

ISCRA at 40 years

Dr. A. E. Smith

Remember in all that follows how compressed is the time axis.

21 Schools at 5 days per School is 105 days and many Schools were longer than 5 days

In this talk I can only give you a flavour, but maybe this is of more utility than many details.

What I have personally experienced and learned from senior people.

Loosely based on a talk by Prof. Wefel in 2016.

40 years is a long time in human life, two generations and not many (marriages) last that long.

4 people still married to the same passion after 40 years (a Ruby marriage) is remarkable.

(US) Only ~ 10% of marriages last for 40 years

Many of the young attendees on the 1st night seemed pessimistic of the world.

Have things got worse in the 40 years of the School?

| World Population | 1978 | 2008 | Change |
|------------------|----------------|----------------|----------------|
| | 4.3 billion | 7.6 billion | ~2x |
| Growth | 1.8% | 1.1% | |
| World Economy* | \$18.8 billion | \$77.9 billion | ~4x |
| | | | |
| At 1.1% pop | will double in | 66 years, but | growth slowing |

* contemporary \$

1970's Energy crisis, Peak oil, 'experts' said all oil gone by 2000.

Wind, wave, solar negligible

Mad max scenario of a world with out oil

East and west, nuclear daggers drawn, at each other's throat.

Machining mostly by hand, accurate to maybe 25 microns.

No internet, slow & very expensive computers.

1978

Jimmy Carter (Physicist) US president humiliated by Iranian hostage and rescue failure.

Replaced by Ronald Reagan: hated and loathed by many as is Trump now.

Manufacturing too limited to satisfy demand. Too much money chasing too few goods—Inflation

2018

Renewable energy, UK now 30% and growing fast

Internet, makes us all super human in what we know and how we communicate

Machining routinely to 1 micro meter, additive 3D printing now common = sophisticated instruments

Super fast and inexpensive computers, e.g. Arduino a few \$ each = low cost data acquisition, theoretical calculation

Rise of China to become one of the great Scientific nations and with manufacturing that can produce in volume anything, no longer inflation.

Re-useable rockets, lower cost access to space.



Vala Afshar ✓

@ValaAfshar

Storage cost of 1 GB:

1981 \$300K

1987 \$50K

1990 \$10K

1994 \$1K

1997 \$100

2000 \$10

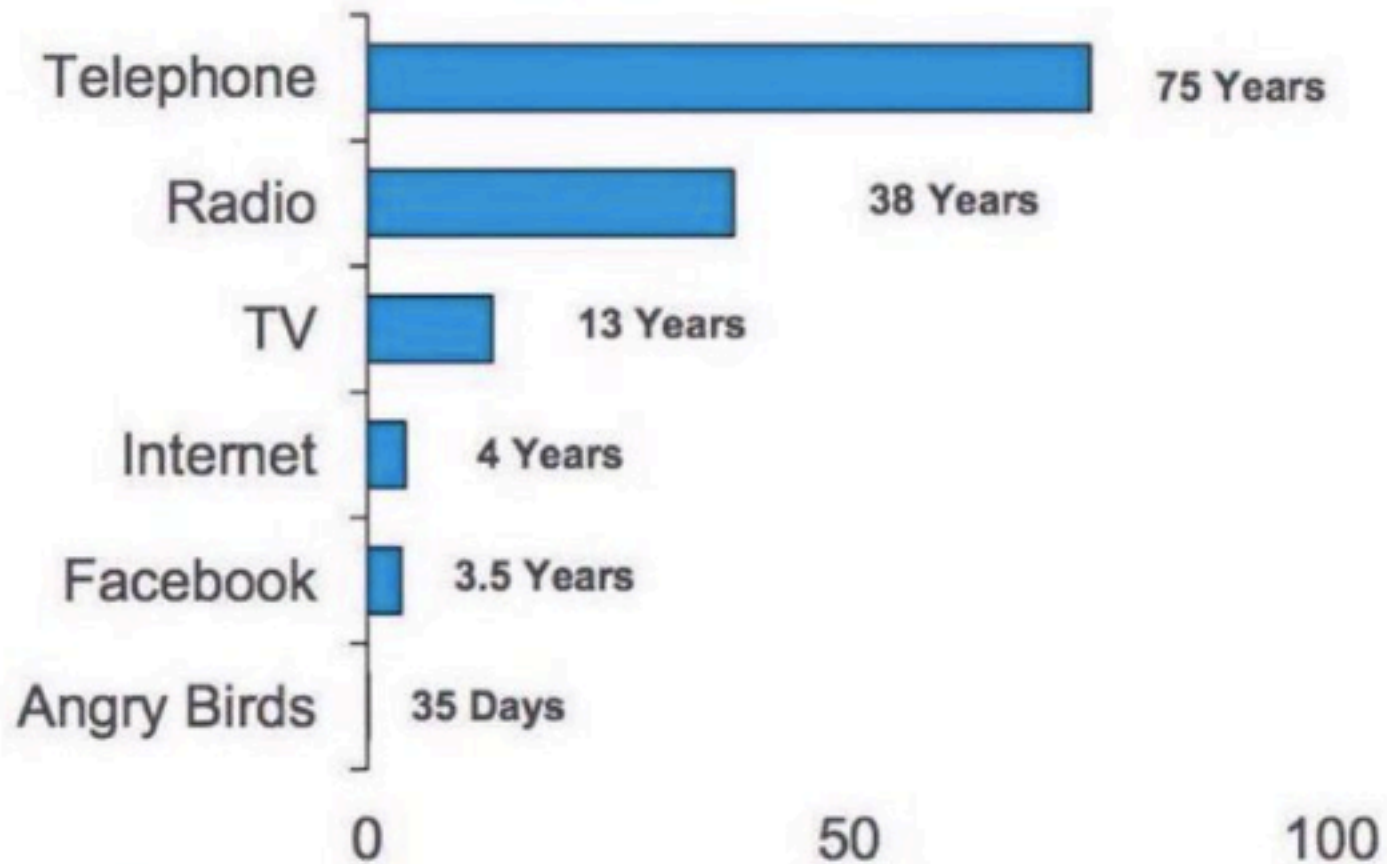
2004 \$1

2012 \$0.10

100GB : Free via Box

10:41 AM - 3 Nov 2014

Figure 5. Time to reach 50 million users



Source: Citi Digital Strategy Team

**No indication that the rate of advancement
is slowing,**

It continues to accelerate,

Amazing.

1970's Great concern for the future of humanity

Concern for scientists being compelled to work on things they dislike

Prof Zichichi realised scientists needed a place to meet, discuss, promote the universality of scientific knowledge and freedom for scientists.

- Winston Churchill:
- **The brain of a modern man does not differ from that of the human beings who fought and loved years ago, under sufficient stress—starvation, terror, warlike passion, modern man will do terrible deeds.**
- **We need to guide ourselves to do good things and the Erice statement is a good start.**
-

1972 World Federation of Scientists by I.I. Rabi and A. Zichichi

1982, P.A.M. Dirac, P. Kapitza, and A. Zichichi drafted the **ERICE Statement, which has guided the work of the EMCSC and the WFS ever since.**

ISCRA has adhered to the principles of EMCSC and the WFS and has received supported from them and their sponsors.

