

## High energy gamma rays



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- **Scientific leader:** Mathieu de Naurois (LLR) \*
- **Laboratories involved:** APC (Paris), CC-IN2P3 (Lyon), CPPM (Marseille), LAPP (Annecy), LLR (Palaiseau), LP2I (Bordeaux), LPNHE (Paris), LUPM (Montpellier)
- **Nature:** research infrastructure
- **Status:** international project in operation, mainly funded by France and Germany
- **Website:** <https://www.mpi-hd.mpg.de/hfm/HESS/>

### SCIENTIFIC OBJECTIVES

HESS is an observatory designed to study cosmic gamma rays from a few tens of giga-electronvolts to 100 tera-electronvolts. HESS does not detect gamma rays directly, but rather the tiny trace of light emitted when they interact with the atmosphere. With its five arrayed telescopes, among which one very large telescope, it provides a stereoscopic image of the traces, making it possible to determine both the energy of the gamma ray and its point of origin on the sky. HESS thus studies high-energy cosmic phenomena: cosmic rays, interstellar medium, compact objects, gamma-ray bursts, cosmology, dark matter, etc.

### RESOURCES DEPLOYED

- HESS is deployed in Namibia at an altitude of 1 800 m near the Gamsberg, a region well-known for the excellent optical quality of its sky.
- The large central telescope of HESS has a mirror area of 614 m<sup>2</sup>, while the four smaller telescopes each have a mirror area of 107 m<sup>2</sup>.
- The cameras at the focal point of each of the four identical telescopes weigh 800 kilograms, while the camera at the large telescope weighs over three tonnes.
- This is the only telescope array in the world to operate a stereoscopic view of atmospheric cascades with telescopes of different sizes, thus foreshadowing the future CTA array.

- 40** research institutions
- 25** metres: the diameter of the largest telescope
- 13** participating countries
- 20** years of operation
- 150** Terabytes of data are generated per year
- 28** million euros (construction costs)

### IN2P3 CONTRIBUTIONS

- Design and construction of the cameras for all five telescopes, which operated on site from 2003 to 2017 for the first four telescopes, and from 2012 to 2019 for the camera of the fifth and largest telescope.
- Participation in the design and deployment of computer tools for data acquisition, simulation, reconstruction and analysis.
- Daily contribution to data analysis and interpretation.

### OTHER FRENCH LABORATORIES INVOLVED

Irfu (CEA Saclay), LUTH (Meudon)

### 2002

Signature of the memorandum between the CNRS and Namibia

### 2004

Inauguration of the four-telescope HESS system

### 2005

HESS captures its first images of the Milky Way

### 2012

Deployment of HESS with the addition of the 5<sup>th</sup> telescope

### 2015

Discovery of the very high-energy gamma-ray emission from the Vela pulsar

### 2017

Replacement of the cameras of the four smaller telescopes

### 2019

Extension of HESS for 5 years