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# The Gamma-Flash Project: High-energy radiation and particles in thunderstorms, lightning, and terrestrial gamma-ray flashes

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The Gamma-Flash program, funded by the Italian Space Agency (ASI) and led by the National Institute for Astrophysics (INAF), aims to study high-energy emissions related to thunderstorms, such as terrestrial gamma-ray flashes (TGFs) and gamma-ray glows. The program led to the development of two main detection systems: a ground-based system, installed at the "O. Vittori"Observatory on top of Mt. Cimone (Northern-Central Italy), and an airborne payload, installed on a Cessna CITATION Mustang aircraft, for in-flight campaigns.

The ground-based detection system consists of five γ-ray and three neutron detectors, and has been collecting data from Jul 2022 to Oct 2023, overall experiencing 95 days of thunderstorm activity (36% of the total). During this first observational survey, a gamma-ray glow of 1.5 min was revealed. The event light curve shows an abrupt interruption at the end, coinciding with the occurrence of a CG lightning discharge, that took place within 2 km from the detectors.

The avionic payload consists of 6 γ-ray and 2 neutron detectors. Up to now, only a first test flight with clear sky was performed, in December 2023. The purpose of this second payload is to collect additional data by flying nearby convective systems, in order to observe high-energy emissions directly from the sky. Further flights are planned to be conducted in June-September 2024.

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