

# Ettore Majorana Foundation and Centre for Scientific Culture

President Prof. A.Zichichi

## International School of Ethology

Directors Prof. D.Mainardi & S.Parmigiani

30<sup>th</sup> International Workshop  
Erice, Sicily (Italy) : October 18-21, 2013

### Cetacean echolocation and outer space neutrinos: ethology and physics for an interdisciplinary approach to underwater bioacoustics and astrophysical particles detection



Photo by A.Passini

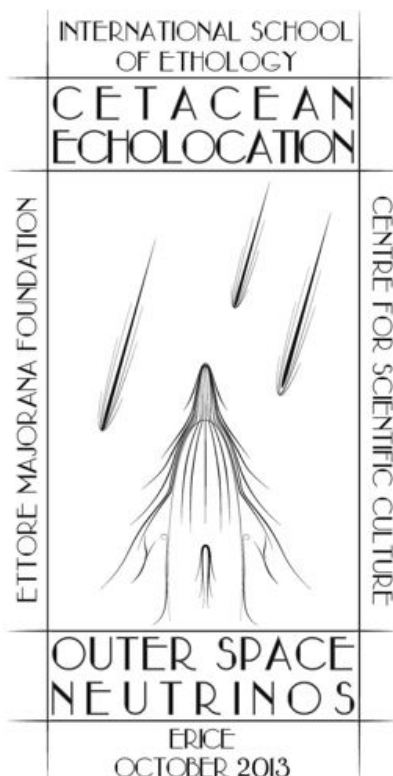
#### Directors of the workshop

Gianni Pavan (Centro Interdisciplinare di Bioacustica e Ricerche Ambientali, University of Pavia, Italy)

Peter Tyack (Sea Mammal Research Unit, University of St Andrews, Scotland, UK)

Giorgio Riccobene (INFN-LNS, Catania, Italy)

William A. Barletta (Dept. of Physics, MIT, Cambridge, MA, US)



The development of underwater ocean observatories has stimulated new interactions between disparate disciplines to optimize their sensors and layout. One of the least predictable synergies has come from interactions between astrophysicists working to detect light and acoustic signals from neutrinos and marine biologists listening to the sounds of marine animals.

Acoustics is a particularly good tool for remote sensing in the ocean because sound propagates more efficiently than other cues. Rather than having each discipline search for their signal of interest among what is treated as random noise, it may be more effective for all of the disciplines to work together to tease apart their signals of interest from ocean acoustic sensors, helping one another to separate each desired signal from undesired ones.

This workshop is intended to join these different disciplines to promote the understanding of the underwater acoustic world and the development of common research strategies and tools. The workshop will focus on the study of the acoustic behaviour of marine mammals, on the acoustic detection of neutrinos in the sea, on the sources of sound in the ocean, on the sharing of detection technologies, and on the related technological challenges with a broad interdisciplinary approach.

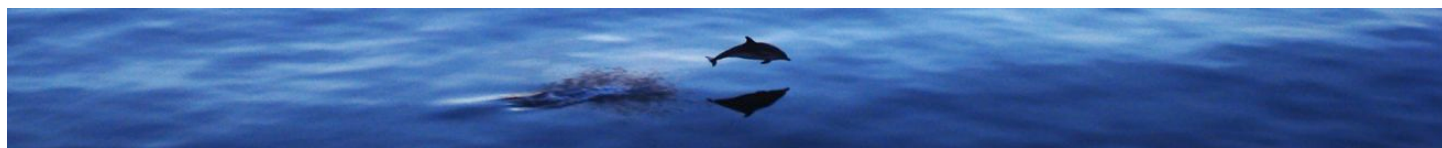


**CIBRA**



More info and registration link on [www.unipv.it/erice](http://www.unipv.it/erice)

# Cetacean echolocation and outer space neutrinos: ethology and physics for an interdisciplinary approach to underwater bioacoustics and astrophysical particles detection



## Program

### Day 1 - October 18<sup>th</sup> - Friday

#### Opening Ceremony

#### Acoustical Oceanography

- Henrik Schmidt (MIT, US) - Nested Autonomy: A Robust Operational Paradigm for Adaptive and Collaborative Ocean Acoustic Sensing

#### Acoustic communication, vocal learning and cognition in marine mammals

- Brandon Southall (California Univ., US) – Overview of vocal parameters and hearing abilities in pinnipeds and cetaceans

#### Astrophysics with acoustics in deep sea

- Lee Thompson (Sheffield Univ., UK) - Listening for neutrinos, Part I - from astrophysics to the deep sea
- Sean Danaher (Northumbria Univ., UK) - Listening for neutrinos, Part II - acoustic neutrino detection & signal processing techniques
- Francesco Simeone (INFN Roma, Italy) – NEMO and SMO Projects

#### Short talks – Session I

### Day 2 - October 19<sup>th</sup> - Saturday

#### Submarine Multidisciplinary Observatories

- Paolo Favali (INGV Roma, Italy) - EMSO - European Multidisciplinary Seafloor and water column Observatory
- Kim Juniper (Victoria Univ., Canada) - Expansion of the Ocean Networks Canada hydrophone network and linking with AIS monitoring
- Gianni Pavan (CIBRA/UNIPV, Italy) - Bioacoustic results in NEMO-SN1 ONDE and way ahead with EMSO, the European Multidisciplinary Submarine Research Infrastructure
- Michel Andre (UPC, Spain) - A Global Ocean Soundscapes Monitoring Approach

