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Constraining the Properties of Kilonovae based on the Zwicky Transient Facility Searches for 13 Neutron Star Mergers PRIYADARSHINI RAJKUMAR, Texas Tech University, MICHAEL COUGHLIN, University of Minnesota, SHREYA ANAND, California Institute of Technology, SIDDHARTH MOHITE, University of Wisconsin-Milwaukee — In their third observing run (O3), LIGO and Virgo detected gravitational-wave (GW) candidates from several neutron star-black hole (NSBH) and binary neutron star (BNS) mergers. The Zwicky Transient Facility (ZTF), an optical time-domain survey telescope, followed-up thirteen of these GW events in search of kilonovae (KNe; electromagnetic counterparts to GW events). However, no KNe were found. To assess the implications on potential KN emission based on the upper limits, we determined empirical limits on the KN peak magnitude and evolution rate. In this work, we present a novel Bayesian statistical framework to derive more realistic constraints on kilonova parameters. To exclude improbable regions of the parameter space, we weight these constraints with priors informed by radiative-transport based KN models, parameterized by ejecta mass and inclination angle. Using ZTF observations of GW190425, we compare the Bayesian non-detection constraints with our previous empirical limits. Finally, we close with an application of this methodology to derive constraints on KN ejecta masses.

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