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GLADEnet: a progressive web app for multi-messenger cosmology and electromagnetic follow-ups of gravitational-wave sources

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The rare multimessenger event GW170817 showed a new way of making cosmology with the potential to resolve the tension between different measurements of the expansion rate of the Universe given by the Hubble constant.

However, most of the detected gravitational wave signals from compact binaries up to date do not have a multi-messenger counterpart, earning them the designation of dark standard sirens and in order to infer cosmological parameters from them statistical approaches are used by requiring the knowledge of galaxies within the event localization volume.

In the multi-messenger context, evaluating the completeness of catalogues of galaxies is of paramount importance, as it plays crucial i) for correctly optimizing observational strategies and maximising the chance to detect a counterpart and ii) for the postobservation data analysis, for example, to evaluate the efficiency of galaxy-targeted searches or
to correctly infer cosmological parameters.

In this work we describe the progress on the new interactive web tool, named GLADEnet, which enables us to evaluate galaxy incompleteness in real-time across the gravitational-wave sky-localization. In particular, we introduce a parameter, referred to as Completeness coefficient C. This measurement is of particular importance when we use catalogs such as GLADE (Galaxy List for the Advanced Detector Era) catalogue which comprises a collection of various catalogues. Hence, its completeness differs across different regions of the sky.

Here we present a comprehensive guide on how to use the web app detailing its functionalities geared towards managing the vast collection of over 22 million objects in GLADE. The completeness coefficient and the GLADE galaxy list will be disseminated in real-time via GLADEnet–https://virgo.pg.infn.it/gladenet/catalogs/ powered by the Virtual Observatory (VO) standard and tools.

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