

Enrico Fermi School

Varenna 1953-2022



GALLERIA DEI PREMI NOBEL CHE HANNO TENUTO LEZIONI A VARENNÀ

PHOTO GALLERY OF NOBEL PRIZE WINNERS WHO HAVE LECTURED IN VARENNÀ



IN VARENNÀ IN



P. M. S. Blackett
Nobel Prize 1948

1953



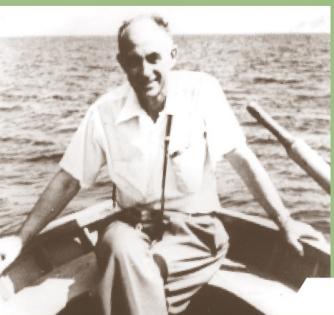
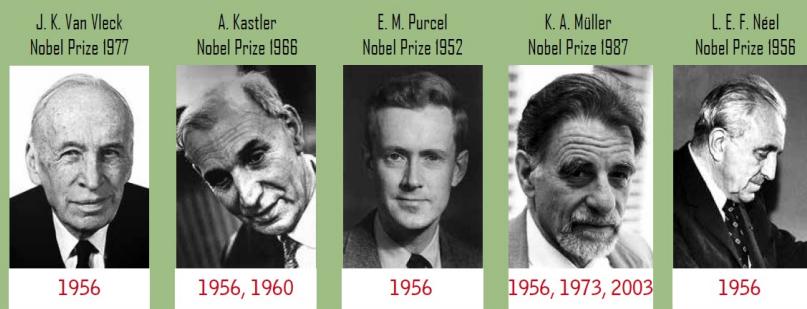
D. A. Glaser
Nobel Prize 1960

