

## **PERSONAL INFORMATION of Prof. Teresa Montaruli (23.02.2022)**

Montaruli Teresa, ORCID ID: 0000-0001-5014-2152; Italian, Born on 4/10/1968;

Web site: <https://unige.ch/sciences/astroparticle/>; **Career break:** Feb-Jun/2013 maternity leave (two twins).

Full CV and Publication list in <https://unige.ch/sciences/astroparticle/people/>

## **EDUCATION**

6/1998 PhD in Physics, Dipartimento di Fisica, Università di Bari, Italia on atmospheric neutrino oscillations with MACRO and neutrino astronomy, 3D atmospheric neutrino simulation with FLUKA.

1995 Specialization Diploma in Physics, Dip. di Fisica e Astronomia, Univ. di Bologna, on indirect searches of dark matter.

12/1994 Master Diploma, Dipartimento di Fisica, Università di Bari, Italia

## **EMPLOYMENT HISTORY**

9/2022 Sabbatical year at Gran Sasso Science Institute (GSSI) with professorship appointment, L'Aquila;

10/2011 Prof. Ordinaire, Département de Physique Nucléaire et Corpusculaire (DPNC), Faculté des Sciences, Université de Genève (UniGE), Switzerland;

2006–11 University of Wisconsin, Department of Physics: Full Prof. in Physics (4-8/2011); Associate Prof. with tenure (Physics and Astronomy, 9/2007-3/2011); Assistant Prof. in Physics (1/2006-8/2007);

2001–9 Ricercatore. Universitario (tenured in 2004), Dipartimento di Fisica, Università di Bari, Italia;

2000 Assegno di Ricerca, Università di Bari.

## **INSTITUTIONAL RESPONSIBILITIES AT UNIGE**

2011- : Faculté de Sciences UNIGE: Commission de Planification, Commission on Outreach; Commission d'Enseignement, Member of Collège de Professeur, Member of Comité de Gestion of Département de Physique Nucléaire et Corpusculaire. In numerous commissions for Professorships; MER and PhD/Master Theses.

2020: Swiss Coordinator of the CTA Observatory in which UNIGE with SERI Ministry are shareholders.

## **APPROVED RESEARCH PROJECTS and RESPONSIBILITIES IN PROJECTS (2017-2022)**

Since 2022: Member of NUSES experiment on satellite for ultra-high energy cosmic ray measurement, responsible of photosensor plane and of the simulation and design of the experiment TERZINA on ultra-high energy cosmic rays.

Since 2020- CTAO (Cherenkov Telescope Array Observatory) Council member and Swiss Coordinator;

Since 2012: Member of Consortium Board (CB) of CTAO; 2012-2019 member of CTA Project Committee as PI of SST-1M.

Since 2012: Project leader of the small-size telescope project SST-1M, which I designed, in particular the camera also developing a new hexagonal sensor with Hamamatsu. The DPNC at UNIGE laboratory developed under my guidance and thanks to the funds I procured two SiPM-based cameras with innovative technologies. M. Heller coordinated directly the work of the engineers. I lead the Consortium of about 50 people from Switzerland, Poland and Czech Republic. Two telescopes are taking first data from March 2022 at the Ondrejov Observatory, close to Prague.

Since 2019: Member of Consortium Board of Large Size Telescope (LST) project.

Since 2017-2022 Member of LHAASO cosmic ray and gamma-ray experiment and Institute representative.

Since 2006– IceCube Neutrino Telescope: Member of CB; Coordinator of IceCube-Pierre Auger-Telescope Array working group (2014-2020); Data analyses: point sources and dark matter searches; atmospheric neutrinos. While at UW-Madison: Member of Trigger Filtering Transmission Board, Publication Committee.

2016-2019 PI of SENSE H2020 FET-OPEN EXCHANGE on low-light level photosensor roadmap and development. 2015-2018 PI of GENERA H2020 Project on Gender in Physics.

