



ITALIAN PHYSICAL SOCIETY
SOCIETÀ ITALIANA DI FISICA

International School of Physics “Enrico Fermi”
of the Italian Physical Society – SIF
Villa Monastero – VARENNA

Course CXCVIII (198th)
QUANTUM SIMULATORS
22 – 27 July 2016

Directors:

Tommaso CALARCO – Universität Ulm (Germany)

Rosario FAZIO – Scuola Normale Superiore, Pisa and ICTP, Trieste (Italy)

Paolo MATALONI – Università "La Sapienza", Roma (Italy)

Topics

- ❑ Cold atoms in optical lattices
- ❑ Trapped ions
- ❑ Solid state implementations
- ❑ Quantum many-body physics
- ❑ Quantum photonics
- ❑ Hybrid quantum systems
- ❑ Transport phenomena

Lecturers

- Immanuel BLOCH - Ludwig-Maximilians-Universität, München (Germany)
- Andrew DALEY - University of Strathclyde (UK)
- Massimo INGUSCIO - Università di Firenze and CNR (Italy)
- Fedor JELEZKO - Universität Ulm (Germany)
- John MARTINIS - UC Santa Barbara (USA)
- Giovanna MORIGI - Universität des Saarlandes, Saarbrücken (Germany)
- Mauro PATERNOSTRO - CTAMOP, Queen's University Belfast (Northern Ireland, UK)
- Fabio SCIARRINO - Sapienza Università di Roma (Italy)
- Enrique SOLANO - University of the Basque Country, Bilbao (Spain)
- Philip WALTHER - Universität Wien (Austria)

VARENNA

A PRESTIGIOUS SUMMER SCHOOL

A number of **advanced Courses** have been held in **topical fields** in the past 63 years

Considerable attention is paid to the **cultural impact** and up-to-date scientific content of the themes discussed, as well to a fair distribution among the **different fields of contemporary physics**

All Courses have been **directed** and attended by famous and **outstanding** physicists from all over the world, including 60 physics **Nobel laureates**

The **proceedings** of all Courses have been published by SIF since the foundation of the School: besides the pedagogical value, they have also a relevant interest as historical archive

1953 – 2013



115 ANNI
e oltre



190 courses
> 12000 participants
60 physics Nobel Prize winners

Physics Nobel Prize winners in Varenna

Along the years several physics Nobel Prize winners participated in the International School of Physics "Enrico Fermi" in Varenna as lecturers or directors.

Name (prize awarded in year) In Varenna in year

Serge Haroche (2012)	1992 - 2001 - 2008
David J. Wineland (2012)	1991 - 2001
Roy J. Glauber (2005)	1967 (director) - 1991
John L. Hall (2005)	1991 - 1992
Th. W. Hänsch (2005)	1975 - 1992 (director) - 1995 - 1998 - 2000 - 2006 (director)
A. J. Leggett (2003)	1987
Riccardo Giacconi (2002)	1965 - 1975 (director)
Eric A. Cornell (2001)	1991 - 1998 - 2001
Wolfgang Ketterle (2001)	1991 - 1998 - 2006 (director) - 2014
Carl E. Wieman (2001)	1991 - 1992 - 1998 (director)
Robert B. Laughlin (1998)	2002
Steven Chu (1997)	1991 - 1992
C. Cohen-Tannoudj (1997)	1960 - 1991
William D. Phillips (1997)	1991 (director) - 1995 - 1998 - 2000 - 2016
Georges Charpak (1992)	1984
P.-Gilles de Gennes (1991)	1973 - 1996 - 2003
Norman F. Ramsey (1989)	1991 - 2005
Wolfgang Paul (1989)	1965
Leon M. Lederman (1988)	1959 - 1964
Melvin Schwartz (1988)	1964
Jack Steinberger (1988)	1954 - 1964 - 1967 (director) 2013
K.A. Müller (1987)	1956 - 1973 (director) - 2003
Klaus von Klitzing (1985)	2012

