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WST and Gravitational Waves: Exploring the Era of Next-Generation Ground-Based Observatories

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The detection of the first gravitational-wave signal from the merger of a binary neutron star system, GW170817, together with its optical counterpart AT2017gfo, provided firm evidence that such mergers produce kilonovae and are crucial for heavy element formation in the Universe. While GW170817 demonstrated the vast potential of multi-messenger astronomy, impacting fields from relativistic astrophysics to cosmology and nuclear physics, it remains a rare event. Next-generation gravitational wave observatories, such as Einstein Telescope (ET) and Cosmic Explorer, will dramatically increase detection rates, identifying up to 10^5 binary neutron star (BNS) mergers per year and extending our observational horizon far beyond the peak of star formation. This talk will explore the revolutionary multi-messenger prospects for the next-generation observatories. Starting from the expected optical signals from the BNS merger populations, we will discuss the prospect of optical counterpart detections using wide-field optical telescopes, highlighting the unique synergy with WST.

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