

«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE

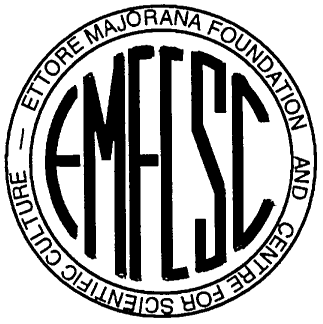
INTERNATIONAL SCHOOL OF COSMIC-RAY ASTROPHYSICS
«MAURICE M. SHAPIRO»

23rd Course: “Multi-Messenger Astroparticle Physics” 20 – 28 July 2024

PRESIDENT AND DIRECTOR OF THE CENTRE: PROFESSOR A. ZICHICHI

DIRECTORS OF THE COURSE: PROFESSORS J.R. HÖRANDEL, T. STANEV, R. SPARVOLI - J.P. WEFEL (director emeritus)

WELCOME!



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INTERNATIONAL SCHOOL OF COSMIC-RAY ASTROPHYSICS
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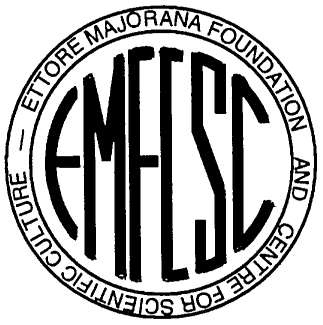
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Maurice M. Shapiro



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According to legend, Erice, son of Venus and Neptune, founded a small town on top of a mountain (750 metres above sea level) more than three thousand years ago.

The founder of modern history - i.e. the recording of events in a methodic and chronological sequence as they really happened without reference to mythical causes - the great Thucydides (~500 B.C.), writing about events connected with the conquest of Troy (1183 B.C.) said: "After the fall of Troy some Trojans on their escape from the Achaei on the sea towards the West arrived in Sicily by boat and as they settled near the border with the Sicanians all together they were named Elymi: their towns were Segesta and Erice".

This inspired Virgil to describe the arrival of the Trojan royal family in Erice and the burial of Anchise, by his son Enea, on the coast below Erice. Homer (~1000 B.C.), Theocritus (~300 B.C.), Polybius (~200 B.C.), Virgil (~50 B.C.), Horace (~20 B.C.), and others have celebrated this magnificent spot in Sicily in their poems.

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During seven centuries (XIII-XIX) the town of Erice was under the leadership of a local oligarchy, whose wisdom assured a long period of cultural development and economic prosperity which in turn gave rise to the many churches, monasteries and private palaces which you see today.

In Erice you can admire the [Castle of Venus](#), the [Cyclopean Walls](#) (~800 B.C.) and the [Gothic Cathedral](#) (~1300 A.D.). Erice is at present a mixture of ancient and medieval architecture. Other masterpieces of ancient civilization are to be found in the neighbourhood: at Motya (Phoenician), [Segesta \(Elymian\)](#), and [Selinunte \(Greek\)](#). On the Aegadian Islands – theatre of the decisive naval battle of the first Punic War (264-241B.C.) – suggestive neolithic and paleolithic vestiges are still visible: the grottoes of Favignana, the carvings and murals of Levanzo. Splendid beaches are to be found at San Vito Lo Capo, Scopello, and Comino, and a wild and rocky coast around Monte Cofano: all at less than one hour's drive from Erice.

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In the mid 1970's, discussions among Rossi, Shapiro and others recognized the need for continuing international education in the then emerging field of Cosmic Ray Astrophysics.

Prof. Zichichi who, in 1963, had founded the EMFCSC, agreed to establish the IS CRA as one of the Erice Schools, offering biennial courses with Shapiro as director.



Antonio Zichichi and Maurice M. Shapiro circa 2004

IS CRA School and Course Directors:

Maurice M. Shapiro, Rein Silberberg, John P. Wefel, Vladimir Ptuskin, Todor Stanev, Piero Galeotti, Jörg R. Hörandel, and Roberta Sparvoli

Executive Secretary:

Arthur Smith



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1st course: Progress and Problems in Cosmic Ray Physics - 1978

M. M. Shapiro and R. Silberberg, Directors of the Course

PURPOSE OF THE COURSE

The goals are:

- i) To provide students with knowledge and understanding that will enhance their contributions to cosmic-ray astrophysics.
- ii) To enable lecturers and other participants to exchange ideas and explore models which may promote progress in this field.
- iii) To acquaint the students with unsolved problems in cosmic-ray physics and to advise on methods for resolving these.
- iv) To elucidate the relationship between observations (e.g. of cosmic-ray composition, spectra, and isotropy) and theories of origin, acceleration and propagation.
- v) To provide insight into the coupling between cosmic radiation and related disciplines such as radioastronomy, optical and x-ray astronomy, plasma physics, solar physics, stellar evolution, nucleosynthesis, gravitational collapse (and its consequent pulsars, neutron stars, black holes, and supernovae), geophysics, nuclear physics, cosmology, elementary particles and high energy physics.