Carlo Rubbia (1984)	1987 - 1990 - 2013
S. Chandrasekhar (1983)	1975
William A. Fowler (1983)	1965
Nicolaas Bloembergen (1981)	1963 - 1975 (director)
Arthur L. Schawlow (1981)	1963 - 1992
Sheldon Lee Glashow (1979)	1964
Abdus Salam (1979)	1971
Arno Allan Penzias (1978)	2004
Philip W. Anderson (1977)	1966 - 1983 - 1987
Sir Nevill F. Mott (1977)	1957
John H. van Vleck (1977)	1956
Aage Niels Bohr (1975)	1976 (director) - 1955
Ben Roy Mottelson (1975)	1960 - 1976 - 1992
Leo Esaki (1973)	1991
Leon Neil Cooper (1972)	1955
John R. Schrieffer (1972)	1957 - 1973 - 1983 - 1987 (director) - 1992 - 1997
Dennis Gabor (1971)	1958
Hannes O.G. Alfvén (1970)	1959 (director)
Louis E.F. Néel (1970)	1956
Luis Walter Alvarez (1968)	1964 (director)
Hans Albrecht Bethe (1967)	1984
Alfred Kastler (1966)	1956 - 1960
Charles Hard Townes (1964)	1955 - 1960 - 1963 (director)
Eugene Paul Wigner (1963)	1963 (director)
Donald Arthur Glaser (1960)	1953
Tsung-Dao (T.D.) Lee (1957)	1964 (director)
John Bardeen (1956)	1983
Willis Eugene Lamb (1955)	1963
Edwards Mills Purcell (1952)	1956
Cecil Frank Powell (1950)	1953
Patrick M.S. Blackett (1948)	1953
Wolfgang Pauli (1945)	1958
Isidor Isaac Rabi (1944)	1955
Enrico Fermi (1938)	1954
Paul A.M. Dirac (1933)	1972
Werner K. Heisenberg (1932)	1954
L.-V.P.R. de Broglie (1929)	1970

1953

*“ With the hope that this ‘dress rehearsal’
– being as it is in the hands of so outstanding scientists and
followed by students with so impatient inquiring minds –
might proceed worthily and fruitfully grow, I have the
honour to declare open the 1953 summer course of the
International School of Physics of the Italian Physical Society.*

*And to this School, that adds up to the other initiatives of our
association, I would dare assign as mission, the famous one,
contained in the words of the ‘great Farnese’,
Cardinal Alessandro Farnese:*

*Votis subscribunt fata secundis
(Destiny does make dreams come true). ”*

Giovanni Polvani – SIF President



1953

With these words the then President of the Italian Physical Society **Giovanni Polvani** concluded his inaugural address to the 1st course of the Varenna School which was titled:

“Issues related to elementary-particle detection, with special attention to cosmic radiation”

The course was directed by Giampietro Puppi and the lecturers were outstanding scientists like Cecil Powell, Patrick Blackett, Hannes Alfvén, Giuseppe (Beppo) Occhialini, to name but a few

A scenic view of a lake with mountains in the background and a decorative metal railing in the foreground. The railing is ornate, with floral and scrollwork patterns. The lake is calm, and the mountains are hazy in the distance under a clear sky.

1954

The 1st course was a real success, to the extent that Puppi was asked to direct another one in the Summer of 1954

The 2nd course was again devoted to elementary particles, this time placing emphasis on accelerators:

“The contribution from existing and planned accelerators to elementary particles physics”

In his opening address Puppi talked about *“the fantastic world of high-energy phenomena”*

To illustrate them, eminent physicists were invited to lecture, like Enrico Fermi, Werner Heisenberg, Gilberto Bernardini, Bruno Rossi ...

