB models they are at least around 3 orders of magnitude faster than solving the original equations, with physically equivalent results. For numerical simulations the speedup is at least 11 orders of magnitude. For parameter estimation our current numbers are about bringing ∼100 days for a single SPA inspiral binary neutron star Bayesian parameter estimation analysis to under a day. More recently, it has been shown that the full precessing problem for, say, 200 cycles, can be represented, through some new ideas, by a remarkably compact set of carefully chosen reduced basis waveforms (∼10-100, depending on the accuracy requirements). I will highlight what I personally believe are the challenges to face next in this subarea of GW physics and where efforts should be directed.

This talk will summarize work in collaboration with: Harbir Antil (GMU), Jonathan Blackman (Caltech), Priscila Canizares (IoA, Cambridge, UK), Sarah Caudill (UWM), Jonathan Gair (IoA. Cambridge. UK), Scott Field (UMD), Chad R. Galley (Caltech), Frank Herrmann (Germany), Han Hestahven (EPFL, Switzerland), Jason Kaye (Brown, Stanford & Courant). Evan Ochsner (UWM), Ricardo Nochetto (UMD), Vivien Raymond (LIGO, Caltech), Rory Smith (LIGO, Caltech) Bela Ssilagyi (Caltech) and MT (UMD & Caltech).