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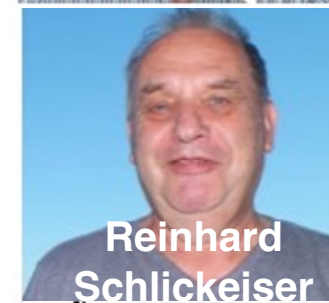
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students 1978
senior attendees 2018
(40th anniversary of IS CRA)

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1	2 Jeremy Lloyd-Evans	3 Ray Wills?	4	5	6 J. Kempler	7 Janet Luhmann	8 Kostas (Greek, Milan?)
9 Ellen Zweibel	10 G. Erdős (?)	11 Vic Stenger	12 Jorge Perez-Pereza	13 Yves David	14 John Clifford	15 Jake Waddington	16 Maurice Shapiro
17 Juan Sequiros	18 Carmen Baixeras	19	20 Maria Giller	21 G. Siegmon	22 Elana Ashley	23 Andy Strong ?	24 Rudolph Beaujean
25	26 Javiev Ottaola	27	28 Helina Bilokon	29	30 Einar Juliusson	31	32
33	34	35 Rein Silverberg	36	37 Oscar Saavedra	38 Willi Niemann	39	40
41	42 Reinhard Schlickeiser	43	44 T. Gregory Guzik	45	46	47 Peter Fowler	48 John Linsley
49 Piero Galeotti	50 Harm Moraal	51	52 Satio Hayakawa	53 John Simpson?	54 Fred Reines	55 David Schramm	56 Roger Bussard
57 Todor Stanev	58 John Cooper	59 Simon Swordy	60 Steve Jordan	61	62 Reuven Ramaty	63	64 J C Carvalho
65 Subir Sarkar	66 Arnold Wolfendale	67	68 Alan Watson	69			





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- 1992: Particle Astrophysics and Cosmology ***
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- 1996: Towards the Millennium in Astrophysics: Problems and Prospects ***
- 1998: New Vistas in Astrophysics ***
- 2000: Astrophysical Sources of High Energy Particles and Radiation ***
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- 2004: Neutrinos and Explosive Events in the Universe ***
- 2006: Astrophysics at Ultra-high Energies ***
- 2008: Gamma Ray and Cosmic Ray Astrophysics: From Below GeV to Beyond EeV Energies**
Including tribute session for Maurice M. Shapiro, who had passed the previous year. IS CRA named in his honor.
- 2010: Astro & Particle Physics: From Underground to Outer Space**
- 2012: A new Era in Particle Astrophysics: New instruments, New Results and New Understanding**
- 2014: Exploring the High Energy Universe**
- 2016: Particle, Gamma-ray and Neutrino Astrophysics in the 21st Century**
- 2018: Astroparticle Physics: Yesterday, Today and Tomorrow**
- 2020: no course, Covid-19**
- 2022: From Cosmic Particles to Gravitational Waves: Now and To Come**
- 2024: Multi-messenger Astroparticle Physics**