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1954

Enrico Fermi and Werner Heisenberg gave the first two lectures of a series on the physics of pions and nucleons

Gilberto Bernardini, Bernard T. Feld and others took care of a second group of lectures on photoproduction

Bruno Rossi lectured on fundamental particles and on the origin of cosmic rays

Various particle accelerator facilities and projects in different laboratories in Europe were illustrated by a number of world experts



Salvini

Castagnoli

Steinberger

Puppi

Conversi

Leprince-Ringuet

Rossi

Fermi

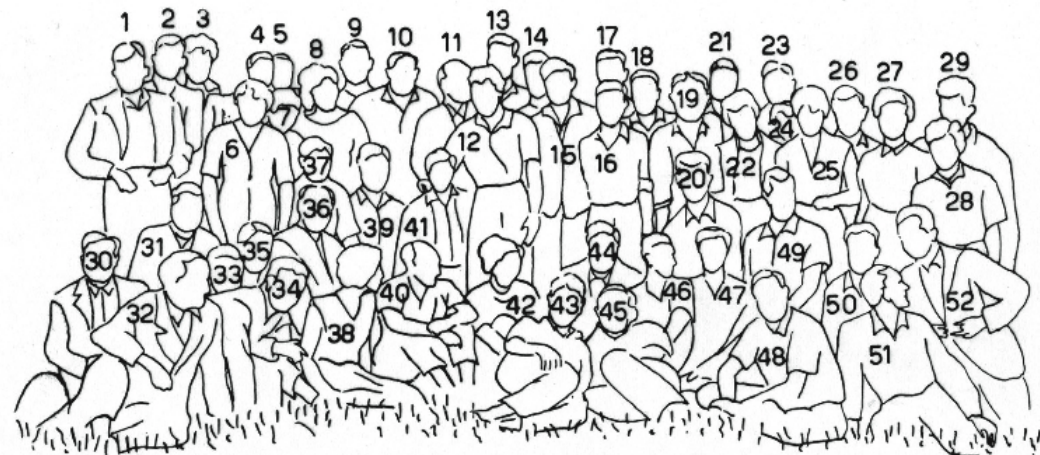
Borsellino

G. Bernardini

Polvani

Occhialini

A celebrated
group photo
1954



1. M. CRESTI - 2. M. DEUTSCHMANN - 3. B. PUPPI - 4. J. STEINBERGER - 5. N. DALLAPORTA - 6. I. POLVANI - 7. S. C. NASSAR - 8. A. ORKIN-LE-COURTOIS - 9. G. SALVINI - 10. C. CASTAGNOLI - 11. G. FOIANI - 12. A. ROGGOZINSKY - 13. J. BRIZOT - 14. J. TREMBLEY - 15. M. CECOCARELLI - 16. M. PORTER - 17. P. GIACOMETTI - 18. K. KANDIAH - 19. G. WATAGHIN - 20. U. HABER-SCHAIM - 21. J. G. RÖDERER - 22. B. LOCATELLI - 23. K. GOTTSTEIN - 24. C. M. GARELLI - 25. C. DILWORTH-OCCHIALINI - 26. Y. FUJIMOTO - 27. L. TALLONE - 28. G. TOMASINI - 29. R. LEVI-SETTI - 30. A. ROSTAGNI - 31. B. BRUNELLI - 32. A. BORSSELLINO - 33. G. FIDECARO - 34. P. CALDIROLA - 35. B. ROSSI - 36. G. POLVANI - 37. D. KEEFE - 38. G. CINI - 39. M. G. K. MENON - 40. E. FERMI - 41. Y. GOLDSCHMIDT-CLERMONT - 42. M. BRUIN - 43. G. BERNARDINI - 44. G. PUPPI - 45. G. OCCHIALINI - 46. L. SCARSI - 47. B. VITALE - 48. M. CONVERSI - 49. G. QUARENI - 50. A. BONETTI - 51. L. LEPRINCE-RINGUET - 52. B. T. FIELD



PASSION FOR PHYSICS

International School of Physics Enrico Fermi

60th Anniversary



15 June 2013
Villa Monastero
Varenna (Lake Como)

Fermi gave 16 lectures in Varenna on
“PIONS and NUCLEONS”
from 16th of July to 6th of August 1954

His last gift to Italy

He passed away a few months later

Exactly one year later on the 6th of August 1955
an official commemorative ceremony was organised
by President Polvani in Varenna and Como
in the presence of Fermi's wife, Laura Fermi Capon,
and Fermi's sister, Maria Sacchetti Fermi

President Polvani announced that
the School would be named after Enrico Fermi

“ ... a series of astral conjunctions has created around the second course a particular charisma, besides the fact that clearly during the course a sort of theological summa of what was known about pion physics has been made which has served as reference for a long time.

