



# Matteo Sanguineti

Fixed-term assistant professor

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## *Education and training*

2016

### **PhD in Physics**

Search for GRB neutrino emission according to the photospheric model with the ANTARES telescope

University of Genoa - Genoa - IT

2016

### **PhD in Physics**

Search for GRB neutrino emission according to the photospheric model with the ANTARES telescope - Très honorable

Université Paris 7 Diderot - Paris - FR

2012

### **Master degree in Physics of Fundamental InteractionAstrophysics**

Misura del flusso di neutrini di altissima energia dalle Fermi bubbles con il rivelatore ANTARES - 110/110 e lode

University of Genoa - Genoa - IT

## *Academic experience*

2018 - ONGOING

### **Research Assistant Professor (RTDa)**

University of Genoa - Genoa - IT

ANTARES-KM3NeT and WHALESAFE collaboration

2017 - 2018

### **Research fellow**

INFN Genoa - CPPM Marseille - Genoa - Marseille - IT

ANTARES - KM3NeT collaboration

2016 - 2017

### **Research fellow**

University of Genoa - Genoa - IT

WHALESAFE experiment

## *Language skills*

### **Italian**

Mother tongue

### **English**

Proficient

### **French**

Independent

## *Teaching activity*

- AY 2018/2019 Chair in General Physics (Bachelor degree in Mechanical Enginery)
- AY 2017/2018 Chair in General Physics - second term (Bachelor degree in Mechanical Enginery)
- AY 2017/2018 Chair in Materials Physics Laboratory (Bachelor degree in Materials Science)
- AY 2016/2017 Assistant professorin in General Physics - first term (Bachelor degree in Mechanical Enginery)
- AY 2016/2017 Assistant professor in Nuclear Physics, Particle Physics and Astrophysics 2 (Master degree in Physics)
- AY 2016/2017 Assistant professor in Experimental Physics with Earth system applications (Bachelor degree in Geology)
- AY 2015/2016 Didactic tutor (Bachelor degree in Chemistry)
- AY 2015/2016 Didactic tutor (Recovery of Formative Debt (OFA) course lecturer)
- AY 2014/2015 Organization, coordination and supervision of experimental activity for the high school student stage "Measurement of the cosmic rays with a scintillator detector".
- AY 2014/2015 Didactic tutor (Recovery of Formative Debt (OFA) course lecturer)
- AY 2013/2014 Didactic tutor (Recovery of Formative Debt (OFA) course lecturer)
- AY 2013/2014 Didactic tutor (Bachelor degree in Chemistry)

## *Postgraduate research and teaching activity*

### **Supervision of PhD students, residents and post-doctoral fellows**

- 2017 - ongoing Supervision of a PhD thesis

## *Research interests*

**KM3NeT** will be a future network of underwater neutrino telescopes designed for the detection of astrophysical neutrino sources and for the determination of the neutrino mass hierarchy, **ANTARES** is its predecessor and it is operating since 2008.

My principal activities devoted to the KM3NeT-ANTARES collaboration include:

- **Study of a new promising neutrino emission model of gamma ray bursts (GRB) and search of a neutrino flux in correspondence of very bright gamma ray bursts with ANTARES**

The GRB photospheric model predicts a large emission of neutrino in a lower energetic range with respect to the classical gamma ray burst emission mechanisms. For the first time in a physical analysis of the ANTARES collaboration I used a special sample of unfiltered. Moreover I developed a special directional trigger and a dedicated neutrino events reconstruction algorithm. The proposed analysis improved consistently the efficiency of the ANTARES detector in the interesting energetic range (50 GeV -104 GeV). My analysis did not yield to a measure of a neutrino flux in correspondence of bright gamma ray bursts, but it allowed to set an upper limit on the neutrino flux from the GRBs in a energetic range which fits the predictions of the most recent emission models.

- **Study of the “Moon shadow” with ANTARES and KM3NeT**

The pointing accuracy and the angular resolution of the neutrino telescopes are the key properties and a reliable way to evaluate these performances is needed. One possibility to measure the pointing accuracy is to analyse the “shadow of the Moon”, i.e. the deficit in the atmospheric muon flux in the direction of the Moon induced by absorption of cosmic rays. I used The ANTARES data recorded in the last 8 years to prove the correct pointing of the detector and to measure the telescope angular resolution. The Moon shadowing has been detected with a  $3.5 \sigma$  significance. Moreover I developed a dedicated Monte Carlo simulation of the KM3NeT detector to estimate the significance of the Moon shadow deficit for the future telescope.

- **Research of a neutrino flux from the Fermi Bubbles with ANTARES**

Analysis of the Fermi-LAT data has revealed two extended structures above and below the Galactic Centre emitting gamma rays with a hard spectrum, the so-called Fermi bubbles. Hadronic models attempting to explain the origin of the Fermi bubbles predict the emission of high-energy neutrinos and gamma rays with similar fluxes. The ANTARES detector, a neutrino telescope located in the Mediterranean Sea, has a good visibility to the Fermi bubble regions. Using data collected from 2008 to 2011 no statistically significant excess of events is observed and therefore upper limits on the neutrino flux in TeV range from the Fermi bubbles are derived for various assumed energy cutoffs of the source.

- **Study of KM3NeT-ARCA sensibility to a neutrino flux from blazars**

I started the study of the KM3NeT-ARCA sensibility to one of the most promising neutrino sources: blazars. The activity is performed in collaboration with INAF Brera. In particular, we will study the 'shower-like' event contribution in order to increase the KM3NeT-ARCA sensibility. **WHALESAFE** is a European project (NATURA +LIFE) that will develop a system for the detection and the monitoring of the sperm whales in the Pelagos

sanctuary (Ligurian Sea). The system will prevent the collision between cetacean and ships emitting warning messages to the vessels in the area. The sperm whales will be identified with a network of hydrophones that will detect the sound emitted by the cetaceans for echolocation.

My principal activities devoted to the WHALESAFE project include:

- **WHALESAFE project manager**
- **Member of the Technical Coordination Committee**
- **Development of two different algorithms for the reconstruction of the cetacean position**

The first algorithm exploits two hydrophone systems to triangulate the cetacean position, while the other algorithm exploits the sound reflection of the sea surface to reconstruct the sperm whale position using only one hydrophone system.

An accident in spring 2016 damaged irremediably one of the two hydrophone systems leading to a serious risk of project default. However, the European commission recognized the good performances of my algorithm that exploit the sound reflection and approved the amendment and the continuation of the project.