Introduction to the AGILE symposium

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1 Introduction

This volume of the *Rendiconti dell'Accademia Nazionale dei Lincei* collects papers and contributions to the International Symposium dedicated to the scientific results of the Italian Mission AGILE on the occasion of the first 10 years of operations in space. The Symposium entitled *A Decade of AGILE: Results, Challenges and Prospects of Gamma-Ray Astrophysics* was held in Rome, on December 11–13, 2017 under the auspices of the Accademia Nazionale dei Lincei, Italian Space Agency (ASI), and Italian Institute of Astrophysics (INAF). The Academy hosted the scientific sessions during the first 2 days of the Symposium in the Auditorium, and the sessions of the last day were hosted by the ASI Headquarters in Rome.

The Symposium celebrated the scientific results obtained by AGILE and provided a great occasion to discuss a variety of topics ranging from high-energy astrophysics to terrestrial phenomena. The conference was introduced by the Presidents of the three Italian research institutes involved in the AGILE program, Nicolo D'Amico (INAF), Ferdinando Ferri (INFN) and Roberto Battiston (ASI). The Symposium was organized in ten sessions, each dedicated to a specific topic of relevance.

- *Session 1—Gamma-ray astrophysics today*, which provided the scientific context of the AGILE mission in the light of the past and current developments.
- *Session 2—Astrophysics of gravitational wave sources*, which presented the most interesting results on the new

and surprising sources of gravitational waves and the search for their electromagnetic counterparts.

- *Session 3—Gamma-ray pulsars and their winds*, a topic of great interest for gamma-ray astrophysics, and an occasion to discuss pulsars as sources of relativistic winds made of very energetic electrons and positrons.
- *Session 4—The mystery of gamma-ray Flares from the Crab Nebula*, a topic related to one of the most important discoveries by AGILE that revealed a novel mechanism of particle acceleration currently at the center of the theoretical debate.
- *Session 5—Gamma-ray emission from galactic binary systems*, which provided a discussion of several systems emitting gamma rays at special transitions and accretion disk instabilities related with relativistic jet ejections as in the source Cygnus X-3.
- *Session 6—Black holes in blazars, relativistic jets and particle acceleration in FSRQs and BL Lacs*, a topic of great interest dealing with the complex phenomena in jets produced by supermassive black holes that recently indicate the importance of magnetic field reconnection mechanisms of particle acceleration.
- *Session 7—Diffuse gamma-ray emission and the origin of cosmic rays*, an important issue at the focus of many theoretical investigations for which AGILE contributed in a decisive way in identifying a number of supernova remnants as sources of hadronic cosmic rays.
- *Session 8—Gamma-ray bursts*, among the most energetic phenomena of our Universe and at the center of recent new observational and theoretical developments focused on processes leading to the formation of compact objects (neutron stars and black holes) from stellar collapses and explosions.
- *Session 9—Terrestrial gamma-ray flashes, lightning and meteorology*, a topic for which AGILE contributed in a substantial way with important discoveries, a clear demonstration of how basic science based on an astrophysics experiment can provide data useful for our society and useful to study phenomena with an important environmental impact.

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- *Session 10—Future missions/experiments/telescopes and their interplay*, which provided a broad discussion on the prospects for future space missions and ground experiments in high-energy astrophysics and cosmic-ray physics.

The discussions following the presentations were very lively, and an interested audience participated and very much enjoyed the Symposium. High-energy astrophysics deals with phenomena and events at the edge of the current knowledge and theoretical understanding. These processes involve gravity and general relativity, particle physics, electromagnetic radiation, plasma physics, magneto-hydrodynamics, magnetic field instabilities, shocks, sudden fluid and particle accelerations, formation of neutron stars and black holes. In a special talk, Piero Boitani, an expert in comparative literature, also reminded us how science and astrophysics permeates current poetic and literary work. This is an important link with a broad audience “out there” which is very interested in science and needs to be closer to the results of telescopes, experiments, satellites. The AGILE

Symposium offered an occasion to present the latest results in high-energy astrophysics with openness to a large audience and vision of the future.

The Symposium is dedicated to the late Giovanni (Nanni) Bignami, who passionately supported the AGILE Mission and considered it as a continuation of the Italian tradition in astrophysics and physical sciences. Nanni, a proud Linceo, always worked to make Italian science stronger and better.

The AGILE satellite continues observing the sky in search of new signals and collects data on the most energetic phenomena of the cosmos. We appreciate the great work of all who contributed to the Mission ! Let us also hope that future observations by AGILE and their legacy will foster even more interest from both scientists and non-scientists in search of deeper knowledge about our Universe, our Home.

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