1953



C. F. Powell
Nobel Prize 1950

1953



E. Fermi
Nobel Prize 1938

1954



W. K. Heisenberg
Nobel Prize 1932

1954



J. Steinberger
Nobel Prize 1988

1954, 1964, 1967



L. N. Cooper
Nobel Prize 1972



I. Rabi
Nobel Prize 1944

1955



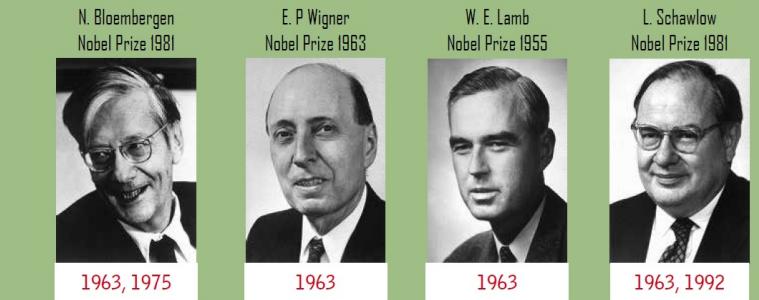
C. H. Townes
Nobel Prize 1964

1955, 1960, 1963



A. N. Bohr
Nobel Prize 1975

1955, 1976



L. W. Alvarez
Nobel Prize 1968



1964

M. Schwartz
Nobel Prize 1988



1964

S. L. Glashow
Nobel Prize 1979



1964

T. D. Lee
Nobel Prize 1957



1964

G. Charpak
Nobel Prize 1992



1984

H. Bethe
Nobel Prize 1967



1984

A. J. Leggett
Nobel Prize 2003



1987

C. Rubbia
Nobel Prize 1984



1987, 1990



R. Giacconi
Nobel Prize 2002



1965, 1975

W. Paul
Nobel Prize 1989



1965

W. A. Fowler
Nobel Prize 1983



1965

P. W. Anderson
Nobel Prize 1977



1966, 1983, 1987

R. J. Glauber
Nobel Prize 2005



1967, 1991

L. Esaki
Nobel Prize 1973



1991

J. L. Hall
Nobel Prize 2005



1991, 1992

C. E. Wieman
Nobel Prize 2001



1991, 1992, 1998

S. Chu
Nobel Prize 1997



1991, 1992

E. A. Cornell
Nobel Prize 2001



1991, 1998, 2001

L. De Broglie
Nobel Prize 1929



1970

A. Salam
Nobel Prize 1979



1971

P. A. M. Dirac
Nobel Prize 1933



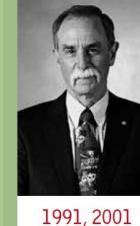
1972

P. G. De Gennes
Nobel Prize 1991



1973, 1996, 2003

D. J. Wineland
Nobel Prize 2012



1991, 2001

N. F. Ramsey
Nobel Prize 1989



1991, 2005

W. D. Phillips
Nobel Prize 1997



1991, 1995, 1998, 2000

W. Ketterle
Nobel Prize 2001



1991, 1998, 2006



T. W. Hänisch
Nobel Prize 2005



1975, 1992, 1995, 1998, 2000, 2006

S. Chandrasekhar
Nobel Prize 1983



1975

J. Bardeen
Nobel Prize 1956



1983

S. Haroche
Nobel Prize 2012



1992, 2001, 2008

R. B. Laughlin
Nobel Prize 1998



2002

A. Penzias
Nobel Prize 1978



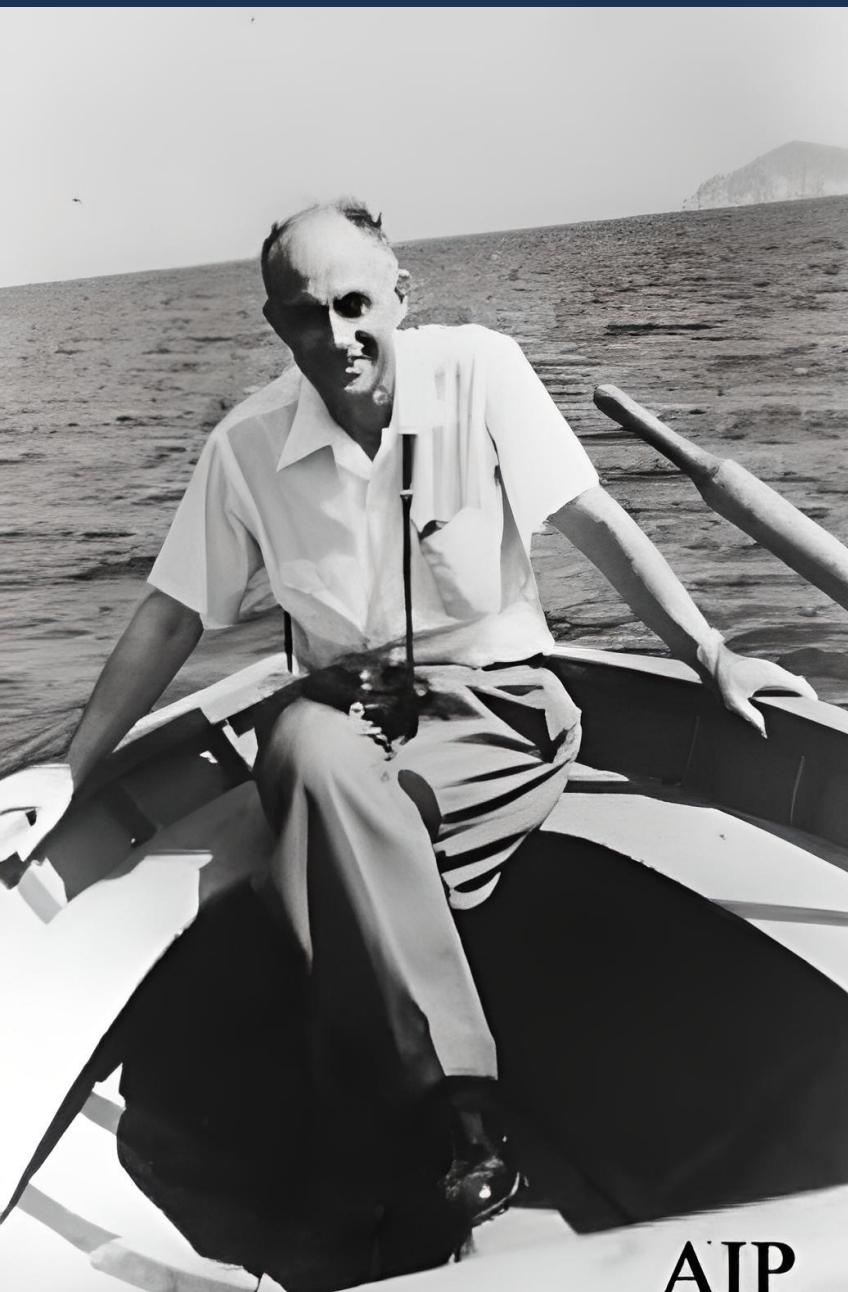
2004

K. Von Klitzing
Nobel Prize 1985



2012

II Summer School on "Accelerators for elementary particles physics" (Varenna, July 1954)



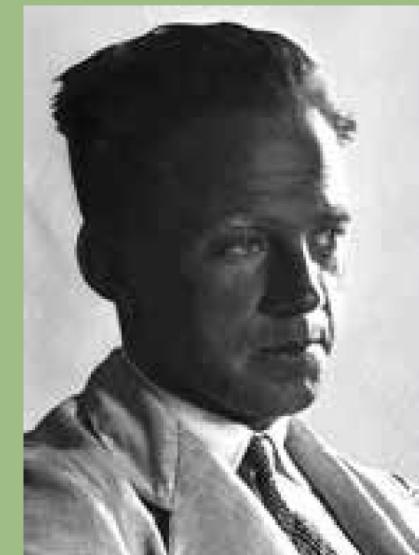
AIP

E. Fermi
Nobel Prize 1938



1954

W. K. Heisenberg
Nobel Prize 1932



1954

Prof. Avanzi
Magnifico Rettore
Università di Pisa

Caro Professore,

in occasione del mio soggiorno alla Scuola di Varennna i professori Conversi e Salvini mi hanno accennato la possibilità che l'Università di Pisa possa disporre di una somma veramente ingente destinata a favorire il progresso e lo sviluppo della ricerca in Italia.

Interrogato circa le varie possibilità di impiego di tale somma, quella di costruire in Pisa una macchina calcolatrice elettronica mi è sembrata, fra le altre, di gran lunga la migliore.

Essa costituirebbe un mezzo di ricerca di cui si avvantaggerebbero in modo, oggi quasi inestimabile, tutte le scienze e tutti gli indirizzi di ricerca.

Mi consta che l'Istituto per le Applicazioni del Calcolo, diretta dal prof. Picone, ha in corso di acquisto una macchina del genere . Non mi sembra però che questa circostanza diminuisca il bisogno che di tale macchina verrà ad avere un centro di studi come l'Università di Pisa. L'esperienza dimostra che la possibilità di eseguire con estrema speditezza e precisione calcoli elaborati crea ben presto una sì grande domanda di tali servizi che una macchina sola viene presto saturata. A questo si aggiungono i vantaggi che ne verrebbero agli studenti e agli studiosi che avrebbero modo di conoscere e di addestrarsi nell'uso di questi nuovi mezzi di calcolo.

Con molti cordiali e distinti saluti.

(Enrico Fermi)



III Summer School on "Topics of Nuclear Structure" (Varenna, July 1955)

I. Rabi

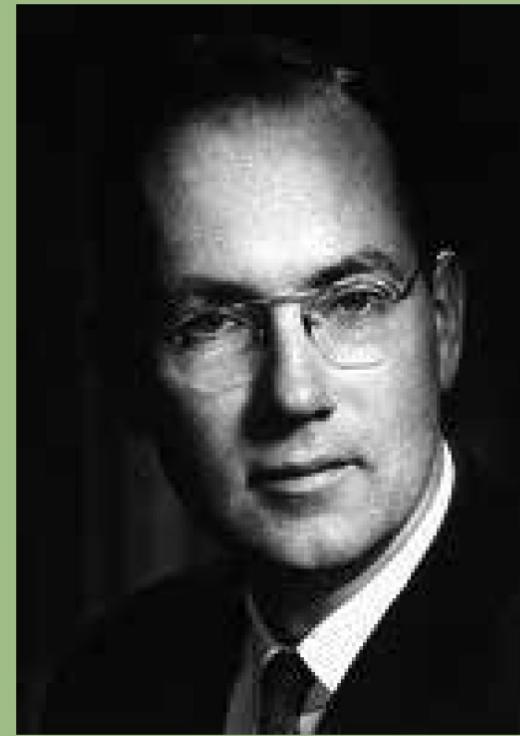
Nobel Prize 1944



1955

C. H. Townes

Nobel Prize 1964



1955, 1960, 1963

III Summer School on "Topics of Nuclear Structure" (Varenna, July 1955)

3° CORSO ESTIVO - VARENNA SUL LAGO DI COMO - VILLA MONASTERO - 17 Luglio - 6 Agosto 1955



I. Rabi

C. Townes



PARTE SECONDA. — **Momenti nucleari.**

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A. DE SHALIT — Magnetic Moments of Nuclei	»	1195
C. H. TOWNES — On the Interpretation of H.F.S. in Molecules in Terms of Molecular Structure and Nuclear Moments	»	1201