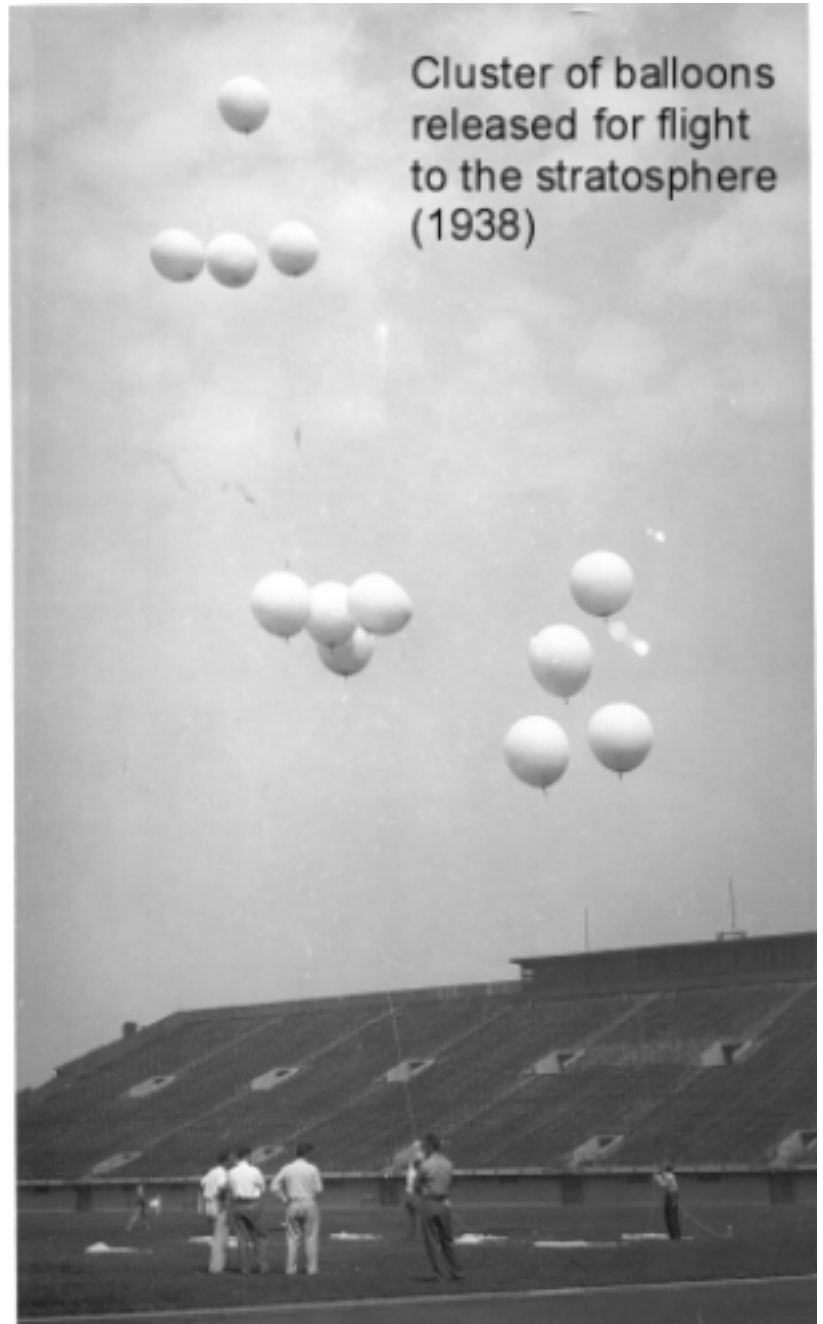
Prof. Shapiro had a passion for science, a gift of birth like all of you here. The EASY part

He CHOOSE to promote science, to help young researcher, to be kind, to remember the giants, steadfast against anyone he thought misleading the young researchers.

Any lecture, no matter of seniority or youth, who made a statement he thought misleading knew about it, if I didn't type up the schedule as he wanted, it came back.

Prof. Shaprio's science career began as a child when he read of Hess and was smitten with a love for cosmic rays

- Arthur Compton in his home town of Chicago drew him**
- He read that photographic emulsion could register radiation, he studied and wrote a report about how to detect cosmic rays.**
- Compton liked it and he was admitted as a research student: He was student and mentor**





1. A. H. Compton
 2. A. Duibo
 3. M. S. Villars
 4. C. Anderson
 5. V. F. Hess
 6. W. Doke
 7. W. Heisenberg
 8. L. Clay

9. W. F. G. Swan
 10. G. Herzog
 11. Beeler
 12. W. D. Harkins
 13. S. Nudlermeyer
 14. T. H. Johnson
 15. F. Auger
 16. B. Rossi

17. J. R. Oppenheimer
 18. S. Goudsmit
 19. E. Teller
 20. R. Brook
 21. H. Bethe
 22. C. G. Montgomery
 23. W. E. B. DuBois
 24. L. Nordheim

25. S. E. Forbush
 26. V. Wilson
 27. J. Wheeler
 28. M. Tomerani
 29. D. Teresi
 30. R. Serber
 31. E. Wolf
 32. M. M. Sapiro

33. C. Eckart
 34. D. Hughes
 35. W. J. J. J. J.
 36. J. B. Hoag
 37. N. F. Phillips
 38. P. G. Gill
 39. A. Stoll

[Note: Participants in group photo taken in 1939 identified by the author (in 2002) when possible]
 International Cosmic-Ray Conference, Chicago, 1939

Fig. 1.

Shapiro was born in 1915, making him 24 in 1939.

He delighted in Chicago and sport, asked Enrico Fermi if he would play him at tennis.

Shapiro had a jalopy of a car which when it rained there was more rain inside than out but he got it a number plate 137000 which Fermi noticed.

Fermi won the Nobel Prize in 1938 for a mistake, believing that by adding neutrons to heavy elements he was creating super heavy elements

Fermi never gave the prize back.

Happy Science interrupted by war, Shapiro was summoned to Los Alamos.

He met the giants of that project, describing Feynman as 1000 times smarter than he was.

He knew Harry Daggian & Louis Slotin, killed in criticality experiments that he thought un-needed

Witnessed the first nuclear test (Trinity). Rocket engineers said rockets would win the war. A small bet that the atomic bomb would and he collected his winnings.

One has to be careful of “Man with a hammer syndrome” who sees every problem as a nail. Often experts in one field do not have a wider view and make big errors.

He knew Oppenheimer and was distressed by political troubles that came to him.



Prof. Shapiro Los Alamos ID

He was chair of the Association of Los Alamos scientists who lobbied for democratic and International control of nuclear energy.

