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Electromagnetic counterpart searching for gravitational wave

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During the second science run(O2) of the Laser Interferometer gravitational-wave Observatory (LIGO) and Virgo Interferometer, a gravitational-wave signal consistent with a binary neutron star coalescence(BNS) was detected on 2017 August 17th (GW170817), quickly followed by a coincident short gamma-ray burst(GRB170817a) trigger by the Fermi satellite. 10 hours later, 6 groups independently detected a coincident optical kilonovae (AT 2017GFO/sss17a/DLT17ck). The era of multi-messenger astronomy has truly begun. Two complementary approaches are used in order to search for electromagnetic(EM) counterpart of gravitational wave(GW) signal with large localization uncertainty: wide-field search on high probability GW region, e.g. Gravitational Wave Inaf Team(GRAWITA) project or pointed search of selected galaxies in high probability GW region, e.g. Distance Less Than 40 Mpc survey(DLT40) project. As one of the six groups independently detected the kilonova, DLT40 was designed as a one day cadence supernova search, which would use a Prompt 5 0.4m telescope to monitor around a sample of 2000 local galaxies including NGC4993, the host galaxy of the kilonova. Since DLT17ck is the first confirmed kilonova detected, we also reported the kilonova rate for the BNS system based on DLT17 light curve and the one year DLT40 survey log. With the expected increase in sensitivity of the LVC detectors, in LIGO O3 the volume where BNS mergers can be detected will reach 150 Mpc. At this distance, current galaxy catalogs are incomplete. The wide FoV strategies, like GRAWITA, would play more important role. From the wide FoV searching process, we found that the difficulty would be the large amount of consuming time for running pipelines and choose the best source as soon as possible during thousands of candidates. The parallel computing would increase the computing speed while the machine learning algorithm would be employed to make transient search much more efficient.

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