Ultracold Varenna

1998 BEC



2006 Fermions



2014 Quantum Matter



2022 Quantum Mixtures



COURSE CXL

edited by M. INGUSCIO, S. STRINGARI and C. E. WIEMAN

VARENNA ON LAKE COMO

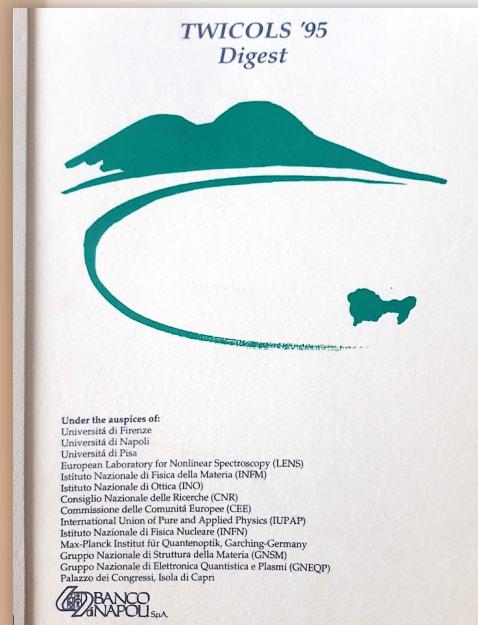
VILLA MONASTERO

7-17 July 1998

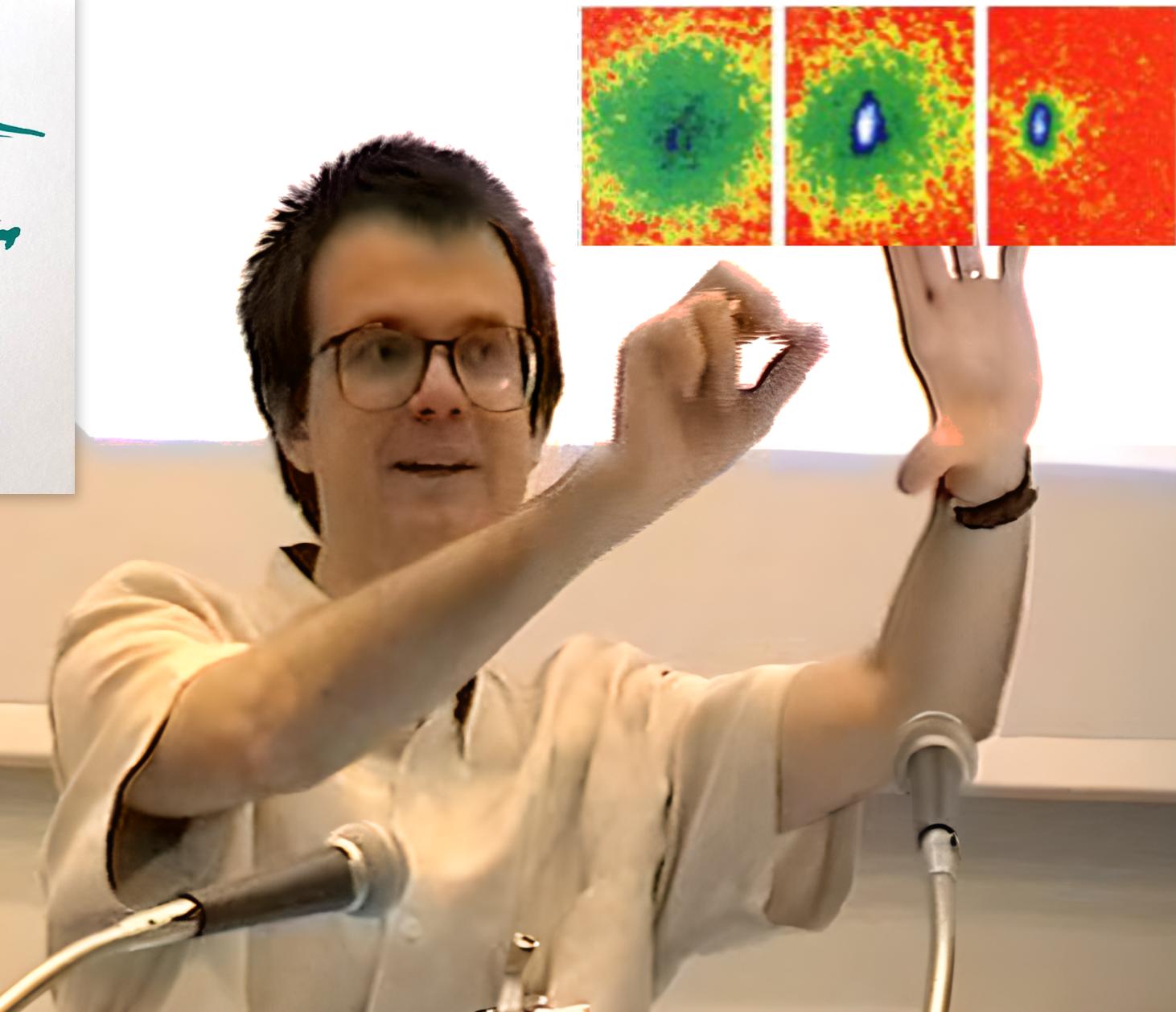
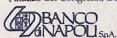
Bose-Einstein Condensation in Atomic Gases



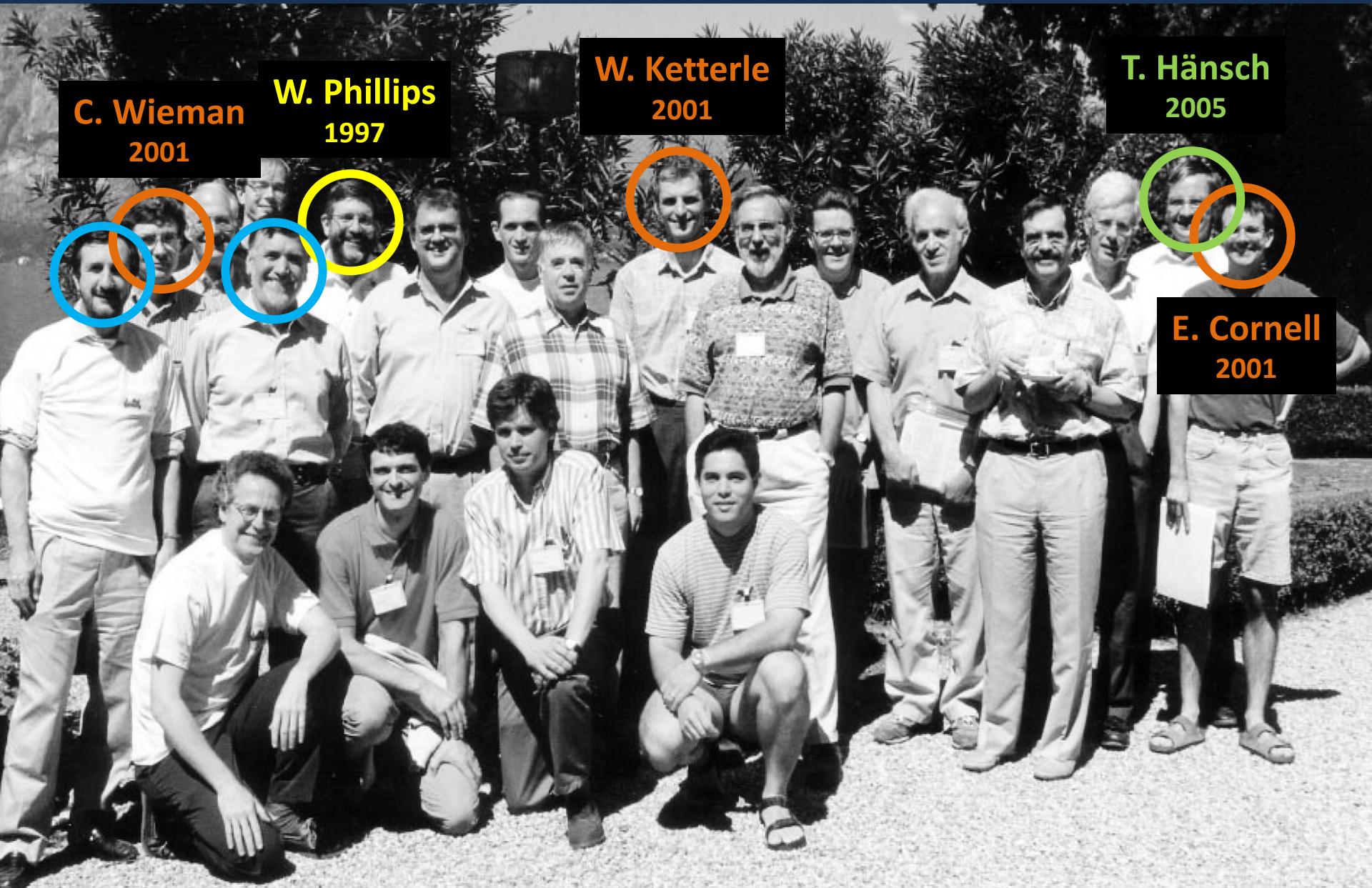
20th International Conference on Laser Spectroscopy (Capri, 11th-16th July 1995)



