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Exploring uncharted horizons of astrophysical binary black holes

Monday, 8 July 2024 11:30 (30 minutes)

In this talk, we will explore the theoretical foundations of binary black holes and the revolutionary simulations in numerical relativity that have deepened our understanding of these objects. We will also showcase the remarkable achievements in observational astronomy made possible by gravitational wave observations, which have not only confirmed the existence of binary black holes but have also provided invaluable information about their characteristics, such as mass, spin, and environment. Additionally, we will discuss the potential for electromagnetic observations of binary black hole mergers and the insights they can offer, especially concerning gravitational wave recoils predicted by numerical relativity simulations.

Looking ahead, we will address the exciting prospects made possible by upcoming astronomical facilities, advanced gravitational wave observatories, and space missions like LISA. These advancements will enable us to penetrate further into the cosmos and uncover even more intriguing binary black hole systems. It cannot be overstated how important theoretical calculations are in bridging observational data with the underlying physics. We will delve into the challenges associated with these calculations, from the intricacies of computational methods to the complexities of understanding the physics underlying these phenomena. Furthermore, we will highlight ongoing efforts to develop modern computational tools that will enhance our understanding and improve the accuracy of binary black hole modeling, with a particular focus on simulating accreting supermassive binary black holes and their behavior and interactions.

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