PHYSICS & GEOMETRY

Remembering Giuseppe Morandi

Bologna, University of Bologna

Dept. of Physics and Astronomy

November 24-25, 2017

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DIPARTIMENTO DI FISICA E ASTRONOMIA

INFN
Istituto Nazionale di Fisica Nucleare
Sezione di Bologna

curriculum vitae

- Dic. 1963. Laurea in Fisica con punti 110/110 e lode. Universita' di Bologna.
- Gennaio 1964. Premio "Guglielmo Marconi" per la Fisica.
- 1964-'65. Borsista MPI. Universita' di Bologna
- A.A. 1965-'66. Professore Incaricato. Universita' di Modena.
- 1966-1970. Ricercatore (R6 e R5) INFN Sezione di Bologna.
- 1968-1969: Postdoctoral Visitor e Research Assistant, Imperial College of Science and Technology, London (UK).
- 1970: NATO Senior Fellow (Orsay (France)) e Invited Visitor Laue-Langevin Laboratory, Garching (Munich, (FRG)).
- AA.AA. 1970-'73. Professore Incaricato. Universita' di Napoli.
- 1973. Visiting Fellow (Imperial College of Science and Technology) con programma scambio Acc. Dei Lincei-Royal Society.
- AA.AA. 1973-1982. Professore Incaricato e Assistente di Ruolo. Universita' di Modena.
- A.A. 1978-79. Research Associate, Physik Abteilung, Universita' di Dortmund (RFT).
- AA.AA. 1982-'86. Professore Associato di Fisica Teorica. Universita' di Modena.
- AA.AA. 1986-1990 Professore Associato di Fisica Generale. Ubiversita' di Ferrara.
- AA.AA. 1991-2008. Professore Associato di Fisica Teorica. Universita' di Bologna.

- Corsi: Istituzioni di Fisica Teorica. Metodi Matematici per la Fisica. Fisica Teorica. Relativita' (Ristretta e Generale). Fisica Generale I. Termodinamica. Teoria Classica dei Campi. Stato Solido. Teoria dei Molti Corpi. Teoria del Modello di Anderson. Difetti Topologici e Fasi Quantistiche Adiabatiche. Effetto Hall Quantistico. Sistemi Elettronici fortemente correlati in bassa dimensionalita'. Superconduttività ad alta temperatura critica. Fisica Superiore (Relativita' Ristretta e Meccanica Statistica). Teoria dei Molti Corpi. Geometria Differenziale e Meccanica Classica. Transizioni di Fase e Fenomeni Critici.

- Organizzazione di Scuole

International School on: "Geometrical Methods in Theoretical Physics". (Ferrara, 1987)

3d International Workshop on: *"Differential Geometrical Methods in Classical Dynamics".* (Ferrara, 1988)

International School on: *Anomalies, Phases, Defects...".* (Ferrara, 1989)

International School on: *"Quantum Field Theory and Condensed Matter Physics".* (ICTP, 1992)

International School on: *"Field Theories for Low-dimensional Condensed Matter Systems".* (Chia Laguna, 1997)

Tratta da una delle quattro trasmissioni televisive sulla microscopia elettronica che nel 1976
Pier Giorgio Merli, **Lucio Morettin**i e **Giuseppe Morandi** realizzarono per la rubrica "Sapere" della RAI

Alan M Portis, Hugh D Young

LA FISICA DI BERKELEY. LABORATORIO

Prima edizione
1977

FUORI COMMERCIO

Traduzione di: Bergia Silvio, Bonsignori Francesco, Gioia Isabella, Morandi Giuseppe, Savoia Mirko Revisione di: Bergia Silvio Titolo originale dell'opera: Berkeley Physics Laboratory McGraw-Hill, Inc., 1971

Mrzud -

CONTRIBUTIONS

from the

DEPARTMENT OF PHYSICS, FACULTY OF SCIENCE,

UNIVERSITY OF TOKYO

No. 62

On the Convergence of the Perturbation Method.

By Tosio KATO.