Under the auspices of:
Università di Firenze
Università di Napoli
Università di Pisa
European Laboratory for Nonlinear Spectroscopy (LENS)
Istituto Nazionale di Fisica della Materia (INFM)
Istituto Nazionale di Ottica (INO)
Consiglio Nazionale delle Ricerche (CNR)
Commissione delle Comunità Europee (CEE)
International Union of Pure and Applied Physics (IUPAP)
Istituto Nazionale di Fisica Nucleare (INFN)
Max-Planck Institut für Quantenoptik, Garching-Germany
Gruppo Nazionale di Struttura della Materia (GNSM)
Gruppo Nazionale di Elettronica Quantistica e Plasmi (GNEQP)
Palazzo dei Congressi, Isola di Capri



CXL School on "Bose-Einstein Condensation in Atomic Gases" (Varenna, July 1998)



20 years later... Trento-Firenze Meeting (Pisa, 2018)



LETTER TO THE EDITOR

Quantum degeneracy and interaction effects in spin-polarized Fermi–Bose mixtures

L Vichi[†], M Inguscio[‡], S Stringari[†] and G M Tino[§]

[†] Dipartimento di Fisica, Università di Trento and Istituto Nazionale per la Fisica della Materia, I-38050 Povo, Italy

[‡] Dipartimento di Fisica and European Laboratory for Nonlinear Spectroscopy (LENS), Università di Firenze, and Istituto Nazionale per la Fisica della Materia, Largo E Fermi 2, I-50125 Florence, Italy

[§] Dipartimento di Scienze Fisiche, Università di Napoli ‘Federico II’ and Istituto Nazionale per la Fisica della Materia, Complesso Universitario di Monte S Angelo, via Cintia, I-80126 Naples, Italy

PROCEEDINGS
OF THE
INTERNATIONAL SCHOOL OF PHYSICS
«ENRICO FERMI»

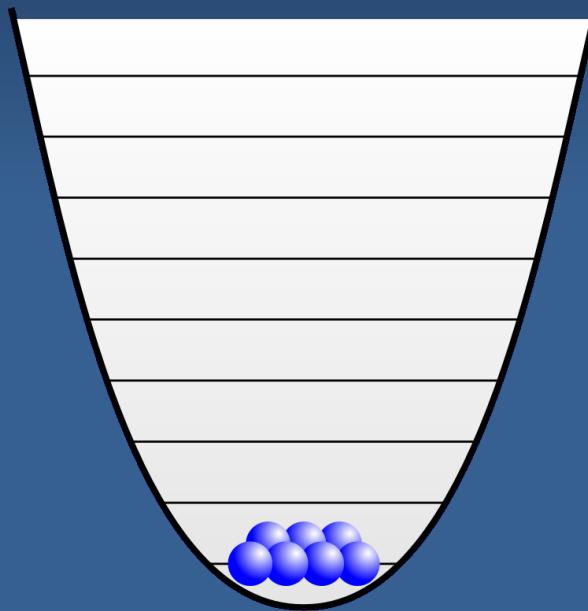
COURSE CXL
edited by M. INGUSCIO, S. STRINGARI and C. E. WIEMAN

VARENNA ON LAKE COMO
VILLA MONASTERO
7–17 July 1998

*Bose-Einstein Condensation in
Atomic Gases*

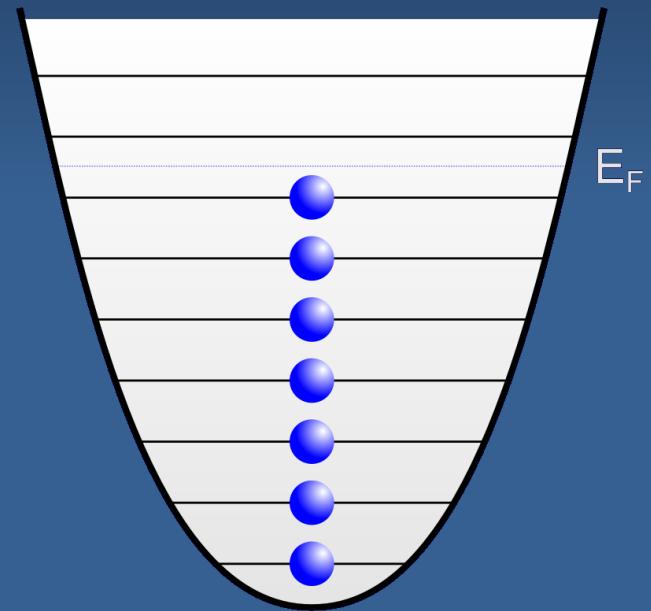
G. M. TINO, F. S. CATALIOTTI, E. A. CORNELL, C. FORT, M. INGUSCIO and M. PREVEDELLI – Towards quantum degeneracy of bosonic and fermionic potassium atoms	» 521
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BOSONS



