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I'm an experimental physicist and I have focused my research on the characterization of atmospheric aerosols and Particulate Matter, PM, and of their natural and anthropogenic sources. Since 1995, I'm the Head of the Laboratory for Environmental Physics (<http://labfisa.ge.infn.it>) at UNIGE. In 2012, together another staff member and five young researchers, I founded PM_TEN srl (<https://www.pm10-ambiente.it/en>), a spin-off devoted to the technological transfer of the research in environmental physics performed at UNIGE. Today, PM_TEN is an innovative SME with six staff employees. Since 2018, I have been the Director of the post-degree School in Medical Physics at the University of Genoa.

I contributed to the assessment of sampling techniques, laboratory analyses and data reduction methods finalized to source apportionment (i.e. quantitative determination of sources impact on PM levels). So far, I introduced in Italy the use of two-stage continuous streaker samplers for the identification of atmospheric pollution sources on the basis on their emission temporal pattern and elemental composition. This required the use and development of proper Ion Beam Analysis methodologies on low-energy ion accelerators and of innovative optical techniques. I built the first atmospheric simulation chamber in Italy, ChAMBRe, which is now a European facility part of the ERIC-ACTRIS (<https://www.actris.eu/>), the worldwide largest research infrastructure devoted to observation and study of atmospheric phenomena.

I have designed and managed many projects/experiments on PM characterization and source apportionment in several sites, among these (not quoting several INFN-CSN5 grants since the year 2000):

1998: coordinate research program “Techniques for atmospheric particulate analysis” funded by Italian National Council of Research, CNR, PI (budget: 40k€)

2001-2002: PRIN, Caratterizzazione del particolato atmosferico e di reperti nell'ambito dei Beni Culturali, local PI (budget 116 k€)

2002: the first PM10/PM2.5 sampling campaign in four major Italian towns (Florence, Genoa, Milan, Naples), PI (budget: 100k€)

2003: PM10/PM1 characterization campaign at the “remote” climatologic station of Monte Cimone (Italian Apennines, 2250 m a.s.l.), PI (budget: 90k€)

2003-2004: PRIN, Analisi con fasci ioni e tecniche complementari per lo studio del particolato atmosferico e dei beni culturali, local PI (budget 79 k€)

2004: first PM1 characterization campaign organized in the same period in three Italian cities (Florence, Genoa, Milan), local PI (budget: 30k€)

2003-2013: PM10, PM2.5 and PM1 source apportionment studies in Genoa commissioned by the Province of Genoa, PI (budget: 210k€)

2007-2008: PRIN, Metodi ottici e di Ion Beam analysis per la determinazione delle componenti elementali ed organiche del carbonio nel particolato atmosferico, local PI (budget 82 k€)

2007-2010: development a new technique for the size-segregated apportionment of the particle number concentration. The approach is based on the contemporary use of optical particle counters and particulate matter samplers and can give the size distribution of chemical and/or elemental components of atmospheric aerosols in a complementary way to the standard method based on the multi-stage cascade impactors. PI (budget 60k€)

2010-2013: source apportionment studies through receptor models and chemical transport models in five European harbours (Barcelona, Marseille, Genoa, Venice and Thessaloniki) in the frame of the MED-APICE project; local PI (budget 306k€)

2010-2011: assessment of the impact of vehicular traffic to the air quality of the city of Genoa through numerical simulations in the frame of the MITA project (grant Municipality of Genoa), PI (budget 90k€)

2011-2012: development of a software for numerical simulations of air quality in the Regione Liguria as sub-contractor of the ALCOTRA-AERA project, PI (budget 130k€)

2012-2014: development of a new multi-wavelength optical technique for the determination of Black and Brown Carbon content in PM and campaigns in rural areas. The approach is presently exploited in collaboration with MPI-Mainz in the assessment of biomass burning and biogenic emissions in the Amazonian site of Atto (Manaus-Brazil) PI (budget 50k€).

2014-June 2015: source apportionment study focussed to the PM emission of touristic maritime traffic in Barcelona, Marseille, Genoa, Venice and Thessaloniki in the frame of the MED-CAIMANs project, local PI (budget 130k€)

2016-2021: H2020-Eurochamp2020: Integration of European Simulation Chambers for Investigating Atmospheric Processes – Towards 2020 and beyond (budget 167k€)

2019-2022: PON-Per Actris-IT: Aerosol, Clouds and Trace Gases Research Infrastructure (budget: 834 k€)

2019-2023: INTERREG-maritime: Aer Nostrum (budget 215 k€)

2020-2022: BLUE-LAB Net, POR-FESR Regione Liguria for research infrastructures (196 k€)

2021-2025: H2020 ATMO-ACCESS, local PI (budget 180 k€)