As the defence work reached its conclusion, he was able to complete his translation of “What are Cosmic Rays” by Pierre Auger that was published in January 1945, second impression April 1945.

- **After defence a dream job came as branch head in a new program at the naval research laboratory, 33 productive and exciting years followed.**

Worked on DUMAND, forerunner of the great observatories that are now producing so much.

- **Love of cosmic rays was too deep within him for retirement, he accepted an invitation from Prof. Zichichi to direct his first School in 1978.**

- **But it was not these great and happy achievements that set me on the course to become the School secretary.**

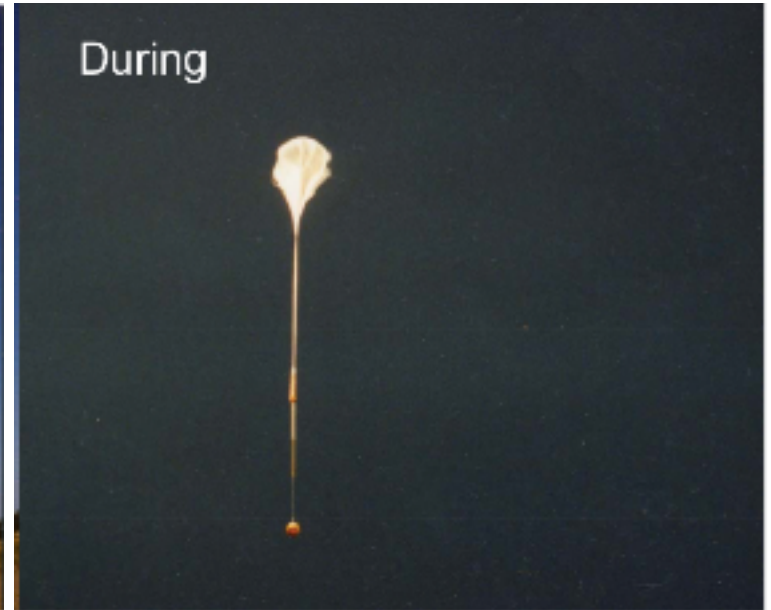
In the 1980's a Korean researcher (Dr. Kyoung Hye Moon) had completed her PhD and needed a job, like many of you. She found her next job working for Prof. Wefel in the US, 1988 she came to this School.

I met her when I moved to Marshall Space Flight centre in Alabama. She worked on emulsions which I thought obsolete but she defended her research with eloquence and passion & I respected her.

At the 1993 ICRC in Calgary Kyoung Hye introduced me to Prof. Shapiro and told me of ISCRA.

Kyoung Hye planned to come to the 1994 School.

Meanwhile I was flying a balloon borne cosmic ray detector.



**What could be worse?
Alas this was nothing.**



**One day Kyoung called me to her office and said she has an illness
Someone who just got a karate brown belt sick? Her instructor called her little dynamite, but a terrible cancer had come.**

•Unbowed, she wrote to Prof. Shapiro telling him of her illness and that she would return to Korea but that she did not want to lose her chance to come to his School.

But we lost her! I came to the 1994 School in her memory.

She was so strongly in my purpose bred that all the world besides me though was dead. (slightly modified Shakespeare Sonnet 112)

At my first School I was asked by Prof. Wefel to chair a session, with Ginsberg who went over time. I tried once to stop him, but there was no way he would stop till he wanted to.

His passion brought a Nobel Prize in 2003 and success in many fields.

People will say that luck played a large part in the success of X, but the best people have luck in many fields.

as Newton said:

If others would think as hard as I did they would have similar results.

Simplified:

Luck is when Preparation meets Opportunity

John Mather was also there, he won the Nobel prize for his work on COBE in 2006

But we are getting ahead of history of the School.

Beginning in 1978 there has been a great sequence of advanced study covering all the important developments in Cosmic Rays and associated disciplines.

International School of Cosmic-Ray Astrophysics

First Course: PROGRESS AND PROBLEMS IN COSMIC-RAY PHYSICS

ERICE - TRAPANI - SICILY: 22 JUNE - 6 JULY 1978

Sponsored by the: Italian Ministry of Public Education
Italian Ministry of Scientific and Technological Research
North Atlantic Treaty Organization
Sicilian Regional Government

PROGRAMME AND LECTURERS

LECTURES

A) The Astrophysical Context and Background Ex. Cosmic-Ray Studies

B) Cosmic-Ray Composition

- (1) The arriving nuclei: elemental composition, nuclei composition, cosmic composition; references regarding size and nature of sources.
- (2) Electrons and positrons: information regarding the distribution and regions of confinement.
- (3) Cosmic γ -rays: from discrete sources, diffuse γ -rays, and inferences about the structure of the galaxy.
- (4) Cosmic sea level ν particles and their origin. Neutrinos from new neutrino formation; neutrinos from supernova shells, within our galaxy and from other galaxies; neutrinos from nuclear collisions in the interstellar gas; the background of neutrinos generated in the earth's atmosphere. Reported schemes of detection, especially -DUMAND-.

C) Origin

- (1) Sites and processes of production: synthesis of the cosmic-ray material, e.g. in supernova events.
- (2) Models of injection and acceleration, e.g. acceleration of ions by turbulent acceleration by solar wind; role of selective injection; acceleration.
- (3) Acceleration in various astrophysical environments.
- (4) Problems of adiabatic losses.
- (5) Extragalactic cosmic rays.

D) Cosmic-Ray Propagation and Confinement

- (1) The leaky box model.
- (2) The "closed galaxy".
- (3) Composite models.

E) Special Topics

- (1) The highest energy cosmic rays ($> 10^{17}$ eV): can they be galactic in origin? If so, what astrophysical are expected? Extensive air showers - improved methods of measurement?

(2) The low-energy cosmic rays, say, 1 to 50 MeV μ

Discuss: how recently is our knowledge of the interstellar medium shared by modulation? By adiabatic deceleration? Other energetic particles observed in the solar system: solar flare particles; the + numerous cosmic-ray particles in the radiation belts.

F) Other Special Topics (for seminars, workshops, panel discussions):

Pulsar acceleration, radioastronomy and gamma-rays, recent data on cosmic waves, the galactic wind, transition radiation, observations of extensive air showers, new techniques in cosmic-ray research.

LECTURERS

- W. I. ANFORD, Lindau, W. Germany
P. H. FOWLER, Bristol, UK
V. L. GINZBURG, Moscow (Lobachev), USSR
S. HAYAKAWA, Nagoya, Japan
E. N. PARKER, Chicago, Illinois, USA
B. PETERS, Copenhagen, Denmark
K. PINKAU, Munich, W. Germany
E. KAMATY, Greenbelt, Md. (NASA), USA
H. KEEVES, Paris, France
F. RINES, Irvine, California, USA
E. ROSSI, Cambridge, USA and Palermo, Italy
D. N. SCHRAMM, Chicago, Illinois, USA
M. M. SHAPIRO, Washington, D.C., USA
R. SILBERBERG, Washington, D.C., USA
J. A. SIMPSON, Chicago, Illinois, USA
C. J. WASHINGTON, Minnesota, USA
A. W. WOLFENDALE, Durham, UK
G. T. ZATSEPIN, Moscow, USSR

International School of Cosmic Ray Astrophysics – First 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.