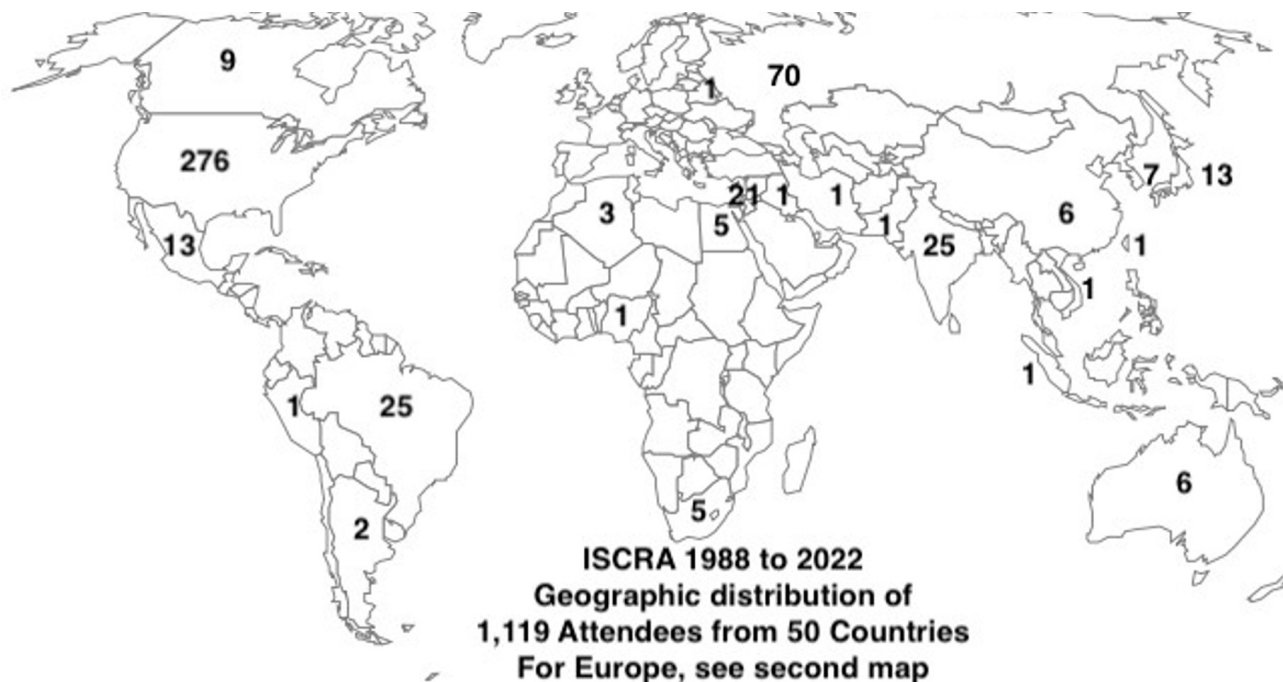
* Hardcopy Proceedings Volume

**23 courses
topics evolved
cosmic-ray astrophysics**

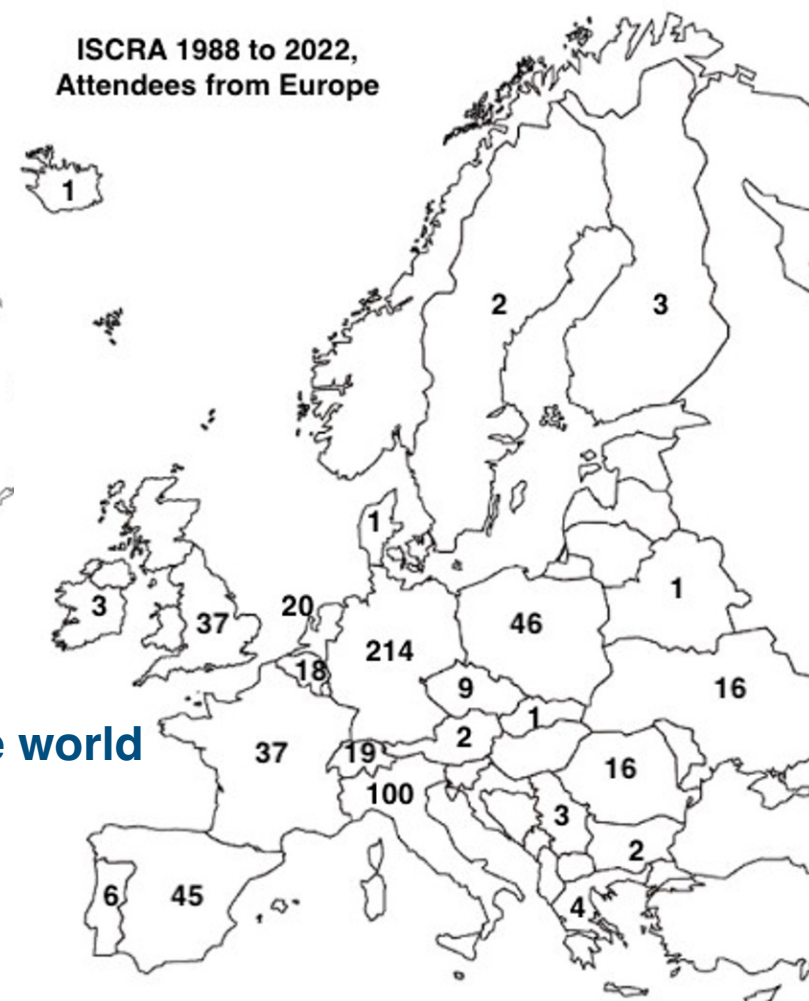


astroparticle physics

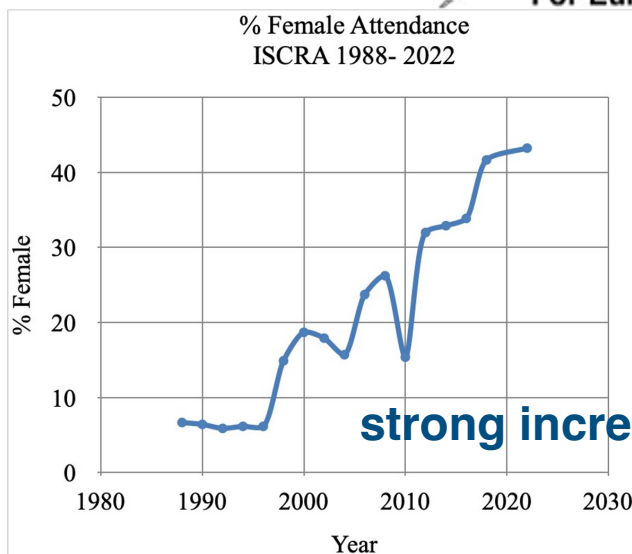
- **direct & indirect measurements of cosmic rays**
- **gamma-ray astronomy**
- **neutrino astronomy**
- **gravitational waves**



IS CRA 1988 to 2022,
Attendees from Europe



participants from around the world



strong increase of female participants

in the last 40 years ~1400 participants (lecturers, senior researchers, and students)



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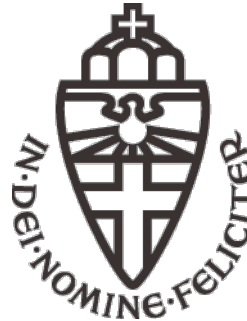
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SPONSORS

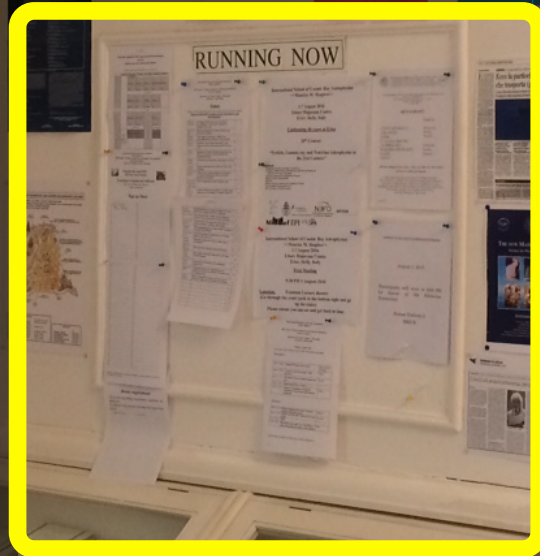


Alliance for Astroparticle Physics

your institute/university/lab!

announcement board for our school

another board is in San Domenico (main lecture hall)
please consult these boards regularly



- *schedule might change due to delayed arrival of people*
- *lists for excursion and departure will be displayed there*



ETTORE MAJORANA FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE

TO PAY A PERMANENT TRIBUTE TO ARCHIMEDES AND GALILEO GALILEI, FOUNDERS OF MODERN SCIENCE
AND TO ENRICO FERMI, THE "ITALIAN NAVIGATOR", FATHER OF THE WEAK FORCES



INTERNATIONAL SCHOOL OF COSMIC RAY ASTROPHYSICS «MAURICE M. SHAPIRO»

23rd Course: *Multi messenger astroparticle physics*

Directors: J.R. HÖRANDEL – R. SPARVOLI – T.S. STANEV – J.P. WEFEL

20 – 28 July 2024

RESTAURANTS

INFO

