

# The search of higher multipole radiation in gravitational waves from compact binary coalescences by a minimally-modelled pipeline

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The coherent WaveBurst (cWB) pipeline implements a minimally-modelled search to find a coherent response in the network of gravitational wave detectors of the LIGO-Virgo Collaboration in the time-frequency domain. Here we describe an extension of the cWB analysis to detect spectral features beyond the main quadrupolar emission of gravitational waves during the inspiral phase of compact binary coalescences. The search is performed by defining specific regions in the time-frequency map to extract the energy of harmonics of main quadrupole mode in the inspiral phase. The shapes of these regions are fixed by a mild optimization of their Receiver Operating Characteristic curves. This method has already been used in the GW190814 discovery paper (ref. [ApJ](#)). Here we describe in full detail the procedure to detect the (3, 3) multipole in GW190814 within the cWB framework, as well as additional searches for other subdominant modes. We also apply this method on another event that displays possible higher multipoles, GW190412.

Keywords: gravitational waves, analysis, multipoles, compact binary coalescences

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