The 1st International
School of Cosmic Ray
Astrophysics (1978)
Director of the School
M. M. Shapiro

- | | | | | | | | |
|-------------------|--------------------------|--------------------|----------------------|--------------------|--------------------|--------------------|--------------------|
| 1 | 2 Jeremy Lloyd-Evans | 3 | 4 | 5 | 6 J. Kempler | 7 | 8 |
| 9 Ellen Zweibel | 10 | 11 | 12 Juan Perez Mendez | 13 | 14 John Clifford | 15 Jake Waddington | 16 Maurice Shapiro |
| 17 Juan Sequiros | 18 | 19 | 20 Maria Giller | 21 | 22 | 23 | 24 Rudolph Benjean |
| 25 | 26 Javier Ottaola | 27 | 28 Helena Dilokon | 29 | 30 Einar Juliusson | 31 | 32 |
| 33 | 34 | 35 Rein Silverberg | 36 | 37 Ramanath Cowsik | 38 | 39 | 40 |
| 41 | 42 Reinhard Schlickeiser | 43 | 44 T. Gregory Gzlik | 45 | 46 | 47 Peter Fowler | 48 John Lindsay |
| 49 Piero Galeotti | 50 | 51 | 52 S Hayakawa | 53 | 54 Fred Reines | 55 David Schram | 56 |
| 57 Todor Stanev | 58 John Cooper | 59 Simon Swardy | 60 Steve Jordans | 61 | 62 Reuven Ramaty | 63 | 64 |
| 65 | 66 Arnold Wolfendale | 67 | 68 Alan Watson | 69 | | | |

Greatly increased opportunities for females:

Solvay conference 1920's to 1930's

**Number of female attendees ~1/30 ~ 3%
(Marie Curie)**

1978

Number of female attendees ~6/64 ~ 9%

2018

Number of female attendees 31/81 ~ 38%

Whether anyone at the first School of 1978 thought the Centre could survive and thrive is unknown, but there was a feeling then that it was something special and a remembrance was made.

A "Composition" by 'some' Attendees at the First Course

**TODAY in the Erice Maze
Cosmic Rays are the Craze
and this because
a Guy Named Hess
Ballooning Up
Found More not Less.***

*The EDELWEISS Consortium
Supported only in part by NATO,
DOE, NSF, NASA, PDQ

MCMLXXVIII A. D.†

†TRAGIC**

**Loose Translation From Ancient Punic

TODAY IN THE ERICE MAZE
~~THE COSMIC RAYS ARE THE CRAZE~~
LE RAYONS COSMIQUES SONT
LE COSMIC RAY ARE THE CRAZE
AND THIS BECAUSE
A GUY NAMED HESS
BALLOONING UP
FOUND MORE NOT LESS.*
* THE EDELWEISS CONSORTIUM
~~SUPPORTED~~
SUPPORTED * ONLY IN PART BY
* NATO, DOE, NSF, NASA,
PDQ, *
MCMLXXVIII A.D.†
~~TRAGIC~~ TRAGIC**
** LOOSE TRANSLATION
FROM ANCIENT PUNIC

Copy of Original – handwriting believed to be
Fred Reines (Courtesy T. G. Guzik)

This was taken to one of the local Ceramic Studios and was converted into a stylish wall plaque. Two copies were made. One remained in Erice and the other returned to the University of Chicago where it hung for many years outside John Simpson's office. [Currently, neither plaque has been found.]

The School, did more than survive, it prospered.

It is hard to find anyone senior in the Astroparticle physics community who has not been to a School.

This could not have happened without the strong support of the Centre and its staff and most importantly from the passion of the directors & Co directors over 40 years:

Prof. Shapiro

Prof. Silberberg

Prof. Stanev

Prof. Wefel

Prof. Ptuskin

Prof. Hörandel

All the directors have worked tirelessly

Best lecturers

Funding

Evolving with the subject

Attendees from all over the planet.

Some Schools had NATO funding, the idea being that bringing together scientists from East and West would reduce tensions and from these prosperous times came many School publications.

**Prof. Shapiro set up a charitable foundation:
Astrophysical Associates.**

**Physicists are not good at selling, too focused on
logic, no emotional skills, but Shapiro knew
the School needed money and in return
for donations he would have the recipients of these
funds write to thank the benefactors.**

**One of my first jobs was helping prepare certificates
for the fellowships that he gave out.**

Acceleration of Particles in Nature - 1980

The EARLY YEARS

Need Help to fill in some of the Details

In 1981, Prof. Shapiro retired from his position of Chief Scientist and Head of the Lab for Cosmic Ray Physics at the Naval Research Laboratory (Washington, DC) after 33 years. He then became a Visiting Professor at the University of Iowa, University of Bonn, MPI fur Astrophysik in Munich and the University of Maryland. He was able to devote much of his time to the organization of the Courses of the ISCRA.

International School of Cosmic Ray Astrophysics – Third Course

Composition and Origin of Cosmic Rays - 1982

Course held as a NATO Advanced Study Institute with “Proceedings”

“*Composition and Origin of Cosmic Rays*”, M. M. Shapiro, Editor, NATO ASI Series C, No. 107, [D. Reidel, 1983, Dordrecht, Holland] 414p. (ISBN 90-277-1609-9)

20 – 30 June, 1982

Lectures/Papers:

| | |
|------------------|----------------|
| J. A. Simpson | P. O. Lagage |
| W. R. Webber | M. Casse |
| M. H. Israel | G. Burbidge |
| M. E. Wiedenbeck | V. Z. Peterson |
| O. C. Alkofer | M. Grande |
| R. J. Protheroe | N. McGowan |
| A. M. Hillas | G. J. Matthews |
| M. N. Vahia | R. Silberberg |
| S. Biswas | J. R. Letaw |
| C. J. Cesarsky | D. Kazanas |
| | P. Galeotti |

R. C. Svoboda
J. U. Schott
B. Rossi
C. H. Tsao

Major Topics:

Composition and Energy Spectra
Acceleration, Propagation and Sources
Muons and Neutrinos in CR Physics and Astrophysics
Techniques of Observation and Calculation
Related Topics (gamma rays, proton decay, HZE radiation effects)

SPECIAL LECTURE: Bruno Rossi

“The decay of ‘Mesotrons’ (1939-1943) – Experimental Particle Physics in the Age of Innocence”

International School of Cosmic Ray Astrophysics – Fourth Course

Cosmic Radiation in Contemporary Astrophysics - 1984

Another NATO Advanced Study Institute with a publication:

“Cosmic Radiation in Contemporary Astrophysics”, M. M. Shapiro, Ed., NATO ASI Series C: No. 162 [Reidel, 1986, Dordrecht, Holland], 274 p. (ISBN 90-277-2144-0)

Major Topics;

Composition

Acceleration

Origin and Propagation

Anisotropies

Gamma Rays, Cosmic Rays and the ISM

Cosmic X-rays and Quasars

Purpose: This course will focus on the interdisciplinary phenomena in cosmic ray astrophysics whose understanding requires input from the other channels in astronomy.