Reprinted from

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Section I Mathematics, Astronomy, Physics and Chemistry

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notes for students

Spin chains in an external staggered field again (Dec., '99)

1. Some exact results.

We start from:

$$\mathcal{Z} = \int [\mathcal{D}\vec{n}] \left[\frac{\mathcal{D}\lambda}{2\pi}\right] \exp(-S_{eff}) \qquad (1.1)$$

where:

$$S_{eff} = \int d\vec{x} \left[\mathcal{L}_E(\vec{x}) - S\vec{H}_s \cdot \vec{n}(\vec{x}) - i\lambda(\vec{x})\left(\vec{n}^2(\vec{x}) - 1\right)\right] \qquad (1.2)$$

$(\vec{x} \equiv (x, \tau))$ and:

$$\mathcal{L}_E(\vec{x}) = \frac{1}{2gc}\left[c^2|\partial_x \vec{n}|^2 + |\partial_\tau \vec{n}|^2\right] \qquad (1.3)$$

We promote S_{eff} to a generating functional: $S_{eff} \to S[\vec{J}]$ (and: $\mathcal{Z} \to \mathcal{Z}[\vec{J}]$) defined as:

$$S[\vec{J}] = \int d\vec{x} \left[\mathcal{L}_E(\vec{x}) - S\vec{J}(\vec{x})\cdot\vec{n}(\vec{x}) - i\lambda(\vec{x})\left(\vec{n}^2(\vec{x}) - 1\right)\right] \qquad (1.4)$$

($\vec{J} = \text{const.} = \vec{H}_s$ at the end) where, after an integration by part (and throwing away boundary terms) $\mathcal{L}_E$ can be rewritten as:

$$\mathcal{L}_E(\vec{x}) = -\frac{\vec{n}}{2gc}\cdot\left[c^2\partial_x^2 + \partial_\tau^2\right]\vec{n} \qquad (1.5)$$

Altogether:

$$S[\vec{J}] = \int d\vec{x}\, d\vec{x}'\; \vec{n}(\vec{x})\cdot K(\vec{x},\vec{x}')\vec{n}(\vec{x}') - S\int d\vec{x}\; \vec{J}(\vec{x})\cdot\vec{n}(\vec{x}) + i\int d\vec{x}\; \lambda(\vec{x})$$

where:

$$K(\vec{x},\vec{x}') = -\frac{1}{2gc}\left[c^2\partial_x^2 + \partial_\tau^2 + 2igc\lambda(\vec{x})\right]\delta^{(2)}(\vec{x}-\vec{x}') \qquad (1.6)$$

1 Nonlinear σ-Model for Spin Chains and the String Order Parameter.

September 15, 2001

1.1 Introduction.

We consider an AFM Heisenberg chain, with Hamiltonian:

$$\mathcal{H} = J\sum_{i=1}^{N} \mathbf{S}_i \cdot \mathbf{S}_{i+1} \qquad (1)$$

with $PBC's$ and: $\mathbf{S}_i^2 = S(S+1)$. The (spin)coherent-state path integral of the canonical partition function (valid in principle only for large S's, though) is:

$$\mathcal{Z} = Tr\{\exp[-\beta\mathcal{H}] = \int [\mathcal{D}\widehat{\Omega}] \exp\{iS\sum_i \omega[\widehat{\Omega}_i(\tau)] - \int_0^\beta \mathcal{H}(\tau)\} \qquad (2)$$

where the $\widehat{\Omega}_i$'s are classical unit vectors: $|\widehat{\Omega}_i| = 1$,

$$\mathcal{H}(\tau) = JS^2\sum_i \widehat{\Omega}_i(\tau)\cdot\widehat{\Omega}_{i+1}(\tau) \qquad (3)$$

and ω is the Berry phase:

$$\omega[\widehat{\Omega}] = \int_0^\beta d\tau\partial_\tau\phi[1-\cos\theta];\ \widehat{\Omega} \equiv (\sin\theta\cos\phi, \sin\theta\sin\phi, \cos\theta) \qquad (4)$$

Remark: Sending $\widehat{\Omega} \to -\widehat{\Omega}$ is achieved by sending: $\theta \to \pi - \theta$ and: $\phi \to \phi + \pi$, so:

$$\omega[-\widehat{\Omega}] = \int_0^\beta d\tau\partial_\tau\phi[1+\cos\theta] = -\int_0^\beta d\tau\partial_\tau\phi[1-\cos\theta] + 2\int_0^\beta d\tau\partial_\tau\phi = -\omega[\widehat{\Omega}]\ mod(4\pi) \qquad (5)$$

When inserted back into Eq.(2), a multiple of $4\pi iS = (integer) \times 2\pi i$ does not contribute, and hence we can consider the Berry phase as an **odd** function of its argument.

