

# Aniello (Daniele) Mennella

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## Profile

Graduated in Physics in 1989, since February 2005 I am a researcher at the Physics Department of the University of Milano.

I have been studying experimental cosmology since 1999 focussing, in particular, on the development of high sensitivity radiometric receivers for Cosmic Microwave Background measurements, in the framework of the ESA Planck mission. In Planck I am *Calibration Scientist* of the Low Frequency Instrument and coordinator of various international working groups. At the Physics Department I teach *Introduction to Astrophysics* and *Space instrumentation laboratory* courses.

Previously (from 1990 to 1999) I worked in the ENI group ([www.eni.it](http://www.eni.it)) doing industrial research in the fields of atmospheric physics and oil/gas exploration and production. During this period I had the opportunity to study many areas of physics, like plasma physics, atmospheric physics, fluid-dynamics in porous media, colloidal science, geochemistry and geophysics.

Since 2002 I am involved in popular science with conferences for schools and general public, and with the realisation of multimedia products. In this field I am particularly interested in joining artistic communication like theatre, music and video with science popularization, and I strongly believe that communication of science to the general public is of key importance in our work of scientists and researchers.

My activity is documented in about 80 publications and 60 technical reports, the majority of which are in the area of experimental cosmology. The detailed publication list is available on request.

## Scientific activities

### Activities in the framework of the ESA Planck Low Frequency Instrument (LFI) project (<http://planck.esa.int>)

The ESA Planck mission (<http://sci.esa.int/planck>) is the third space mission (after COBE e WMAP) dedicated to the measurements of temperature and polarization anisotropies of the Cosmic Microwave Background (CMB). Two instruments (the Low Frequency Instrument, with three channels at 30, 44 and 70 GHz and the High Frequency Instrument, with six channels between 100 and 857 GHz) observe the sky through a 1.5 meter telescope and measure CMB anisotropies with an accuracy limited by cosmic variance and astrophysical foregrounds.

*Official role:* Planck-LFI calibration scientist

- **2009 – present:** after the launch of Planck my primary field of interest is the in flight instrument calibration and the study of instrumental systematic effects on Planck scientific products.
- **2005 – 2009:** during this period I have followed the Low Frequency Instrument test and calibration campaign coordinating the activities of the scientific calibration team. I have also coordinated and participated to the development of the software used for analysing data from on-ground and in-flight calibration.
- **2000 – 2005:** during this period I have participated to the design of the Planck Low Frequency Instrument with particular reference to the development of the radiometric receivers and to the definition of the instrument

scientific requirements. I have also studied the impact of various systematic effects (with particular reference to thermal effects) on the scientific products in order to define technical requirements.

### **Activities in the framework of the BEAST (*Background Experiment Anisotropy Scanning Telescope*) experiment**

The BEAST (*Background Experiment Anisotropy Scanning Telescope*) experiment, has been carried out by a collaboration between the Physics department of the University of Milano and the Astrophysics group of the University of California at Santa Barbara. It run between 1998 and 2004 at the White Mountain ground station and was aimed at high-sensitivity CMB anisotropy measurements on small sky patches (about 2500 square degrees).

- In the framework of the BEAST experiment I collaborated at the analysis of the instrument focal plane in order to define the optimal focal surface and analyse the impact of mechanical distortions on the optical response.

### **Other activities in the context of millimeter-wave astrophysics**

- *2006 – present*: development of high performance corrugated feed-horn antennas for microwave polarisation measurements.

### **Non-astrophysical research activities (1990 – 1999)**

#### ***Geochemistry, geophysics (1998 – 1999)***

- CO<sub>2</sub> migration in hydrocarbon reservoirs, light hydrocarbon diffusion in sedimentary basins, hydrocarbon micro-seepage, hydrate stability calculations.

#### ***Fluid-dynamics in porous media (1992 – 1998)***

- Water/gas/oil – rock wettability and its effect on oil recovery
- Water production control with polymeric solutions and gels
- Tracer molecules propagation in porous media

#### ***Atmospheric physics (1990 – 1992)***

- Optical properties of aerosols

## **Popularization activities**

### **Seminars for general public and high school students**

- *Universe and neighbourhood – people, discoveries and frontiers in modern cosmology*, a conference in which the scientific discussion is backed by readings performed by an actress that shed light on the human experience of the main scientists of this field.
- *Universe origin and evolution*, a seminar on the main discoveries and open problems in modern cosmology.
- *An island in the cosmos – the Milky Way as seen by science*, a seminar on the main astrophysical aspects of the Milky Way.
- *The dark side of the world – lights and shadows on dark matter and dark energy*, a seminar for the general public dealing with the main observational evidences of dark matter and dark energy in the universe.

### **Seminars for middle and primary school students**

- *Cosmology the infinite embrace – man and his mind talking with the cosmos*, a lesson for middle schools that deals with the basic question in modern cosmology, summarising the current knowledge and the main open problems.

- ***Children of the stars – the sky above and within us***, a lesson for middle schools on astronomy in general and on the star life cycle in particular.
- ***Twinkle twinkle little star – wandering in the sky prairies***, a cycle of four lessons for primary schools. It is a virtual journey in the solar system performed with the software Celestia ([www.shatters.net/celestia](http://www.shatters.net/celestia)) and the support of an actress that, with voices offstage, personifies *Celestina*, a crazy space ship that with eccentric theories counteracts the orthodox explanations of the teacher.

### **Video productions**

- ***Children of stars***, an 18 minute video on the star evolution cycle. 3D simulations made with the software Celestia ([www.shatters.net/celestia](http://www.shatters.net/celestia))
- ***The first light – the journey of a special photon***, a 4-minute video shown in the context of the conference ***Universe and neighbourhood***, telling with images and music the 14-billion year journey of a journey of a hypothetical photon from the primordial universe to Penzias and Wilson's antenna when they discovered the existence of the cosmic microwave background.

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