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Abstract:

There would be about 10 nearby (<~130 Mpc) binary neutron-star (BNS) merger events during the fourth observing run (O4) of the gravitational-wave observatory. According to the first and only known electro-magnetic counterpart of the merger GW170817, these mergers might launch relativistic structured radio jets and display single power-law spectra from radio to X-ray wavelengths. The unusual spectra result from the ultra-relativistic shock acceleration of electrons and can be used as an early sign for us to differ successful relativistic jets from choked jets. To verify the scenario from new BNS mergers during the whole O4 (2022 Dec - 2023 Dec), we propose to run rapidly VLBI observations of 3 new-found radio afterglows at Declination >~10 degree for 4 hours per source with the EVN plus e-MERLIN plus FAST at 1.25-1.5 GHz. The parcipation of the FAST could allow us to improve the image sensitivity by a factor of 3-5 and detect a radio counterpart with a flux density of >~25 uJy. The firm VLBI detection at the lowest observing frequency would allow us to localise its birth place independently, significantly improve the estimates of the radio and radio-to-X-ray spectral indices, and predict the appearance of a relativistic jet.