ELIMO - Ristorante Panoramico

HOTEL MODERNO

POSTALE 17

LA PRIMA DEA

CAFFÈ PASTICCERIA MICHELE

SFIZIAMO (drinks included)

VENUS

SAN ROCCO

ULISSE RESTAURANT

IL RIFUGIO DI ENEA

closed on Tuesday

closed on Wednesday

closed on Wednesday

closed on Monday

closed on Monday

closed on Wednesday

closed on Thursday

**DRINKS (Mineral Water, Wine, Coffee, etc.) ARE NOT INCLUDED and must be
paid by participants**

Participants staying at the Eugene P. Wigner Institute (San Francesco), Patrick M.S. Blackett Institute (San Domenico) and Isidor I. Rabi Institute (San Rocco) Institutes may have breakfast at the Isidor I. Rabi Institute from 07.30 am to 09.30 am.

Participants staying in the various hotels in Erice may have breakfast in their hotel.

18 July 2024

Meals

- Order from School menu
- Wear your badge
- Sign the list before you leave (cosmic ray astrophysics)
- Pay for your bottled water, wine, coffee, soft drinks and any extras.



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After you have finished your lunch/dinner the waiter will bring a form for you to sign.

There may be other Schools, so please make sure you sign the “Astrofisica” form & not that of another School.

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Payments

If you have not yet paid, please see Alexandro in EMFCSC secretariat



He will also issue receipts for payments



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Certificate of attendance

Some of you may need letters to confirm your attendance at the school for your administration at your institution.