Major Players:

G.F. Bignami, Milan, IT

R. Ekers, Socorro, NM

W. Kundt, Bonn, DE

W.H.G. Lewin, Cambridge, MA

N. Lund, Denmark

R. Schlickeiser, Bonn, DE

M. Schmidt, Pasadena, CA

J. Trümper, Munich, DE

J. Wdowczyk, Lodz, PL

A. Wolfendale, Durham, UK

International School of Cosmic Ray Astrophysics – Fifth Course

Genesis and Propagation of Cosmic Rays - 1986

A NATO Advanced Study Institute, 1-9 June 1986

“Genesis and Propagation of Cosmic Rays”, M.M. Shapiro and J.P. Wefel, Eds., NATO ASI Series C: Vol. 220, [Reidel, 1988, Dordrecht, Holland, 476p. (ISBN 90-277-2628-0)]

Demographics: 64 participants

France (1), Canada (1), Nigeria (1), Greece (2), India (1), Mexico (1), S. Africa (1), Ireland (1), Bulgaria (1), Poland (1), England (9), Germany (12), USA (21), Italy (11)

Sponsors:

NATO (1.74M BF), European Physical Society, US National Science Foundation, Italian Ministries, Sicilian Regional Government

Highlights:

Radio-astronomy and Cosmic Rays, TeV Gamma Rays, Stars and Cosmic Rays, AGN's, X-ray Background, Pulsars

International Advisory Committee:

M.M. Shapiro, MPI, Bonn

P. Auger, Paris, FR

G.P.S. Occhialini, Milan, IT

B. Rossi, MIT, USA

J.A. Simpson, Chicago, USA

R. Silberberg, NRL, USA

J.A. Van Allen, Iowa, USA

A. Zichichi, EMCSC, Erice, IT

International School of Cosmic Ray Astrophysics – Sixth Course

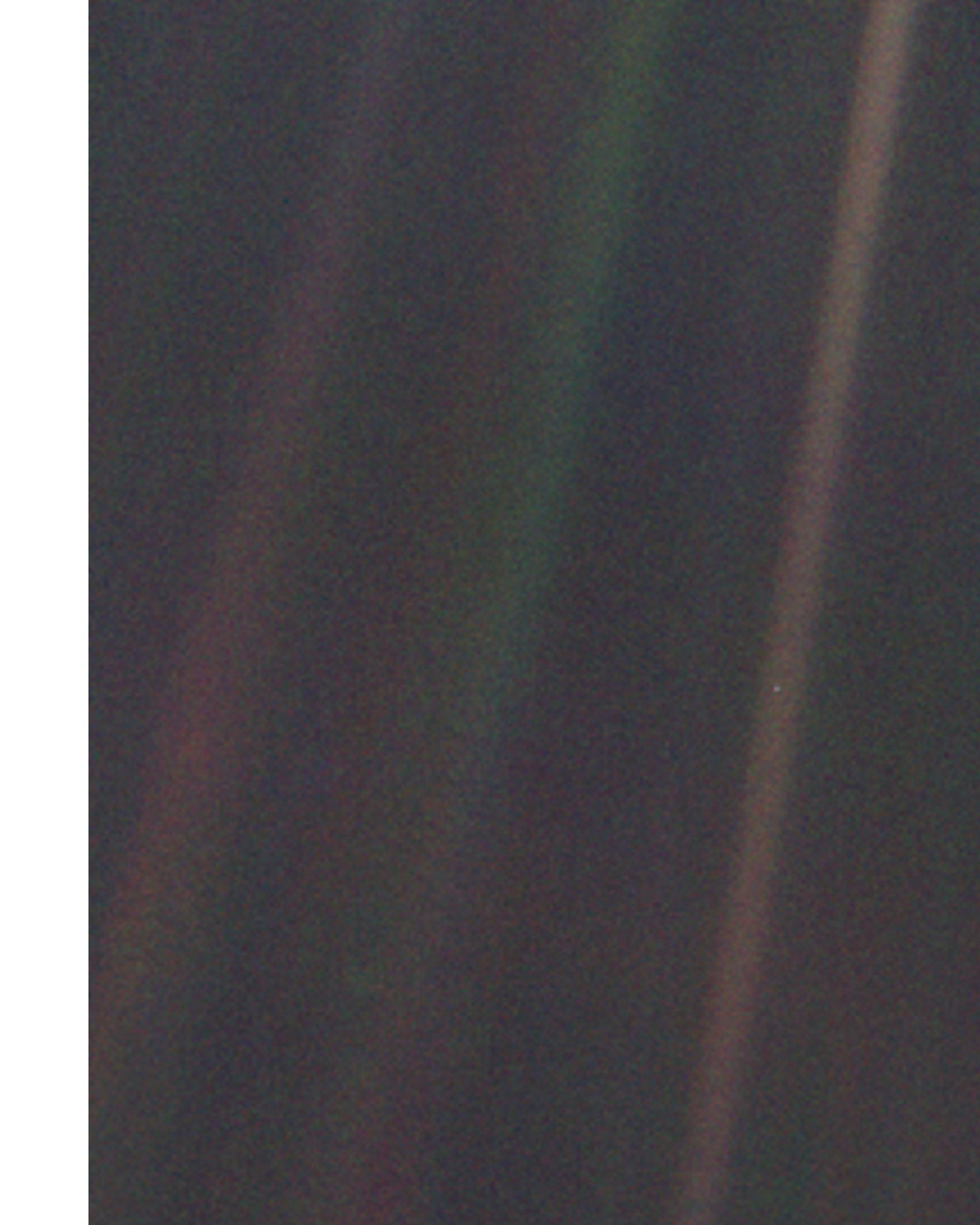
Cosmic Gamma Rays and Cosmic Neutrinos - 1988

A NATO ASI – 20-30 April 1988

“Cosmic Gamma Rays, Neutrinos, and Related Astrophysics,” M.M. Shapiro and J.P. Wefel, Eds., NATO ASI Series C: Vol. 270, [Kluwer, 1989, Dordrecht] 692 p. (ISBN 0-7923-0159-5)



Special Topic -- SN 1987A



February 1990, Carl Sagan
had Voyager 1 photograph
where it was born 6 billion
kilometers (3.7 billion miles,
40.5 AU

Every human
kindness, every
human cruelty,
everything human
happened on that
pale blue dot.

