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AGILE contribution to GW high-energy counterparts search

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The AGILE space mission, having capabilities well suited to transient source studies, participated to all the recent campaigns to search for electromagnetic (e.m.) counterparts to gravitational wave (GW) events detected by the LIGO-Virgo-KAGRA interferometers during the observing runs O2, O3, and the initial part of O4 (O4a), which ended on January 16th, 2024.

AGILE operations ended on January 18th, 2024.

We review here the AGILE contribution, focusing on the follow-up observations of significant GW events detected till now, along with preliminary results from the O4a run. AGILE executed dedicated real-time searches using MCAL (400 keV - 100 MeV), GRID (30 MeV - 30 GeV), and Anticoincidence ratemeters (50-200 keV), with specific Data Analysis pipelines used also for other astrophysical sources.

We published a first paper in 2016 regarding the AGILE data analysis for the first GW source detected, GW150914, and then two papers regarding two events of the O2 run, GW170104 and GW170817, the last being the only GW event till now for which an e.m. counterpart was found, i.e. GRB170817A.

A first thorough analysis of all GW events from O1, and O2 was published in 2022: we describe below this work and the following further analysis of O3/O4a events currently in progress.

No e.m. counterparts were detected, but 3sigma flux upper limits from MCAL and GRID data were extracted, among the lowest and fastest ULs at these energies, and allowing to constrain some emission models. We describe the AGILE role in newborn multi-messenger astronomy, particularly in recent activities, and its challenges in this new field.

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