—> contact Jörg Hörandel

(ideally contact me tomorrow or the day after)



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Your Badge

Please wear your badge.

- Gives you access to the institutes
- Is necessary for meals in the restaurants
- Can get you a 10% discount in many shops
- Allows us, the staff, to know who you are
- Helps you to get to know each other

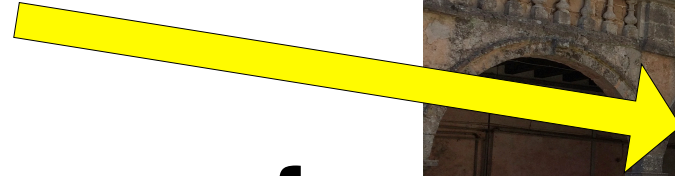


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- breakfast in hotel or in San Rocco
- lunch & dinner in one of the restaurants
- in the evening: informal meeting in piano room

one of the directors needs to be present to open room

absolute silence after 24:00





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Facilities at the Ettore Majorana Centre

- Dirac Lecture Hall in San Domenico
- WiFi is available
- Secretariat is on the lower level of San Rocco
- Washers/Dryers available (right of secretariat)
- Piano room for informal gatherings (left of secretariat)
– the casks of Marsalla are for you to enjoy
- Breakfast/Snack room at bottom of stairs
coffee, tea, water, sandwiches, fruit, biscuits
- Courtyard for meetings/discussions



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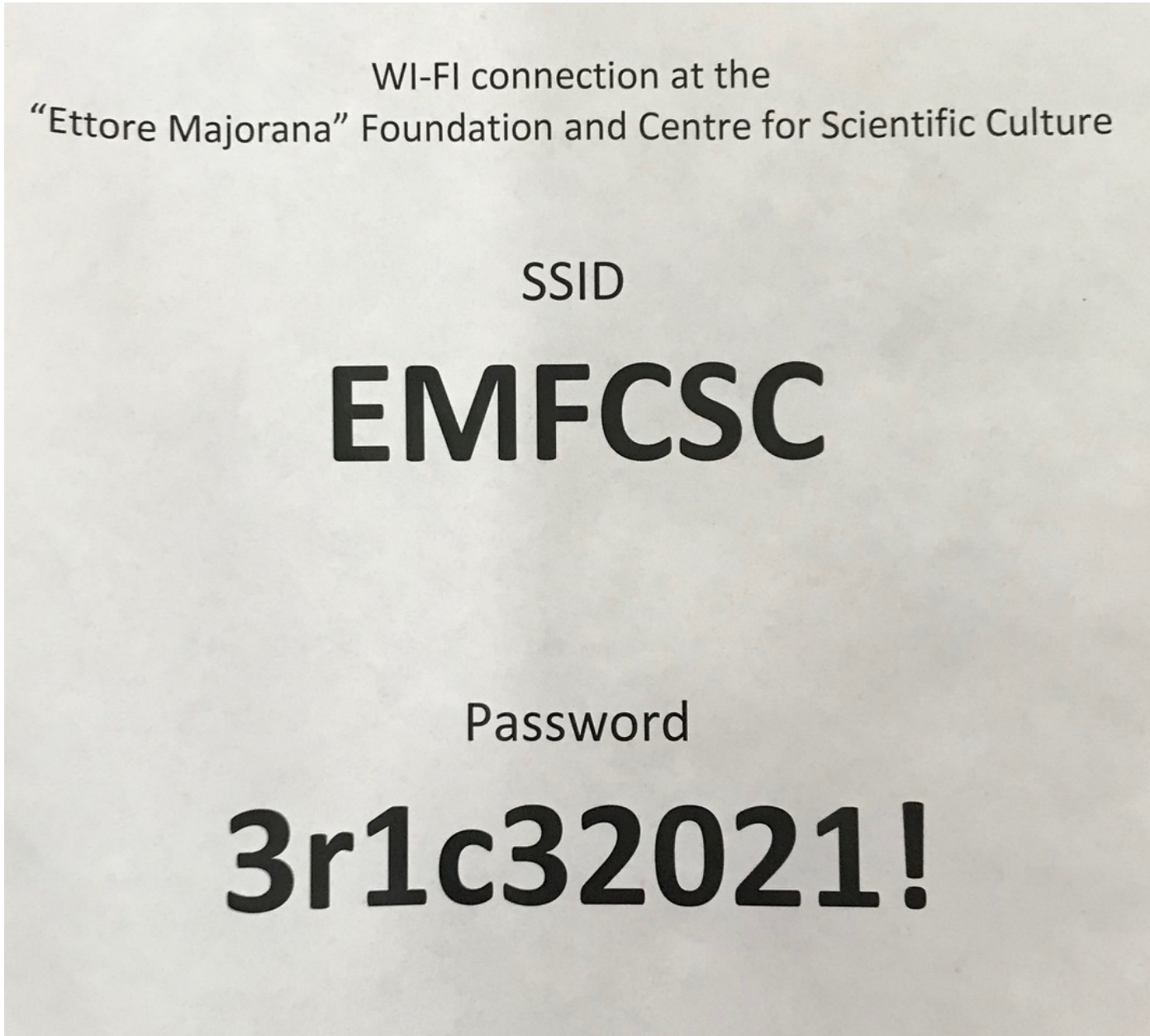
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Getting “LOST” in Erice