2011-2017 Associate member of FACT First G-APD Cherenkov Telescope, responsible of shutter.

Airwatch-RD (precursor of Jem-EUSO): simulation and feasibility study.

## **SUPERVISION OF GRADUATE STUDENTS AND POSTDOCS (2017-2022)**

**DPNC-UniGE: Postdocs:** Georgios Voutsinas, Gregoire Ulrich, Leonid Burmistrov, Andri Nagai, Luca Foffano, Gabriel Emery, Alessandro Carosi, Mysha Dalchenko, Lucia Anna Damone, Anastasia Barbano, Yves Renier (now EPFL), Imen Al Samarai (now in a bank in Paris), Victor Coco (now CERN), Matthieu Heller (Staff Scientist since 3/2018); **PhDs:** Tessa Carver (defense on 15/4/2019, postdoc Cardiff U.), Stephanie Bron (defense in 2020), Cyril Alispach (defense on Dec. 4, 2020), Theodore Njoh Ekoume (defense on 29/10/2019, MAGIC employ on site), David Luis Medina Miranda, Francesco Lucarelli (defense expected in July 2022). **Master:** Maddalena Bugatti (defense June 2020); co-advisor of C. Delacour, EPFL defense, June 2020, N. De Angelis, defense Sep. 2018).

I supervised in total: 2 permanent researchers, 2 engineers, 25 Postdocs (28% female); 7 PhD with defended theses and 2 to be defended in July, 3 who I could not follow to graduation since I moved from

Wisconsin to Geneva. About 7 master students defended their thesis under my guidance of which Three or my graduated PhD students are female students. Tessa Carver was awarded the [Wurth 2 prize of UNIGE](#) for best thesis in the Faculty of Science and Rameez the [CHIPP award 2016](#).

### **TEACHING ACTIVITIES**

I taught at all levels from Bachelor to PhD. Main course I developed is on Astroparticle physics, spanning from senior bachelor up to PhD. I tried to develop it in a way that it provides latest research information in a pedagogical way, by treating cosmic phenomena as examples of application of special relativity and particle physics. I also focus on experimental techniques. **PhD student courses:** Gamma astronomy (GSSI, 10 students, spring semester 2022); Instrumentation and Methods in Astroparticle Physics (UW-Madison, 2 semesters, 10 PhD); Bachelor-PhD level: Particules dans l'univers (6 semesters, ~20 physics, bachelor, master, PhD); Detecteurs et accélérateurs (3 semesters, about 20 physics bachelor, master); **2003–18 Int. PhD schools:** INFN, SLAC, NWO, Niels Bohr Int. Academy, Benasque, Les Houches.

I specialized in Physics courses on Electromagnetism, Optics and Modern Physics for students in Biology tuning them with concrete examples in nature and human body of applications of Physics to Biology problems:

**2011–21 UniGE:** Physique Generale B (3 semesters, 240 pharm/biology bachelors); **2007–11 UW-Madison;** PHYS208 General Physics (3 semesters, ≈200 biology, pharmacy, bachelor) PHYS248 – A Modern Introduction to Physics (2 semesters, ≈70 physics, bachelor); I taught electromagnetism and optics and modern physics and associated laboratory to Physics Students: PHYS103 - General Physics (≈500, 1 semester, bachelor); University of Bari (2005-2011) taught 2 semesters/ye Physics 2 at Engineering and Lab. of Optics & electromagnetism.

I taught at CERN Summer school (2017, 2018, 2019).

### **MEMBERSHIP IN PANELS, BOARDS and COMMISSIONS OF TRUST (2017-2022)**

2020-now Member of Scientific and Teaching Advisory Board of Inst. for Physics of the Universe, France  
2019-now Chair of Astroparticle Physics European Consortium APPEC General Assembly ([www.appec.org](http://www.appec.org)) and Observer in the European Strategy Group of EPPSU2019.

