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Lessons, promises, and innovations in synergistic gravitational-wave science

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The discovery of gravitational waves and their synergistic signatures has opened immense opportunities for astrophysics. Significant advancements in gravitational-wave detector technology, both on Earth and in space, along with progress in electromagnetic and neutrino observatories, have rapidly expanded our understanding of the cosmos. In this talk, I will explore how this wholistic approach has emerged, leading to deep understanding and unexpected breakthroughs. I will share cohesive narratives that highlight the lessons, promises, and innovations from gravitational-wave astrophysics. Emphasizing the scientific impact, I will discuss the results of seamlessly integrating data from gravitational-wave, neutrino, and electromagnetic observatories, including AGN environments and hierarchical mergers.

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