- Easy to do, especially after dark
- You are currently at the highest point in Erice
- Sooooo, when in doubt, walk UP-hill and you will eventually get back here
- There is a watchman on duty at the front door 24 hours a day. If locked, ring bell and show *your badge* for admittance.



Excursion on July 26th

please sign up for the excursion (a.s.a.p.)
and specify dietary requirements

bring **Sun protection** (Sun screen), **hat**
we will be outside in the Sun the complete day

we will go to the beach (swimsuit)



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In case of questions, contact one of the directors



Roberta Sparvoli



Jörg Hörandel

*or our scientific
secretary*

00 39 7890 638 035



Arthur Smith

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Lecturers



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Ground-based Gamma-ray Astronomy with Imaging Air Cherenkov Telescopes

Kathrin Egberts



Gamma Ray Astronomy with satellites

Aldo Morselli





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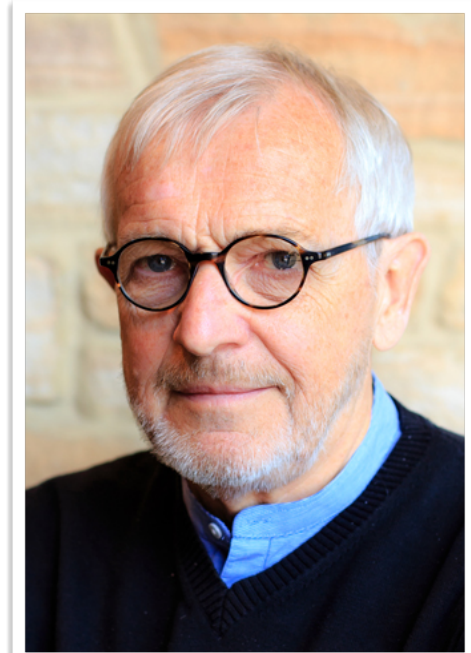
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Neutrino Astronomy Francis Halzen

Gravitational Waves Patricia Schmidt





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Direct measurements of cosmic rays with DAMPE

Paolo Bernardini

Cosmic-ray theory

Carmelo Evoli

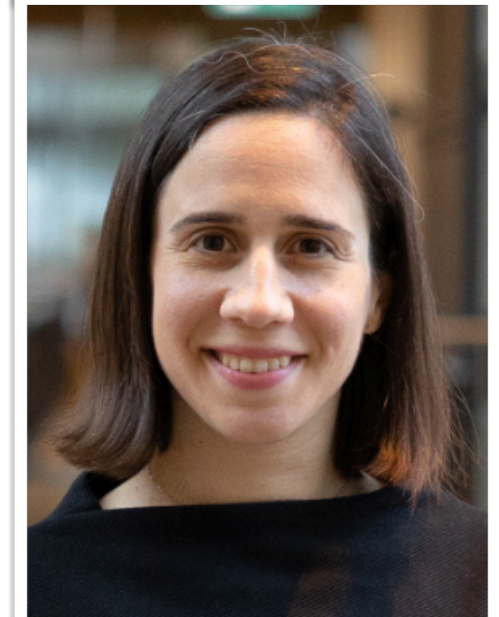




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Ultra high energy cosmic rays Michael Unger

Multi-messenger astroparticle physics Foteini Oikonomou





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Sources of ultra-high-energy cosmic rays