BOSE-EINSTEIN
CONDENSATE

FERMIONS



DEGENERATE
FERMI GAS

COURSE CLXIV

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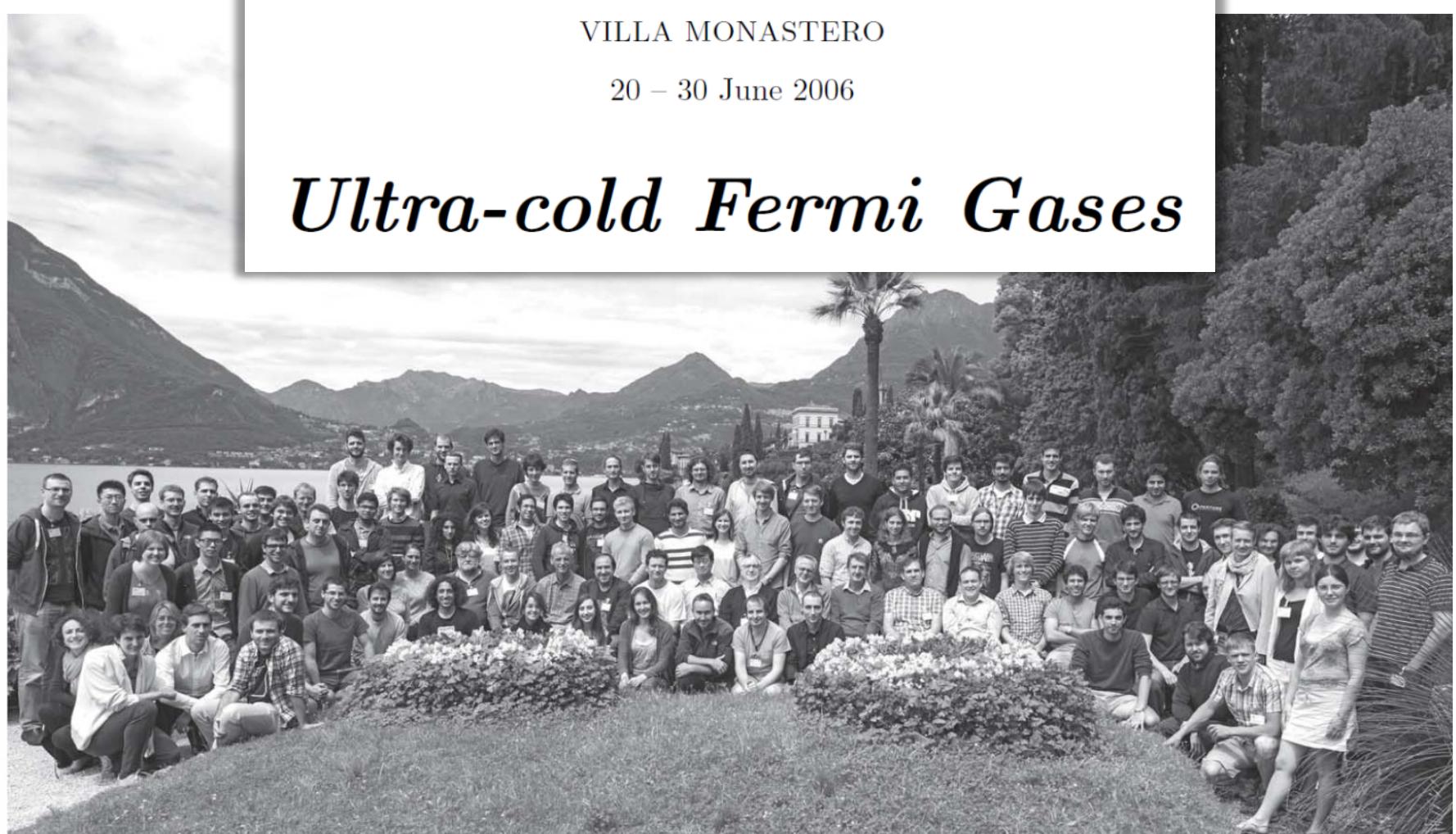
Directors of the Course