International School of Cosmic Ray Astrophysics – Seventh Course

Cosmic Rays, Supernovae, and the Interstellar Medium - 1990

A NATO ASI: 26 July – 5 August, 1990

“Cosmic Rays, Supernovae and the Interstellar Medium”, M.M. Shapiro, R. Silberberg and J.P. Wefel, Eds., NATO ASI Series C: Vol. 337, [Kluwer, 1991, Dordrecht], 350p. (ISBN 0-7923-1278-3)

Lecturers: Dogiel, Drury, Greenberg, Ptuskin, Shapiro, Silberberg, Simon, Wefel, White, Wolfendale, Zichichi

Topics: Gas & Dust in ISM, Cosmic Rays and Supernovae, Gamma Ray Astronomy, X-ray Binaries, Molecular Clouds, Propagation, Composition, Acceleration, Gamma Ray Lines and more

Special Events:

E. Schopper, Frankfurt, “Cosmic Radiation as a Parameter of Life”

K. Sakuri, Tokyo, “Art and Architecture in Ancient Japan”

A. Zichichi, Geneva, “New Physics and New Technology”

Various Participants -- Musical Interlude

Summer Public Concert Series at the Erice Cathedral

As with 88, the color pictures from 1990 are among the missing

International School of Cosmic Ray Astrophysics – Eighth Course

Particle Astrophysics and Cosmology - 1992

A NATO ASI – 20-30 June, 1992

“Particle Astrophysics and Cosmology”, M. M. Shapiro, R. Silberberg and J.P. Wefel, Eds., NATO ASI Series C: Vol. 394, [Kluwer, 1993, Dordrecht], 168p., (ISBN 0-7923-2235-5)



**Special Lecturer
William “Willy” Fowler,
Nobel Laureate from
Cal Tech, shown with
Jim Connell from
Chicago**

Cosmology Focus:

Age of the Universe,
Nucleosynthesis in the Early
Universe, An Inflation Primer,
Fluctuations in the CMB

International School of Cosmic Ray Astrophysics – Ninth Course

Currents in High Energy Astrophysics - 1994

A NATO ASI: 7 – 18 May, 1994

“Currents in High Energy Astrophysics”, M.M. Shapiro, R. Silberberg and J.P. Wefel, Eds., NATO ASI Series C: Vol. 458, [Kluwer, 1995, Dordrecht], 336p. (ISBN 0-7923-3354-3)



Visit by Maury's Family

Lecturers: H-J Blome, R. Ekers, V. Ginzburg, F. Graham-Smith, G. Kanbach, G. Kristiansen, J.C. Mather, Y. Ne'eman, M. Shapiro, R. Silberberg, T. Stanev, J. Wefel

Topics:

Cosmic Gamma Rays, X-rays, and Neutrinos: Compton Gamma Ray Observatory, Gamma Ray Bursts, High Energy X-ray Emission & X-ray Binaries, Solar and Supernova Neutrinos & Neutrino Masses

Cosmic Rays: Source Composition, HiRES, HEGRA, Tibet Array, Acceleration by Black Holes and Cosmic Strings, Dynamic Halo & Heliosphere

Pulsars and Supernova Remnants: Pulsar Physics & Dynamics, Synchrotron & Inverse Compton Radiation in SNR

Cosmology: Big Bang from COBE, Inflation and the “Top”, Galaxy Formation, New Ways in Cosmology

International School of Cosmic Ray Astrophysics – Tenth Course

Toward the Millennium in Astrophysics: Problems and Prospects 16 – 23 June 1996



“Towards the Millennium in Astrophysics – Problems and Prospects”, M.M. Shapiro, R. Silberberg and J.P. Wefel, Eds., Science and Culture Series – Astrophysics, A. Zichichi, Series Ed., [World Scientific, 1998, Singapore], 408 p. (ISBN 981-02-3329-9)

Major Topics:

The High Energy Frontier: UHECR, Topological Defect Models, AUGER, EAS as a tool, HEGRA, KASCADE

Cosmic Gamma Rays and Neutrinos: GRBs and TeV counterparts, High Energy tails to GRBs, Sources of HE Neutrinos, SPASE & AMANDA in Antarctica.

Cosmic Matter and Anti-matter: Propagation and nuclear interactions, AMS experiment, NINA experiment, Reacceleration models

Energetic Particles in the Solar System: High Energy Gamma rays and Neutrons from the Sun, Turbulent current sheets, Cosmogenic Nuclides, Forbush Decreases

Galactic Astrophysics: Accretion Disks, Structure Formation, Galaxies in Rich Clusters, hard X-rays observed by PROGNOZ-9



De-classified document showing Naval Research, Cosmic Ray group publications in 1968



Comparison of Elemental and Isotopic Methods of Deducing Cosmic-Ray Confinement Time, by M. M. Shapiro and R. Silberberg. *Amer. Phys. Soc. Bull.* 13:694 (1968)

Considerations Affecting the Estimation of Cosmic-Ray Age, by M. M. Shapiro and R. Silberberg. *Can. J. Phys.* 46:S561, May 15, 1968

Cosmic Ray Abundances Measured at Near-Equatorial Latitudes above the Atmosphere, by F. W. O'Dell, M. M. Shapiro, R. Silberberg, B. Stiller, C. H. Tsao (NRL), N. Durgaprasad, C. E. Fichtel, D. E. Guss, and D. V. Reames (NASA-Goddard). *Am. Phys. Soc. Bull.* 13: 694 (1968)

Cosmic-Ray Nuclei, by M. M. Shapiro. *Astronaut. & Aeronaut.* 6:6, July 1968

Rene Silberberg had been with Prof. Shapiro for many years at the Naval Research Laboratory and was responsible with C.H. Tsao for much of the groups work. He was also a major help with ISCRA, but alas we lost him.

International School of Cosmic Ray Astrophysics – 11 th Course

20th Anniversary Course: New Vistas in Astrophysics – 15-23 July 1998



“**New Vistas in Astrophysics**”, M.M. Shapiro, R. Silberberg, T.S. Stanev and J.P. Wefel, Eds., Science and Culture Series – Astrophysics, A. Zichichi, Series Ed., [World Scientific, 2000, Singapore], 378p. (ISBN 981-02-4169-0)

Featuring: Felix Mirabel (Saclay)-*Microquasars*; Eugene Loh (Utah)- *Highest Energy CR*; Norma Sanchez (Paris) & Francesco Sylos-Labini (Geneva)- *Fractal Structure of the Universe*; Francis Halzen (Wisconsin)- *High Energy Neutrino Astronomy & AMANDA*; Frank Jones (NASA)- *Shock Acceleration of Particles*; Paulo Macedo (Portugal)- *Magnetic Fields, Scalar Fields and Anisotropies in the Universe*; Robert Hellming (Socorro, NM)-*Radio Astronomy* ; Livio Scarsi (Palermo)- *AIRWATCH & the X-ray afterglow of GRBs*; Martin Harwit (Washington, DC)- *The Infrared Sky*; Chris Burrows (Baltimore)- *New Results from Hubble Space Telescope*; Piero Galeotti (Torino)- *Experiments at Gran Sasso*; Thomas Boller (Garching)- *X-ray Results from ROSAT & AGN*; Todor Stanev (Bartol)- *Neutrino Oscillations*; Lev Dorman (Israel)-*Cosmic Ray Anisotropies*; John Wefel (Louisiana)- *Anti-matter in Cosmic Rays*; Maurice Shapiro (Washington, DC)- *Astrophysics and Cosmology & Extra-Solar Planets.*

