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Abstract for an Invited Paper
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Extreme Scale Computational Astrophysics[1]

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We live in extraordinary times. With increasingly sophisticated observatories opening up new vistas on the universe, astrophysics is becoming more complex and data-driven. The success in understanding astrophysical systems that are inherently multi-physical, nonlinear systems demands realism in our models of the phenomena. We cannot hope to advance the realism of these models to match the expected sophistication of future observations without extreme-scale computation. Just one example is the advent of gravitational wave astronomy. Detectors like LIGO are about to make the first ever detection of gravitational waves. The gravitational waves are produced during violent events such as the merger of two black holes. The detection of these waves or ripples in the fabric of spacetime is a formidable undertaking, requiring innovative engineering, powerful data analysis tools and careful theoretical modeling. I will discuss the computational and theoretical challenges ahead in our new understanding of physics and astronomy where gravity exhibits its strongest grip on our spacetime.

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