Teresa Bister



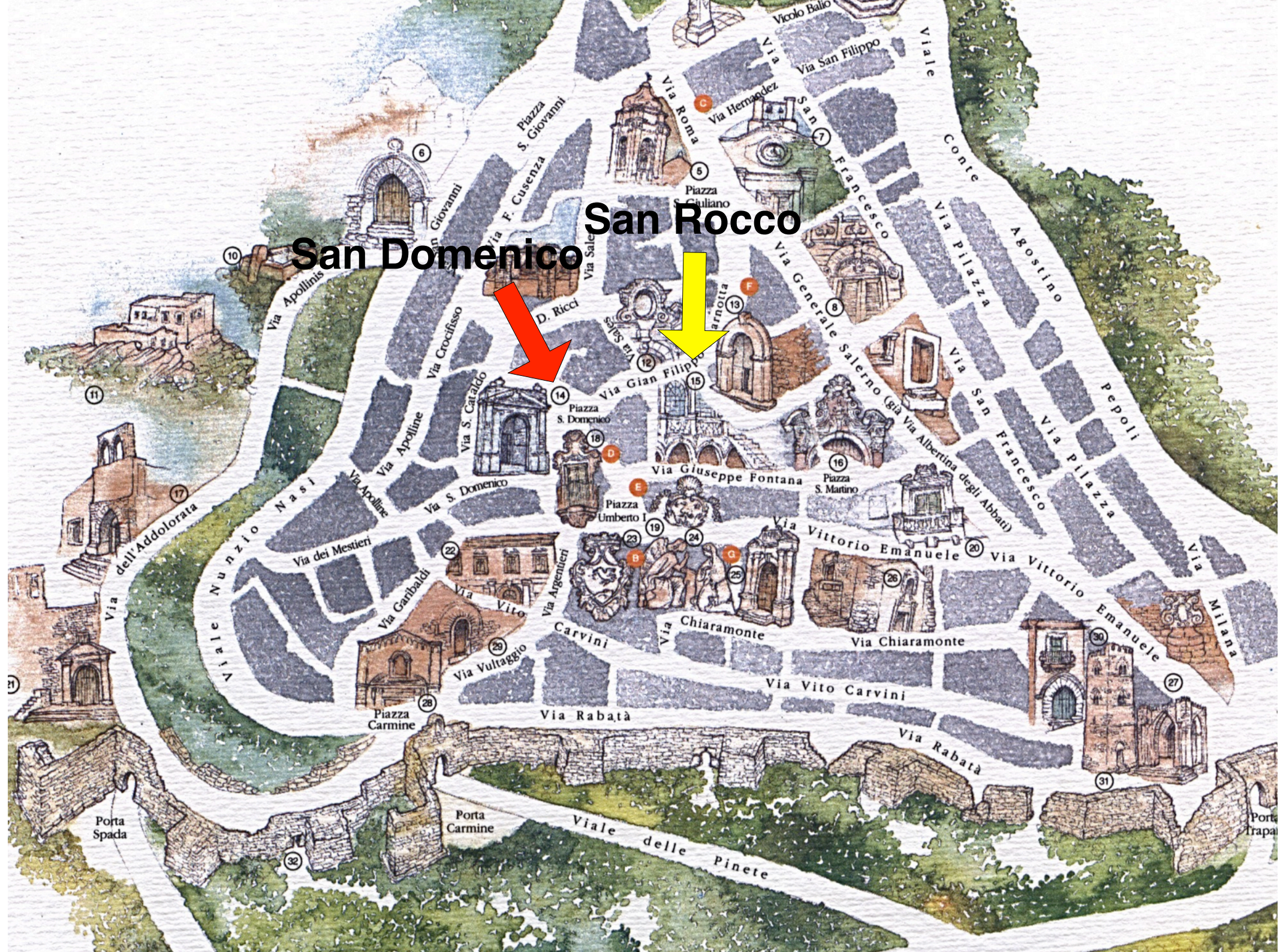
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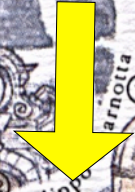
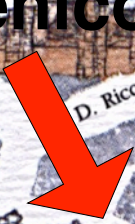
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Introductions

- Let's go around the room and everyone give your name and where you are from
- And say just a word about your work / interests



San Domenico
San Rocco





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< Sat 20/07 Sun 21/07 Mon 22/07 Tue 23/07 Wed 24/07 Thu 25/07 Fri 26/07 Sat 27/07 >

Print PDF Full screen Detailed view Filter

09:00	Opening <i>Erice, Sicily, Italy</i>	Jörg Hörandel 09:00 - 09:15
	Introduction - history of cosmic ray research <i>Erice, Sicily, Italy</i>	Jörg Hörandel 09:15 - 10:15
10:00	Gamma ray astronomy <i>Erice, Sicily, Italy</i>	Kathrin Egberts 10:20 - 11:20
11:00	coffee <i>Erice, Sicily, Italy</i>	11:25 - 11:55
12:00	DAMPE <i>Erice, Sicily, Italy</i>	Paolo Bernardini 11:55 - 12:55
13:00	lunch	





