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Obituary

Francesco Melchiorri



Professor Francesco Melchiorri died on 28 July 2005, at the age of 65. He held the Chair of Astrophysics at the University of Rome “La Sapienza”, and was Editor of *New Astronomy* since the foundation of the journal. Francesco Melchiorri was an “observational cosmologist”, and devoted most of his career to inventing, developing and running experiments to measure Cosmic Microwave Background (CMB) observables with increasing accuracy.

Originally trained as a solid state physicist, he started his experimental research on the CMB in the late 60’s while he was holding a research staff position at the Institute for the Research on Electromagnetic Waves (IROE) of the National

Research Council (CNR) in Florence. At that time only a handful of scientists were active in the field, detectors were orders of magnitude less sensitive than today, and worldwide communication of scientific information was sporadic and slow.

His experimental approach was an original one, using thermal detectors (cryogenic bolometers) at mm wavelengths, when the norm was to use coherent receivers at cm wavelengths. In the early 70’s, when the CMB measurements were still consistent with a Rayleigh–Jeans spectrum, he measured the spectrum of the CMB at short wavelengths (1.4 mm), providing compelling evidence for its Planckian nature.

In the same period he did new experiments devoted to the study of anisotropy and polarization of the CMB. The importance of measuring the CMB polarization, which today is at the forefront of CMB research, was clearly perceived by him: in 1972, more than 30 years in advance of the actual detection of this very weak signal, he flew on a balloon the first instrument aimed to detect the polarization of the CMB. Today the study of CMB polarization involves large international teams and extremely expensive instruments. Measurement plans extend for decades in the future, involving ambitious space missions testing the frontiers of theoretical research on the very early universe.

In 1978, his balloon-borne anisotropy experiment measured for the first time the dipole anisotropy of the CMB at mm wavelengths. He clearly recognized the potential of this peculiar signal as a precise calibrator for CMB surveys and suggested a spectral-independent calibration method, now considered standard. The method was exploited for the first time by ULISSE, his improved anisotropy experiment flown in the 80's, detecting anisotropy in the CMB at angular scales of a few degrees.

The Sunyaev–Zeldovich (SZ) effect attracted his attention since its formulation in 1970. He drew the attention of the community to the importance of sub-mm observations of the effect. In 1978, he proposed these observations to estimate the temperature of the CMB at non-zero redshifts: nowadays these observations are reaching the accuracy needed to test non-standard cosmological models.

In 1981, Francesco Melchiorri was awarded to the Chair of Astrophysics of the University of Rome “La Sapienza” where he founded his school of observational cosmology. He loved to teach, and several of his former students are now respected researchers in various countries.

The quest for angular resolution in CMB studies was becoming evident, and Francesco Melchiorri started a long development project on large aperture, balloon-borne millimetric telescopes. The ARGO experiment, a 1.2 m telescope flown by his group from 1988, was very influential in

the field. In 1993 ARGO was one of the three experiments reporting for the first time a detection of horizon-scale anisotropy in the CMB. This research line resulted in the development of a large aperture balloon-borne telescope with a 2.6 m primary, featuring arcmin resolution at mm wavelengths. This was intermittently funded by the Italian Space Agency. The instrument, called OLIMPO and now fully developed, will be flown by his Observational Cosmology group, producing a multiband catalog of clusters observed with the SZ effect and foreground-cleaned, high resolution observations of CMB anisotropy.

He was among the proposers of the European Space Agency missions CIRBS-ROMA and COSP, in many ways anticipating the COBE and Planck missions. He also proposed and developed an experiment to measure quantum fluctuations of CMB photons. The BOOMERanG experiment, which produced the first detailed images of CMB anisotropy in 2000, had in Francesco Melchiorri one of the founders, and a tireless supporter. The so-called “cosmic spring”, i.e. the epoch when the first non-linear structures appeared in the Universe, was one of his passions. He proposed and carried out observations to detect molecules at high redshifts, a new, extremely interesting field of cosmological research nowadays.

He earnestly proposed and developed Millimetric and Infrared Testa-Grigia Observatory (MITO), a modern millimetric telescope at 3500 m a.s.l. in the Italian Alps near Cervinia, devoted to CMB and Sunyaev–Zeldovich-effect research. This instrument is an important legacy for his research group and for the cosmology community at large.

In 2003, the University of Paris “La Sorbonne” bestowed on him the title of “Docteur Honoris Causa” in recognition of his contributions to the study of the formation of structures in the Universe. His enthusiasm, competence, availability, and almost prophetic vision were unique. He was a man of great generosity, an outstanding scientist, and a stimulating and inspiring colleague: His life and teachings will not be forgotten.

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