2017-now Member of CERN Recognized experiment Commission; 2012–2018 Swiss Delegate in APPEC, vice-chair since 2017-2018;

2019-2020 Expert Board of H2020 ESCAPE; 2012-now Member of Round Table Swiss Representation in Int. Organisations and Research Infrastructures; 2018-now Member of Doctoral Program Committee of GSSI; 2012-18 Member of the Scientific Advisory Committee of the LNGS; 2017 Reviewer for NWO of Nikhef Lab, The Netherlands);

2017-now Member of many professor hiring commissions, between which Full Prof. Fis/01 (Fisica Sperimentale) of the GSSI; National competition for INFN Dirigente di Ricerca, Italy.

2022 Editor of Scientifics Report of Nature. Since 2000 Referee of Astrop. Physics, MNRAS, JCAP, Phys. Rev. J., Astron. J., Rev. Modern Phys., New J. Physics.

### **MEMBERSHIPS OF SCIENTIFIC SOCIETIES**

1994–2005 Società Italiana di Fisica; 2006– American Physical Society

2011– Swiss Physical Society and CHIPP (past member of Executive Board).

### **ORGANISATION OF CONFERENCES (2017-2022)**

**Member LOC:** [Swiss CTA Day 2020](#) e [2022](#), CTA Plenary Meeting, Lugano, Apr. 2019, SENSE TechForum, Jun. 2018; [Gender in Physics Day, 2017](#), Geneva. I will organize ICRC 2025 in Geneva.

**Member SOC:** Between Promoters of the JENAS series of meetings between ECFA, APPEC and NuPPEC ([JENAS 2019](#), LAL Orsay, Oct. 2019, [JENAS 2022](#), Madrid, Maggio 2022); [North America – Europe Workshop on Future of Double Beta Decay, LNGS, Sett 2021](#); APPEC Techforum on Robotics 2022; APPEC Workshop on 0nbb decay, London, Sett. 2021; JENAS 2019, LHC Days, 2022, Split; Chair of session at EPS-HEP 2017, Venice, Italy, 965; IEEE NSS Topic Convener: Astrophysics and space instrumentation, Strasbourg, France (29/10/2016); since 2017 reviewer of IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC).

**Member of LOC or SOC (Conf. title/year/place/participants):** LHC Days in 2022, 2016 and 2014, Split, 90; TeVPA 2016, CERN, 292; Neutrino Telescopes, 2017, 2015 and 2013, Venice, 120; 28<sup>th</sup> Texas Symposium on Relativistic Astrophysics, 2015, Geneva, 460; SUGAR2015, Geneva and 2018, Brussels, 50.

### **FELLOWSHIPS AND AWARDS**

2011– Honorary Fellow of UW- Madison; 2009– American Physical Society Fellow;

8/2001 Duggal Award (<http://archive.iupap.org/commissions/c4/cosnews/cosnews46.html>);

1998 B.Rossi scholarship at “36 Course: from the Planck Length to the Hubble Radius”, Erice;

1995,1998 INFN undergraduate student and Postdoctoral Fellowships;1995–98 PhD Fellowship, Bari Univ.

## **MAJOR ACHIEVEMENTS (2017-2022)**

2019-2020 General Assembly of the Astroparticle Physics European Consortium (APPEC). As such I represented in international fora, such as in NuPECC Assembly and in the CERN Council meetings, the main European funding agencies involved in Astroparticle Physics. The main activity was on the European Particle Physics Strategy Update.

In 2022 I took a sabbatical year and I started working on a satellite-based experiment called NUSES. I take care of the experiment TERZINA which is devoted to ultra-high energy cosmic ray

In the last 5 years, I focused on experimental **multi-messenger astrophysics** and **dark matter** searches with **gamma-rays**, **neutrinos** and **cosmic rays**. With my group, I work on data analysis in IceCube and in Cherenkov Telescope Array (CTA), particularly in the LST. The CTA Consortium is composed of about 1'400 people, aims at building and operating the future generation observatory of ground-based gamma-ray telescopes (IACTs). They image the particle shower development in the atmosphere on a fast camera (sub-nanosecond time resolution) thanks to focusing mirrors. Showers are induced by gamma-rays from sources and by cosmic rays. Gamma-rays can be identified due to the regular shape of electromagnetic showers with respect to hadronic ones. CTA Science comprises astrophysical topics, such as cosmic ray sources and study of their properties [1]. Between them, most prominent are black holes, pulsars, supernova remnants and other more exotic ones such as magnetars and the Fermi bubbles. CTA will have also a prominent role in dark matter searches for particles with mass range larger than 10 GeV.