VARENNA ON LAKE COMO

VILLA MONASTERO

20 – 30 June 2006

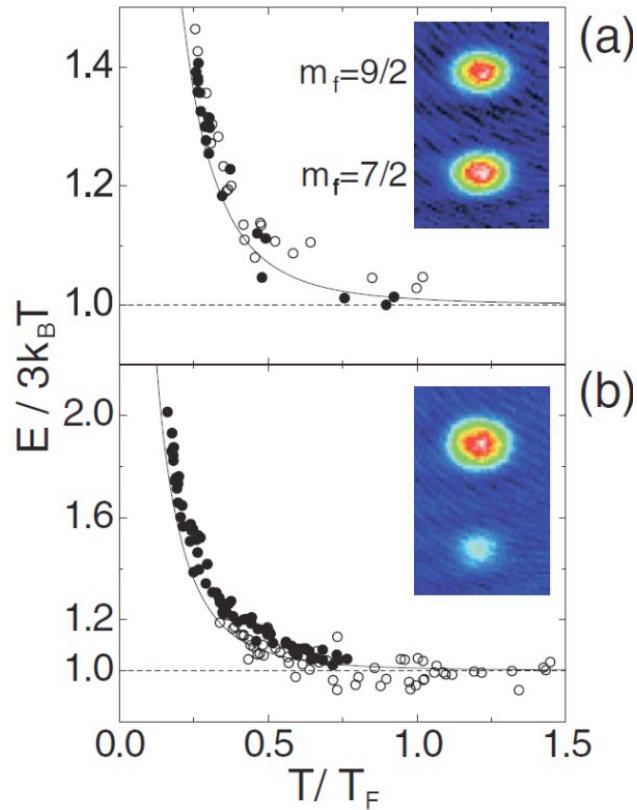
Ultra-cold Fermi Gases



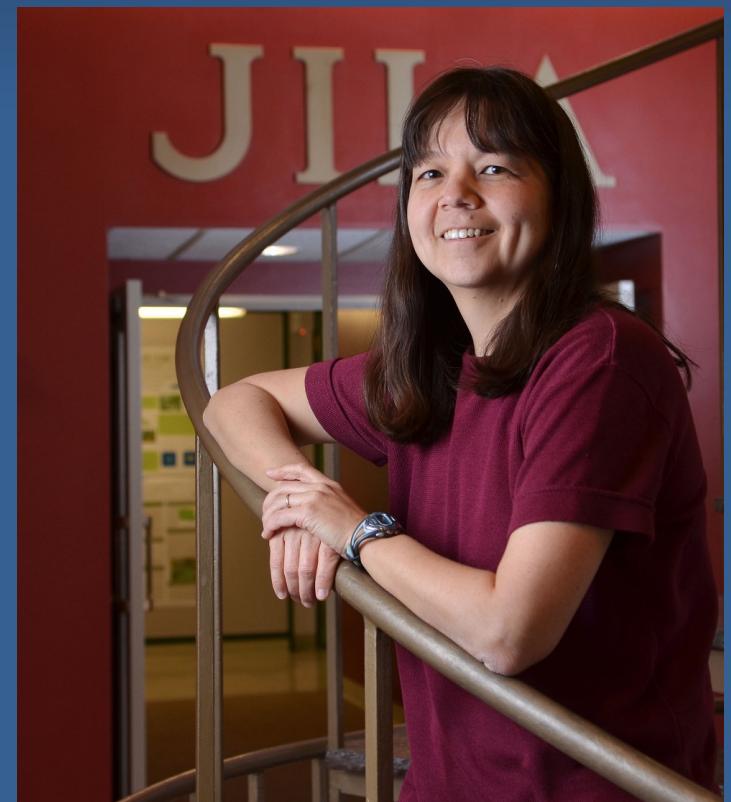
Fermi gas experiments

D. S. JIN and C. A. REGAL

JILA, University of Colorado and National Institute of Standards and Technology
and Department of Physics, University of Colorado
Boulder, CO, 80309-0440 USA



First ultracold Fermi gas
with a spin mixture of ^{40}K



Deborah Jin (1968-2016)

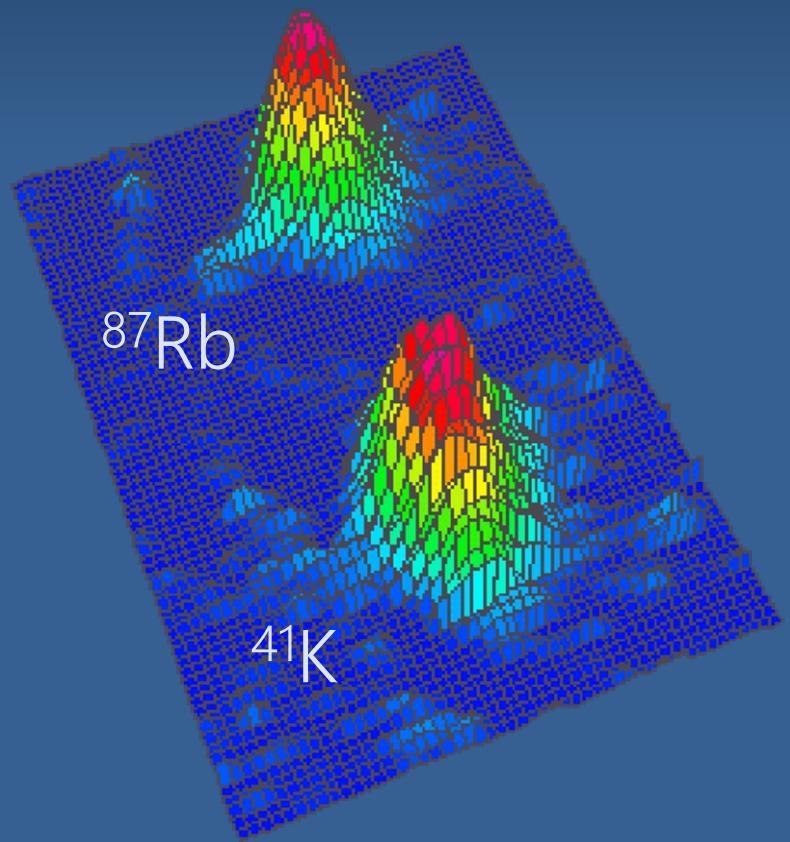
(1926, Arcetri, Firenze)