2022-2024: PNRR IR ITINERIS, local PI (budget 1156 k€)

2022-2025: PNRR ecosystem RAISE, participant (budget 55 k€)

2023-2025: PRIN2022, Focused eEcosystem- Mobilome genes in aTmosphere-Ocean continuum, local PI (budget 95 k€)

My studies results have been published in major international journals; some of them had an impact outside the academic frame. A campaign devoted to the assessment of atmospheric pollution produced by large harbors raised the public awareness in Genoa and triggered ideas and proposals for a sustainable development of one of the largest harbors of the Mediterranean Sea. I was appointed by Justice Courts to assess the impact of particularly dangerous plants: a huge steel smelter in Genoa, the famous marble quarries in Massa Carrara and a Chromium processing factory, one of the most dangerous plants in Europe, near Genoa.

I carried out research in nuclear astrophysics too, in the frame of the LUNA (Laboratory for Underground Nuclear Astrophysics, <https://luna.lngs.infn.it/>) project located in the international laboratory under Gran Sasso (LNGS,Italy). LUNA has been the sole deep-underground accelerator facility for more than 25 years and it is managed by an international collaboration counting about 50 researchers. The direct measurements of the cross section of nuclear reactions involved in astrophysical processes performed at LUNA, have been acknowledged as outstanding results in several review papers. The Italian Ministry of Research approved a 5.3 M€ project for the construction of a new underground facility, based on a 3.5 MV ion accelerator, to be devoted both to astrophysical and multidisciplinary studies, including atmospheric sciences (LUNA-MV, now Bellotti Ion Beam Facility at LNGS). I served as spokesperson of the LUNA Collaboration and Principal Investigator of the LUNA-MV project from July 2015 to January 2020.

I developed my research activity through national and international collaborations, and, in the last twenty years, I continuously had coordination and management responsibilities at several levels. So far, I have been the supervisor of 15 PhD students and 11 post-doc: four of them, are now associate professors (H. Costantini, Dept. of Physics - Univ. of Marseille; F. Marengo, the Cyprus Institute; D. Massabò, Dept. of Physics - Univ. of Genoa; S. Nava, Dept. of Physics - Univ. of Florence), one is senior researcher at the Italian National Institute for Nuclear Physics, INFN (S. Zavatarelli in Genoa), two are assistants professors (A. Lemut,

South Dakota School of Mines, deceased; F. Mazzei, University of Genoa). Two of them (F. Confortola, S. Danelli) are industrial researchers, and three (M.C. Bove, F. Cassola, E. Cuccia) are with the Environmental Protection Agency in La Spezia, Genoa and Milan (IT). Most of my undergraduate students have now positions in industries and in environmental and sanitary institutions.

During my career, I continuously tried to establish synergies among different fields, in particular fundamental and applied physics. Starting from my original background in nuclear physics, I developed two main research activities, initially linked by low-energy ion accelerators: the study of atmospheric aerosols and underground nuclear astrophysics. Today, after about 35 years, both are firm and growing activities at the international state of the art and my research laboratory attracts students and collaborators with different backgrounds. I delivered the expertise accumulated in the detection of extremely rare and low signals (the main experimental issue in underground nuclear astrophysics) to the techniques developed for the characterization of atmospheric aerosols. As well, I developed simulation and data acquisition techniques which are used in the two fields; I adapted some of the data reduction techniques refined in my astrophysics research to the source apportionment problem typical of aerosol studies. I took care several times of composite experimental facilities.

Since 2000, I have been teaching in several academic classes and laboratories in physics at the University of Genoa at undergraduate and PhD level. I have been elected in the board of the Italian Aerosol Society (IAS) and I have also organized two international schools (2009, 2013) at master level. In 2014, I was the Chair of the VI National Conference on particulate matter (PM2014). In 2014, I also designed and conducted on behalf of IAEA a one-week school on atmospheric aerosols at the Sharjah University (UAE)

I am co-author of 198 articles on international peer-review journals: 114 on applied physics (93 on atmospheric aerosols) and 84 papers on nuclear astrophysics. I have been invited several times to give talks in international and national workshops and conferences as well as to give lectures in European and American research Institutes. My presentations to conferences and workshops are about 200: they have been published in more than 90 conference proceedings (most with peer review).

I regularly act as referee for the following international journals: Atmospheric Chemistry and Physics, Atmospheric Environment, Environmental Pollution, Journal of Aerosol Science, Nuclear Instruments and Methods B, Chemosphere; Journal of Water, Air and Soil Pollution; Science of the Total Environment, Environmental Monitoring and Assessment; Journal of Physics G, Applied Spectroscopy, Journal of Environmental Management, Environmental Pollution, Atmosphere.

I'm a project evaluator for several national and international Institutions.