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15:00	Gamma rays (satellites) <i>Erice, Sicily, Italy</i>	<i>Aldo Morselli</i> 15:00 - 16:00
16:00	Contribution of nearby active galaxy nuclei and starburst galaxies to the dipole of ultra-high-energy cosmic rays <i>Caina de Oliveira</i>	
	Searching for MeV-GeV solar-flare neutrinos with KM3NeT <i>Erice, Sicily, Italy</i>	<i>Jonathan Mauro</i> 16:20 - 16:32
	SuperTiger <i>Erice, Sicily, Italy</i>	<i>Nicole Osborn</i> 16:35 - 16:47
17:00	Likelihood reconstruction of neutrino and cosmic ray radio signals <i>Erice, Sicily, Italy</i>	<i>Martin Langgard Ravn</i> 16:50 - 17:02
	coffee <i>Erice, Sicily, Italy</i>	17:05 - 17:35
18:00	Visit to museums <i>Erice, Sicily, Italy</i>	17:35 - 18:35



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Poster presentations

posters will be on display in the San Rocco courtyard

presenters:
be around your poster
to give explanations as
needed

all:
walk around and read
the posters



INTERNATIONAL SCHOOL OF COSMIC-RAY ASTROPHYSICS: • Progress and Problems in Cosmic Ray Physics - 1978 • Acceleration of Particles in Nature - 1980 • Composition and Origin of Cosmic Rays - 1982 • Cosmic Radiation in Contemporary Astrophysics - 1984 • Genesis and Propagation of Cosmic Rays - 1986 • Cosmic Gamma Rays and Cosmic Radiation - 1988 • Cosmic Rays, Supernovae, and the Interstellar Medium - 1990 • Particle Astrophysics and Cosmology - 1992 • Currents in High Energy Astrophysics - 1994 • Toward the Millennium in Astrophysics: Problems and Prospects - 1996 • New Vistas in Astrophysics - 1998 • Astrophysical Sources of High Energy Particles and Radiation - 2000 • Relativistic Astrophysics and Cosmology - 2002 • Neutrinos and Explosive Events in the Universe - 2004 • Astrophysics at Ultra-high Energies - 2006 • Gamma Ray and Cosmic Ray Astrophysics: From below GeV to beyond EeV Energies - 2008 • Astro & Particle Physics: From Underground to Outer Space - 2010 • A New Era in Particle Astrophysics - 2012 • Exploring the High Energy Universe - 2014 • Particle, Gamma-ray and Neutrino Astrophysics in the 21st Century - 2016 • Astroparticle Physics: yesterday, today, and tomorrow - The 40th anniversary of the IS CRA - 2018 • From Cosmic Particles to Gravitational Waves - now and to come - 2022



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IS CRA Modus Operandi

- **This is a School, not a conference, so expect background material as well as results. You are expected, even encouraged, to ask questions after the presentations. *[Remember there are no stupid questions, but there can be stupid answers.]***
- **Equally important is the availability to meet with and question the senior people during meals, coffee breaks, evenings. Ask about science, yes, but also about jobs, funding, visas, conferences or other things – *this is your opportunity !***



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Presentations and Discussion

- **Giovani takes care of the A/V equipment in the lecture hall. See him in advance if you have a question or need to try out a presentation.**
- **Please use the computer at the podium. Load your talk in advance and put it on the desktop.**
- **Use the microphones to ask questions, but turn them *OFF* when not in active use.**
- **We will make all slides available on indico.**



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Sharing the Facilities

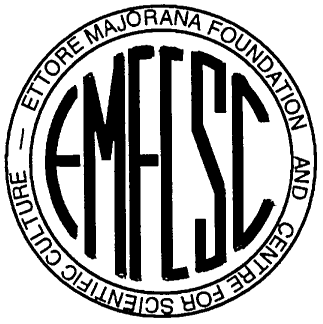
- **There are other Courses/Workshops running simultaneously here.**
- **Everyone will want access to the Piano room (evenings)**
- **Good opportunity to meet new people and learn about a different field**
- **Staff are ‘stretched’ so be patient**



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Reception

- Downstairs in Piano Room
- Two kegs of Marsala wine (sweet and dry) are available for your enjoyment
- Please mix and get acquainted
- BUT, please keep the noise level down since some are trying to sleep.
- Tomorrow we start promptly at 9:00



«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE

INTERNATIONAL SCHOOL OF COSMIC-RAY ASTROPHYSICS
«MAURICE M. SHAPIRO»

23rd Course: “Multi-Messenger Astroparticle Physics” 20 – 28 July 2024

PRESIDENT AND DIRECTOR OF THE CENTRE: PROFESSOR A. ZICHICHI

DIRECTORS OF THE COURSE: PROFESSORS J.R. HÖRANDEL, T. STANEV, R. SPARVOLI - J.P. WEFEL (director emeritus)

WELCOME!