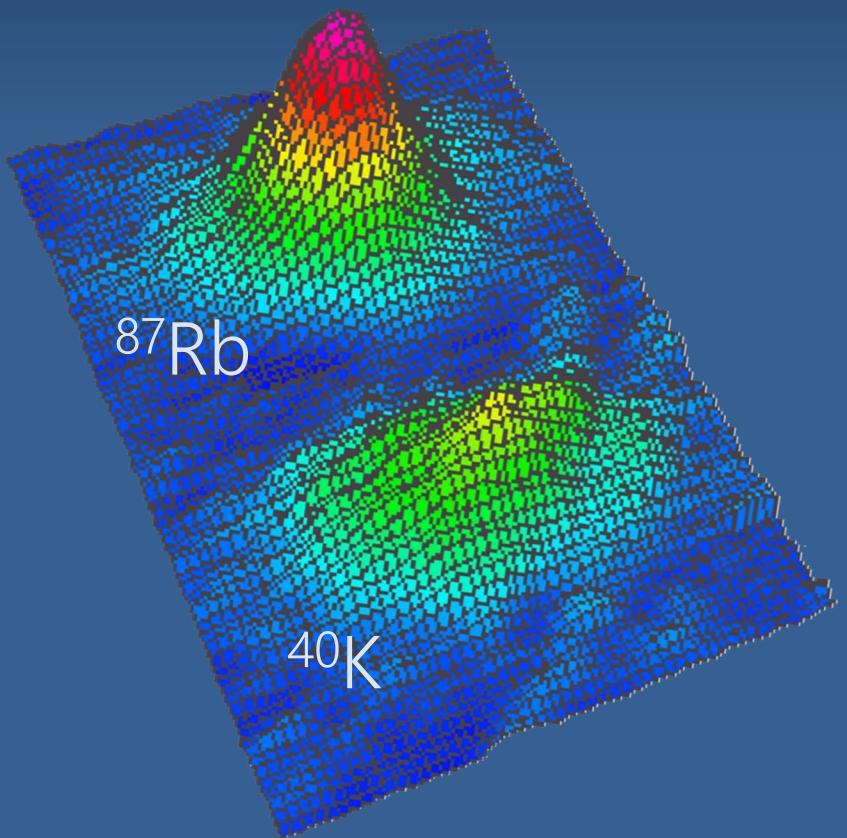
K-Rb quantum mixtures

Bose-Bose and Bose-Fermi mixtures with heteronuclear sympathetic cooling

BOSE/BOSE



BOSE/FERMI



G. Modugno et al., *Science* **294**, 1320 (2001)
G. Roati et al., *PRL* **99**, 010403 (2007)

G. Roati et al., *PRL* **89**, 150403 (2002)

K-Rb quantum mixtures

G. MODUGNO – Fermi-Bose mixture with tunable interactions	» 657
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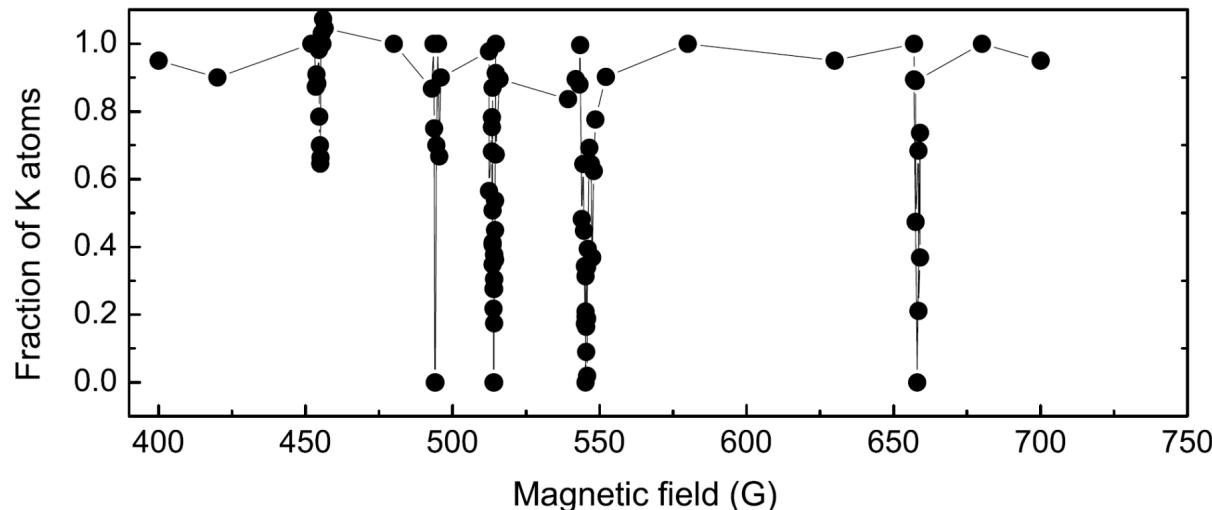
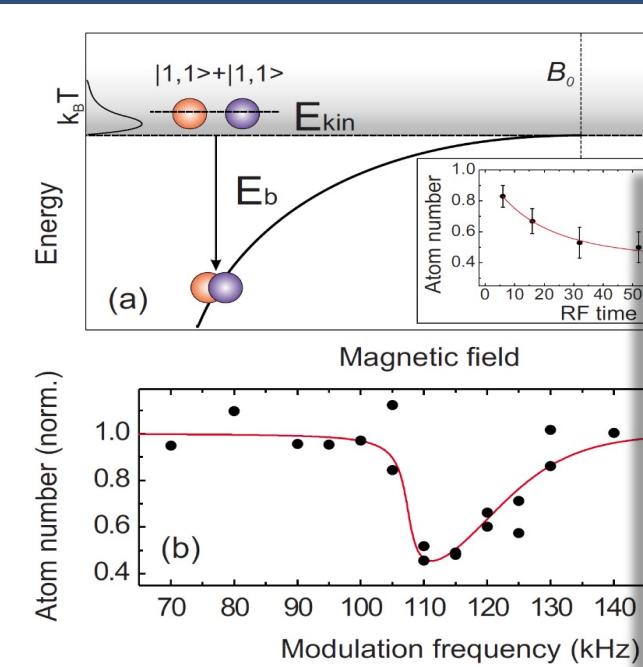


Fig. 1. – Relative inelastic losses of potassium atoms in a ^{40}K - ^{87}Rb mixture in its absolute ground state at interspecies Feshbach resonances. The two features near 456 G and 515 G are *p*-wave resonances, the others are *s*-wave resonances.

K-Rb quantum mixtures

Heteronuclear ^{41}K - ^{87}Rb polar Feshbach molecules

C. Weber *et al.*, PRA **78**, 61601R (2008)



Low dimensional scattering
and impurity physics in ^{41}K - ^{87}Rb
G. Lamporesi *et al.*, PRL 104, 153202 (2010)



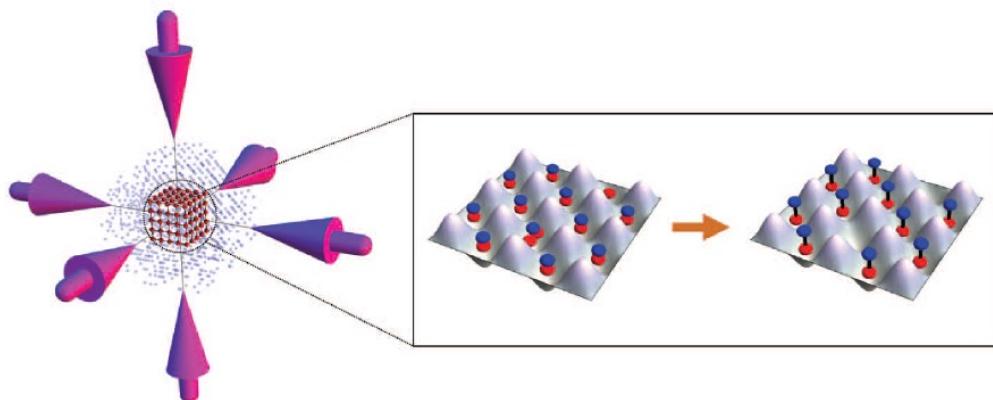
QUANTUM SIMULATION

Science 350, 659 (2015)

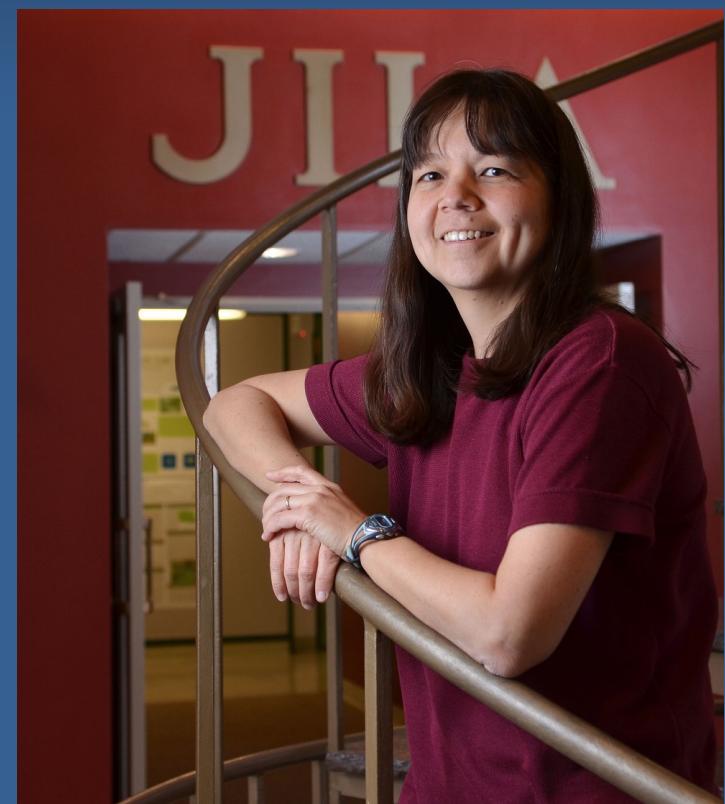
Creation of a low-entropy quantum gas of polar molecules in an optical lattice

Steven A. Moses, Jacob P. Covey, Matthew T. Miecnikowski, Bo Yan,* Bryce Gadway,† Jun Ye,‡ Deborah S. Jin‡

Ultracold polar molecules, with their long-range electric dipolar interactions, offer a unique platform for studying correlated quantum many-body phenomena. However, realizing a highly degenerate quantum gas of molecules with a low entropy per particle is challenging. We report the synthesis of a low-entropy quantum gas of potassium-rubidium molecules (KRb) in a three-dimensional optical lattice. We simultaneously load into the optical lattice a Mott insulator of bosonic Rb atoms and a single-band insulator of fermionic K atoms. Then, using magnetoassociation and optical state transfer, we efficiently produce ground-state molecules in the lattice at those sites that contain one Rb and one K atom. The achieved filling fraction of 25% should enable future studies of transport and entanglement propagation in a many-body system with long-range dipolar interactions.