From 2012-2019 I have been one of the coordinators of the 5 projects for construction of telescopes, the SST-1M. The project comprises scientists from Switzerland, Poland, Czech Republic, Ireland and Ukraine and its TDR is in [2]. The project was born in CTA frame and was evaluated as the most mature and cost effective of the projects by an international panel. I represented the project in the CTA Project Committee, the Advising Board to the CTA Observatory Council on technical aspects and construction of the array, from 2012-2019. CTA has been recognized by SERI as a relevant research infrastructure for Switzerland and since then the Swiss Parliament approved the opening of a credit line of 8 MCHF for providing in-kind contributions for the construction of the project up to 2020. The telescope was designed by me in order to host a powerful gamma-ray camera based on Silicon photomultipliers (SiPM) [3] with very large size. With the group we designed many of the camera components through analytical formulas and optical ray tracing. Some of these components, such as the SiPMs [4], the associated electronics [5] and the lightguides [6], were produced in collaboration with industry. We also created test set-ups for SiPMs at UniGE and IdeaSquare at CERN, this last now serving the SENSE FET-OPEN program of the European community of which I am a PI [7]. In Aug. 31, 2017, we saw the first gamma-ray signals when we switched on the SST-1M camera after installing it on the telescope in Krakow and now we are operating it while building a second telescope. The final destination of the telescopes will be the LHAASO experiment in China and TAIGA is interested to adopt its technology as well. My group is a member of LHAASO experiment that is implementing a similar design for the camera of their telescopes [8]. We heavily influenced the camera design for LHAASO which is now based on SiPM allowing to double the number of telescopes for the same funding. We work with ThinFilm Physics Zürich to produce lightguides for LHAASO and CTA. D. della Volpe coordinates the LHAASO effort. Recently I am joining the TAIGA project with the aim to provide cameras in this project. The work on photosensors, not only led my group into the SENSE project, which aims at building up the roadmap towards the achievement of highly performing low light level sensors, but also into new projects. We submitted to the FET-OPEN program a new concept of silicon photosensor with applications in PET and a project on a beta probe to guide surgeons for removal of cancerous tissues, which now is funded by ATTRACT.

My main contribution to IceCube is the establishment of a likelihood method to look for cosmic sources of neutrinos, which now is used in many analyses [9, 10], which I started to develop in ANTARES [11]. This search method is applied for many searches of cosmic sources: point-like and extended sources [12], time dependent [13] or continuous emissions, and stacking searches. Recently, we performed at UniGE a stacking search looking for correlations with UHECRs measured by Pierre Auger and Telescope Array [14]. I am the coordinator of the joint working group of the IceCube, ANTARES, Pierre Auger and Telescope Array. The method has fundamentally contributed to the evidence for the first cosmic ray source by IceCube [15,16]. When IceCube launched in the astronomer's network an alert to look for the direction of a 300 TeV neutrino, the gamma-ray experiments Fermi-LAT and MAGIC, detected a flaring blazar. From this direction, the PhD student A. Christov under my direction, had measured a previous neutrino flare scanning the full sky looking for burst of neutrinos [17]. This evidence follows the one on a diffuse flux of cosmic neutrinos by IceCube [18] and we recently found a high significant source NGC1068 [19]. With PhD student Rameez, we searched for dark matter trapped in the Sun with IceCube. We set the best current upper limits [20].

## **Bibliography**

## Bibliography

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