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Multi-messenger Astronomy: The Benefit and Contribution of TianQin

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TianQin, a space-based gravitational wave (GW) detector scheduled for launch in the mid-2030s, promises groundbreaking insights into the Universe. Operating in the milli-Hertz band, TianQin can detect a diverse array of sources, including double white dwarfs (DWDs), massive black hole binaries (MBHBs), stellar-mass black hole binaries (SBHBs), extreme mass ratio inspirals (EMRIs), and the stochastic gravitational wave background (SGWB). In this report, we will focus on the benefit and contribution of TianQin to multi-messenger astronomy. With the help of the electromagnetism (EM)detection data from Gaia early data release 3 and Zwicky Transient Facility, we have confirmed 2/5 new potential DWDs as GW candidates for TianQin/LISA, which can be used as verification binaries for TianQin/LISA [2302.02802]. If the GW from an MBHB passes near some massive objects, such as massive galaxies, the strong lensing of the gigantic black hole on the GWs, together with the redshift of the lensing, can give strong constraints on the cosmology parameters [2304.10435]. The merger of MBHBs can result in strong EM radiation, so the near real-time data transmission and the near real-time data analysis of the GW with TianQin make the follow-up EM detections possible, and the MBHBs become a potential multi-messenger source [2309.06910]. Using the sky localization error box determined by the detected SBHB GW signals, one can weigh the galaxies and then get the redshift information of the SBHBs. Adopting the source's angular diameter distance obtained from GW and the redshift from the galaxies catalogue, one can constrain the parameters of cosmology [2110.05224]. The stripped mass from the white dwarf accreted by the central black hole produces periodic X-ray burst signals1, and these systems can be treated as some EMRIs. Thus, these events may be another type of multi-messenger source. The combined detection can provide more information on the system [2307.08231].

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