But then Enrico Fermi's death has reflected on this second year a particular light and when anyone talks about Varenna School, the second year and Enrico Fermi cross our minds.”

Giampietro Puppi – Director of the School

In 1955 in Como at the Tempio Voltiano,
Isidor I. Rabi was invited to give the official
commemorative address in honour of Enrico Fermi

“Here in Italy where his memory is so alive and where so many have heard Fermi lecture I do not have to describe the remarkable fascination he could induce in any audience. He used no histrionics in his delivery. It was always calm and deliberate. The fascination lay in the feeling of clarity and simplicity he could impart to the audience. They felt illuminated and had the sense of participating in profound and beautiful insight”

This is what Fermi's lectures still inspire



In the Aula of Villa Monastero in Varenna in 1955 a bronze medallion with his low-relief effigy was unveiled in memory and in honour of Enrico Fermi



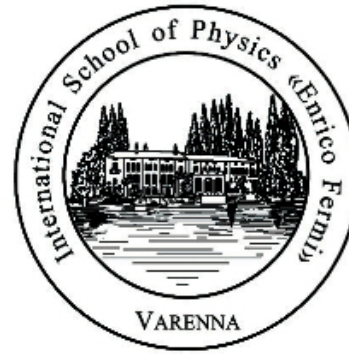
(work of the sculptor
Giannino Castiglioni)

Also a porphyry plaque was placed bearing a Latin epigraph:

ENRICO FERMI

— 1954 - 53rd of his life —

*"Here with quiet spirit among so many natural
beauties, I revealed for the last time,
to a rank of men of science, the ultimate and
most remote elements in motion inside the atoms,
with which I had already made my name immortal"*



On the 70th anniversary of the
Nobel Prize award to Enrico Fermi in 1938
the Italian Physical Society
has reprinted in a special issue of
[La Rivista del Nuovo Cimento](#)
the original
“Lectures on Pion and Nucleons”
by Enrico Fermi

2016

Mostra Enrico Fermi

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EXHIBITS

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ENRICO FERMI

A dual genius between
theories and experiments
Una duplice genialità tra
teorie ed esperimenti



Why the Exhibition | **Perchè la mostra**

The exhibition highlights the extraordinary figure of Enrico Fermi, the great Italian physicist who, paradoxically, is better known abroad than in

Who is it for | **A chi si rivolge**

The scientific achievements, integrated into the various stages of the scientist's life, are presented in a new light suitable for the general public, including the very young, combining objects and traditional panels with video and audio

A stop in Bologna | **Uno stop a Bologna**

After the success of its debut at the "[Festival delle Scienze di Genova](#)" of 2015 (about 15.000 visits), the exhibition arrives in the Emilian city, thanks to

1


ISTITUTO FÍSICO
DELLA
R. UNIVERSITÀ DI ROMA
VIA PANISPERNA, 89-A

90 years after
Fermi-Dirac statistics

Roma, 25/10/1926

Mr. P.A.M. Dirac
St. John's College
Cambridge

Dear Sir!

In your interesting paper "On the theory of Quantum Mechanics" (Proc. Roy. Soc. 112, 661, 1926) you have put forward a theory of the Ideal Gas based on Pauli's exclusion Principle.

Now a theory of the ideal gas that is practically identical to yours was published by me at the beginning of 1926 (Zs.f. Phys, 36, p. ~~312~~ 902 ; Lincei Rend. February 1926)

Since I suppose that you have not seen my paper, I beg to attract your attention on it.

I am, Sir,

Yours Truly

Enrico Fermi

$A_s = \varepsilon_s$

80 years after Fermi's experiments
at the Physics Institute of Via Panisperna in Rome



IN CONCLUSION

This Course will surely be a success and pave the way for further developments in this very promising and fascinating field

Have a pleasant and fruitful stay in
Varenna

Memories ...



<https://www.youtube.com/watch?v=uBcDU2uEjro>