PLUS an Anniversary Celebration



International School of Cosmic Ray Astrophysics – 12th Course

Astrophysical Sources of High Energy Particles and Radiation

A NATO ASI: 11–21 November, 2000 (Co-Directors: J.P. Wefel and V.S. Ptuskin)

“**Astrophysical Sources of High Energy Particles and Radiation**”, M.M. Shapiro, T. Stanev and J.P. Wefel, Eds., NATO Science Series II, Mathematics, Physics and Chemistry – Vol. 44, [Kluwer, 2001, Dordrecht], 379p. (ISBN 1-4020-0173-8)

Major Topics: High Energy Processes; Sources in our Galaxy; Extra-Galactic Sources and Cosmological Connections; Cosmic Photons: X-rays and Gamma Rays; Cosmic Ray Particles; Future Prospects

Demographics: 107 Total Participants; 67 from NATO countries; 29 from Partner Countries; 6 from Mediterranean Dialogue Countries; 5 from Other Countries



Key Personnel: Ptuskin (RU), Wefel (USA), Shapiro (USA), Berezhko (RU), Biermann (DE), Bykov (RU), Cowsik (IN), Fonseca (ES), Galeotti (IT), Giller (PL), Kocharov (RU), Panasyuk (RU), Piran (Israel), Rephaeli (Israel), Sanchez (FR), Scarsi (IT), Smith (UK), Stanev (USA), Trumper (DE)

Note: Erice is ‘cold’ in November

International School of Cosmic Ray Astrophysics – 13 th Course

Relativistic Astrophysics and Cosmology

25th Anniversary Course, 2-14, June 2002

“**Relativistic Astrophysics and Cosmology**”, M. M. Shapiro, T. Stanev and J.P. Wefel, Eds., Science and Culture Series – Astrophysics, A. Zichichi, Series Ed., [World Scientific, 2004, Singapore], 360p. (ISBN 981-238-727-7)

Major Topics: **Understanding and Modeling the Universe and Its Luminous Systems** (An Accelerating Closed Universe, Entangled Universe, Extra-galactic Jets, Supernovae, Gamma Rays and Neutrinos from Pulsars, Young Compact Objects); **Cosmic Rays** (Diffusion in the Dynamic Milky Way, Energy Spectra and Composition near the ‘knee’, Inside and around the Solar System, UHE particles, GRB’s, Supernova and Origin, AMS, TRACER, ACCESS, CAPRICE); **Extensive Air Showers** (UHE status and prospects, KASCADE, Pier Auger Observatory, Simulations, Roland Maze); **Gamma Ray and Neutrino Astronomy** (TeV Sources, VERITAS, Next Generation Telescopes, MAGIC, Blazars, Neutrino Astronomy, RICE)



International School of Cosmic Ray Astrophysics – 14 th Course

Neutrinos and Explosive Events in the Universe - 2004

A NATO ASI (the last); 2-13 July 2004

“**Neutrinos and Explosive Events in the Universe**”, M.M. Shapiro, T. Stanev and J.P. Wefel, Eds., NATO ASI Series II. Mathematics, Physics and Chemistry Vol. 209, [Springer, 2005, Dordrecht], 424p. (ISBN-10 1-4020-3746-5)



The Largest Course – 121 participants from 22 countries; NATO Co-Directors Ptuskin & Wefel



Part I: Contemporary Challenges in Astrophysics and Cosmology

Part II: Explosive Events and their Aftermath

Part III: High Energy Gamma Ray and Neutrino Astronomy

Part IV: Energetic Particles: From the Heliosphere to the Galaxy and Beyond



John P. WITEL
Executive Vice President
WITEL INC.

International School of Cosmic Ray Astrophysics – 15th Course

Astrophysics at Ultra-high Energies

20-27 June 2006

“**Astrophysics at Ultra-high Energies**”, M.M. Shapiro, T. Stanev and J.P. Wefel, Eds., Science and Culture Series – Astrophysics, A. Zichichi, Series Ed., [World Scientific, 2007, Singapore], 226p. (ISBN-10 981-279-014-4)

Encompassing: Gamma Ray Bursts and SWIFT Results (A. Wells; P. Meszaros); The Nature of Dark Matter (Biermann); Cosmic Rays from the Knee to the Second Knee (Hoerandel); Particle Acceleration and Propagation in the Galaxy (Ptuskin, Stanev); Ultra-high Energy Cosmic Rays (Stanev, Biermann); The Pierre Auger Observatory (Privitera, Van Elewyick); The GLAST Mission (Tibolla); Results from AMANDA and ANITA (Silvestri); Galactic Gamma Ray Sources from MILAGRO (Goodman); The KASCADE-Grande Experiment (Cossavela); VHE Gamma Ray Astronomy (Volk); Detection of UHE Neutrinos (Seckel, Spiering); The LVD Detector (Galeotti); Gamma Rays on the Ground and Air Showers (Goodman); Ultra-Heavy Cosmic Rays from TIGER (Rauch); ANTARES and NEMO (Bruijn, Amore); ATIC (Wefel)



International School of Cosmic Ray Astrophysics – 16th Course

Gamma Ray and Cosmic Ray Astrophysics: From Below GeV to Beyond EeV Energies

5 - 12 July, 2008

30th Anniversary – Tribute to the Founder/Director of ISCRA

Maurice M. Shapiro

Major Presentations:

M. Casolino; M.H. Israel;
V. Ptuskin; L. Resvanis;
T. Stanev; M. Tavani; M.
Teshima; A. Watson; J.P.
Wefel; G.B. Yodh
Plus S. Ames; T. Hams;
S. Nagatake, A. Smith



Prof. Shapiro did everything for his health, after bypass surgery he went up Erice hills like a rocket, surprising us when he came back from La Pinita, after a good lunch, with his speed. He was a great swimmer and would go into the sea at Selinunte, no matter the weather, once disappearing for so long that attendees thought an obituary might be needed, but he appeared a very long way down the coast.

Sadly after 92 summers we lost him. I attended his memorial at the Cosmos Club in Washington which was one of his proudest affiliations.

I have met rich and powerful people but he remains one of the finest humans I have met.



Quir



**Physicist and artist
Elena Vannucini (attendee)
who was terrified that Prof.
Shapiro would be upset and
ruin her career, but he said
he didn't take himself that
seriously. Prof. Shapiro
would have been delighted
that Elena went on to a
good career in physics.**

What is next for the International School of Cosmic Ray Astrophysics?