Ground-state ^{40}K - ^{87}Rb polar molecules in an optical lattice



Deborah Jin (1968-2016)

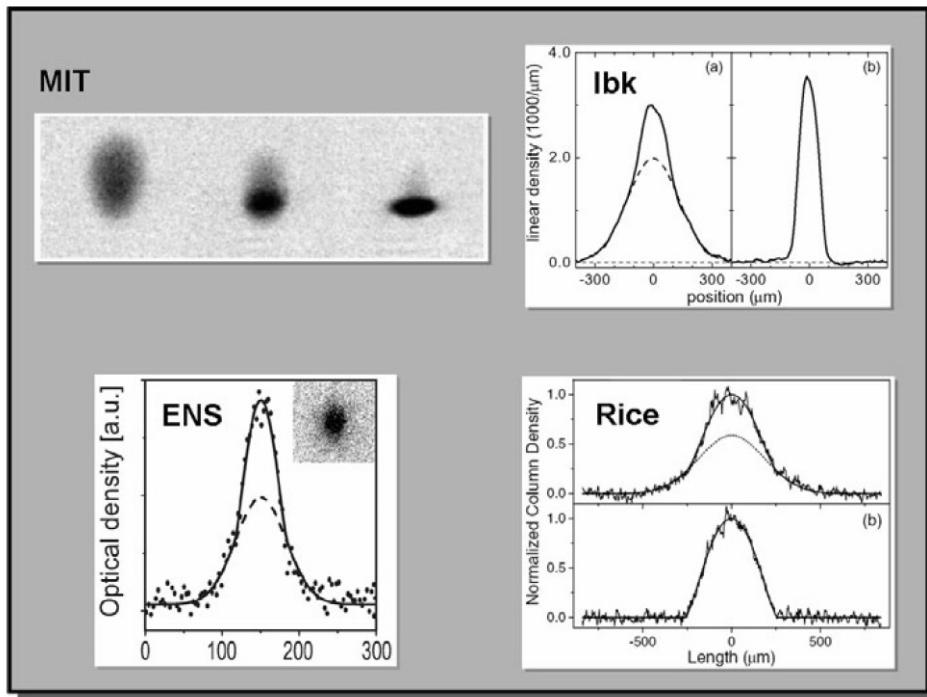
Fermionic mixtures and BEC-BCS crossover

Ultracold Fermi gases in the BEC-BCS crossover: A review from the Innsbruck perspective

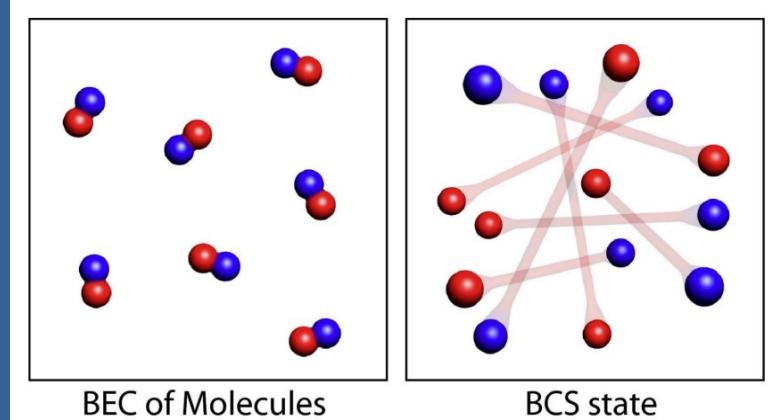
R. GRIMM

*Institute of Experimental Physics and Center for Quantum Physics
University of Innsbruck - Technikerstraße 25, A-6020 Innsbruck, Austria*

*Institute for Quantum Optics and Quantum Information (IQOQI)
Austrian Academy of Sciences, Otto-Hittmair-Platz 1, A-6020 Innsbruck, Austria*



Molecular BEC and fermionic superfluidity in strongly interacting ${}^6\text{Li}$ spin mixtures



COURSE 191

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Directors of the Course

and

G. ROATI

VARENNA ON LAKE COMO

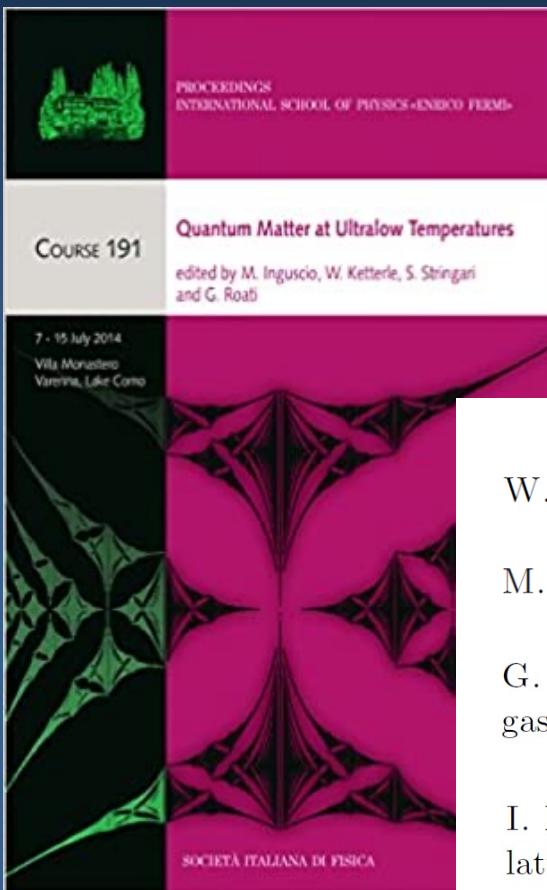
VILLA MONASTERO

7 – 15 July 2014

Quantum Matter at Ultralow Temperatures



More and more quantum mixtures...



W. ZWERGER – Strongly interacting Fermi gases	»	63
M. W. ZWIERLEIN – Thermodynamics of strongly interacting Fermi gases .	»	143
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Enjoy the 2022 school!
Happy mixtures of quantum ideas!





Celebrating
the first 80 years
of fermions