#### Information technology & infrastructures for acoustic data acquisition, archival and analysis

- Lars Kindermann (AWI, Germany) – Underwater acoustics in Antarctica
- Doug Gillespie (St. Andrews Univ., UK) - Looking for spaghetti in a haystack: Semiautomatic approaches to detecting marine mammals in highly variable noise environments
- Alexander von Benda-Beckman (WhaleFM/TNO, Netherland) - Look who's talking – classification of whale sounds using the Whale FM Citizen Science project

#### Short talks – Session II

### Day 3 - October 20<sup>th</sup> – Sunday - Full day excursion

### Day 4 - October 21<sup>st</sup> – Monday

#### Interdisciplinary approach to Computational (Bio)Acoustics

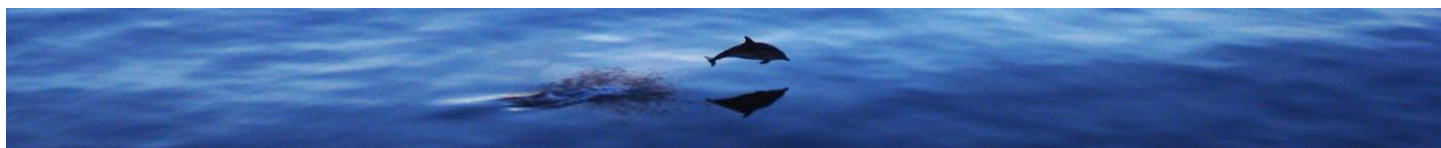
- Walter Zimmer (CRME, Italy) - Model-based bio-acoustics
- Herve Glotin (Toulon Univ., France) - 3D tracking and automatic featuring of sperm whales
- Paul White (Southampton Univ., UK) - Tracking Algorithms in Marine Mammal Acoustics

#### Advanced marine research for conservation

- Peter Tyack (St. Andrews Univ., UK) - How new technology has revolutionized the study of cetacean bioacoustics and suggestions for new directions and collaborations for the future.
- Mauro Taiuti (INFN, Italy) – ARION - Systems for Coastal Dolphin Conservation in the Ligurian Sea
- Hong Young Yan (Academia Sinica, Taiwan) - Impact of noise on fishes and marine mammals
- Tiago Marques (St. Andrews Univ., UK) - Cetacean density estimation from passive acoustic data
- Bob Gisiner (US Navy, US) - The Sea Finds Its Voice: Changes in the Scientific Understanding of Sound and Marine Life from 1993 to 2013.

#### Conclusion and Concluding remarks

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## Short talks – Session I

Viola S. (INFN-LNS, Italy) - SMO acoustic array: calibrations and first results

Larosa G., Viola S. (INFN-LNS, Italy) - Positioning System for neutrino telescopes: SMO and KM3NeT-Italia in Capo Passero

Pulvirenti S. (INFN-LNS, Italy) - Correlation between underwater noise level and AIS data in the Gulf of Catania (Sicily)

## Short talks – Session II

Lin Tzu-hao, Yu Hsin-yi, Chen Chi-fang, Chou Lien-siang (National Univ. of Taiwan, Taiwan) - Detecting the structural variability of cetacean tonal sounds by automatic detection and classification algorithms

Vignola J., Shane G. (Catholic Univ. of America, US) - A preliminary investigation on the seismic air gun reverberant field in a shallow water Arctic environment

Vallarta J., Martin B. (JASCO, US) - Spatial prediction and interpolation effect assessment of marine mammal counter calls, ambient and anthropogenic noise

Caruso F., Sciacca V., Pavan G. (INFN-LNS, Italy) - An algorithm to measure the size of sperm whales recorded by INFN deep-sea observatories in the Ionian Sea (Eastern Sicily).

Sciacca V., Caruso F., Pavan G. (INFN-LNS, Italy) - Acoustic detection of fin whales vocalizations offshore Eastern Sicily, Ionian sea

## Posters

### Acoustic data acquisition systems (AcouDAQ) for the SMO, KM3NeT and SN1 experiments

Pellegrino C.

### Click and burst pulse proprieties of wild bottlenose dolphin in the Central Mediterranean Sea

Buscaino G., Alonge G., Buffa G., Filiciotto F., Maccarrone V., Di Stefano V., Mazzola S.

### A Calibrator for UHE neutrino acoustic detection in underwater telescopes

Adrian Martinez S., Ardid M., Bou M., Felis I., Llorens C., Martinez-Mora, J.A., Saldana M.

### A smart platform for monitoring underwater noise

Barker P., Lepper P.

### Acoustically derived growth rates of sperm whales (*Physeter macrocephalus*) around Ischia and Ventotene Islands (Italy): preliminary results

Pace D. S., Miragliuolo A., Dernowski R., Vivalid C., Mussi B.

### First results on underwater acoustic background in SMO - NEMO Phase II

Grasso R.

### What does a small, shy cetacean which vocalises 6 times above a human's hearing range do underwater? Challenges in localising harbour porpoises.

Macaulay J., Gillespie D., Northridge S., Gordon J.

### WaveShark – a compact multifunctional multichannel high sampling rate recorder

Pelicella I., Balsamo F., Pavan G.

### An Inter-frequency attenuation model for estimation of click distance

Doh Y., Glotin H., Razik J., Paris S.

### Biomechanical Evidence of Low to Infrasonic Hearing in Mysticetes: Implications for Impacts

Ketten D., Arruda J., Cramer S., Zosuls A., Mountain D.