Rename School

**International School of Cosmic Ray Astrophysics
<<Maurice M. Shapiro>>**

Continue biennial Courses

17th Course: Astro & Particle Physics: From Underground to Outer Space
11-18 July, 2010

18th Course: A new Era in Particle Astrophysics: New Instruments, New Results and New Understanding 4-10 July, 2012

19th Course: Exploring the High Energy Universe 4-11 July, 2014

20th Course: Particle, Gamma-ray and Neutrino Astrophysics in the 21st Century 1-7 August, 2016

School of 2006



Andrea Silvestri attended two Schools, greatly enthusiastic and carried a card saying “PhD candidate”.

He would always sit near the front and argued passionately for the production of printed proceedings.

Originally from Italy he liked the Californian life and looked like he would do good things. He was later awarded his PhD.

Alas emails to inform him of the 2012 School came back and after a web search I found that he had been found dead in a swimming pool.

A terrible tragedy!

We may not like the signs of ageing, but while we live we can do things.

- **Why are we here? What is the purpose of life?’**
- **No material progress, can bring comfort to our soul. It is this fact, more wonderful than any that Science can reveal, which gives the best hope.**

Winston Churchill

Much of the work of the School has been published or put on the Internet, creating a rich reservoir of information.

Sometimes one can get good ideas from looking over how people have studied problems in the past.

Books produced by ISCRA:

Composition-Origin-Cosmic-Rays

Cosmic-Supernovae-Interstellar-Medium

Genesis-Propagation-Cosmic-Rays

Relativistic-Astrophysics-Cosmology

Astrophysical-Sources-Particles-Radiation-Science

New Vistas in Astrophysics

Cosmic-Neutrinos-and- Related-Astrophysics

Cosmic Radiation in Contemporary Astrophysics

Currents in High Energy Astrophysics

Astrophysics at Ultra High Energies

Particle Astrophysics and Cosmology

by Shapiro

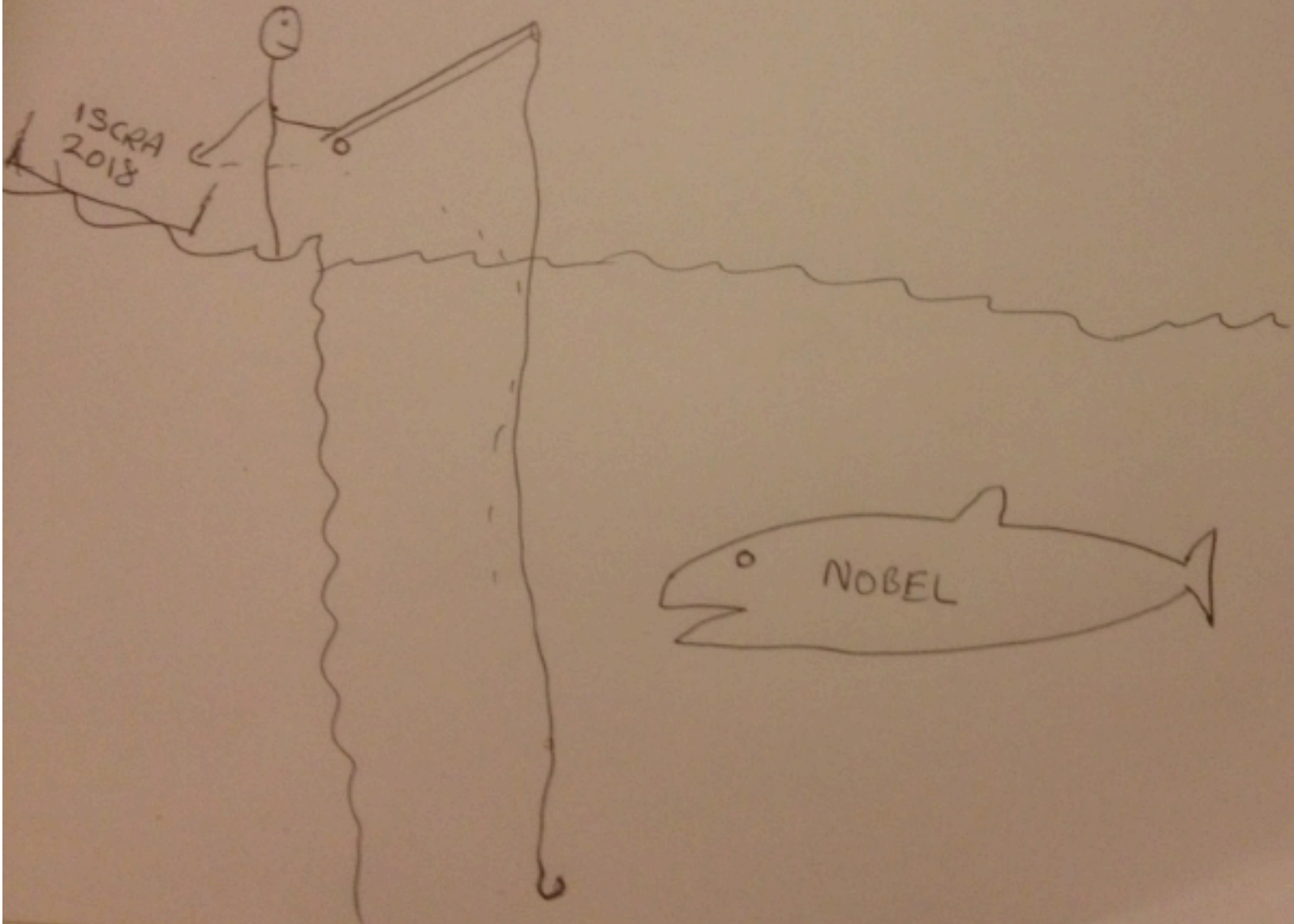
“What are Cosmic Rays?”, translation of Pierre Auger work, (1945)

We hope you will all go away and do GREAT things.

Hard work is not enough, it must be applied sensibly.

If what you are doing is not important and you don't think it is going to lead to anything, why are you working on it?

We hope you have found ISCRA 2018 interesting and informative and that you will use what you have learned well



ISCRA
2018

NOBEL



.... And Our Great Gratitude to:

Ettore Majorana Foundation and Centre for Scientific Culture:

Prof. Zichichi, Fiorella, Pino, Alessandro, porters, kitchen & cleaning.

World Federation of Scientists and The World Laboratory

North Atlantic Treaty Organization (NATO)

European Physical Society; US National Science Foundation; NASA

Italian Ministry of Education, University and Scientific Research

Sicilian Regional Government

Astrophysics Associates, Inc.

All of the Institutes, Universities, Laboratories and Observatories who have provided support for the students

**Co-Directors: J.P Wefel, R. Silberberg, T. Stanev,
V. Ptuskin, J. Hörandel**

Secretary: Arthur Smith

Lecturers and Senior Scientists

Students and Participants

And, of course, to **Maury Shapiro** for the vision that created the ISCRA and the guidance which helped it to grow and prosper

The End