We make the Haldane Ansatz:

$$\widehat{\Omega}_i = (-)^i\widehat{\mathbf{n}}_i\sqrt{1 - \frac{a^2}{S^2}\mathbf{l}_i^2} + \frac{a}{S}\mathbf{l}_i \qquad (6)$$

Notes on Differential Geometry and Geometrical Mechanics

(2008)

By way of an Introduction

This set of notes is meant to serve as a (rather schematic) introduction to (presentation of) the techniques of modern Differential Geometry which, by now, are part of the standard equipment one needs in order to tackle problems in contemporary Theoretical Physics, just, say, Linear Algebra and Complex Analysis used to be many years ago.

As a model of the kind of physical problems we have in mind, we shall mostly take problems in Classical Mechanics, a subject which has experienced a (possibly unexpected) renewal of interest in the past forty years or so.

Postscriptum

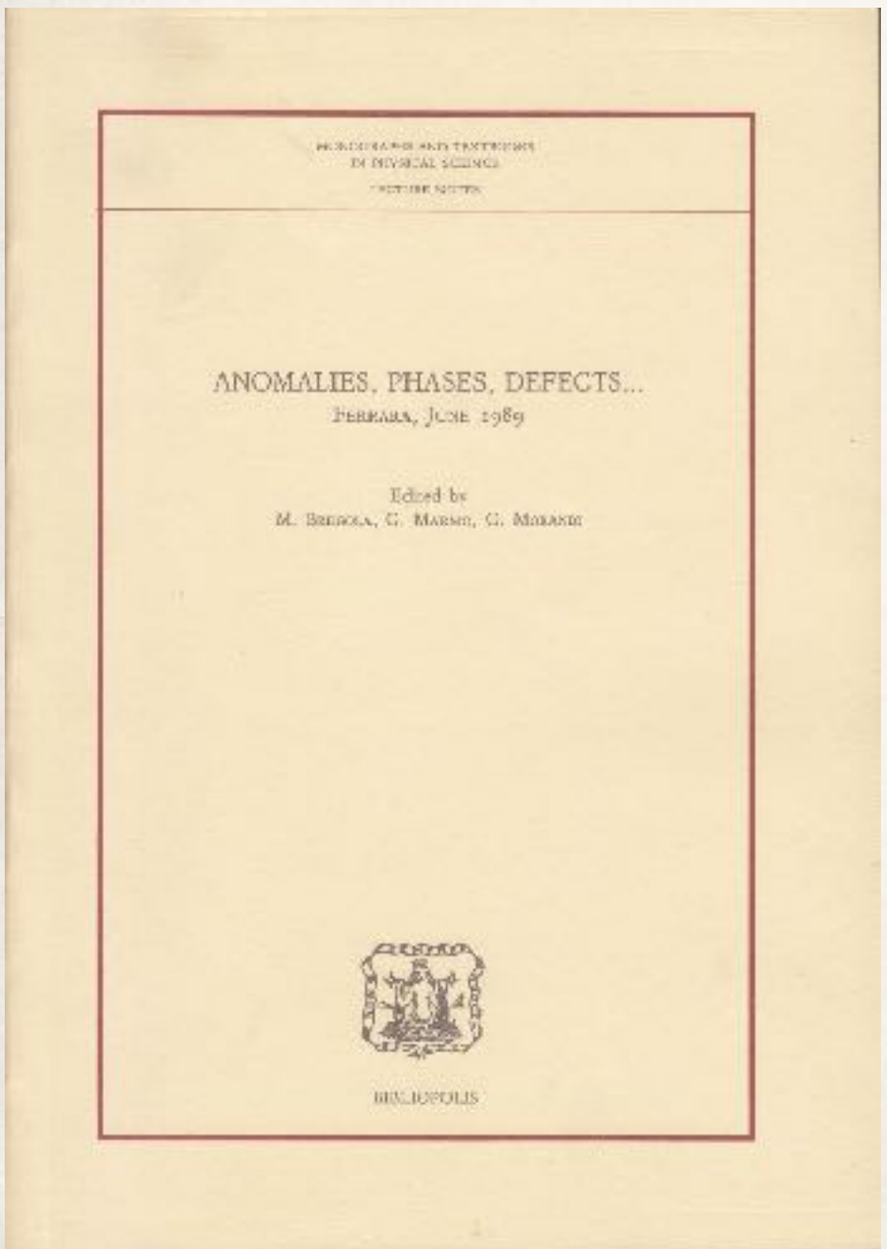
This set of Notes was intended to be originally a preliminary draft for the project of a more comprehensive book on the same subject (Differential Geometry and Classical Dynamics). For various reasons that it would be too long to explain here, the project, that involved also other three fellows physicists (one from Italy and two from India), was never brought to completion. These Notes can serve therefore, hopefully and at best, as background material for introductory lectures on the same subject.

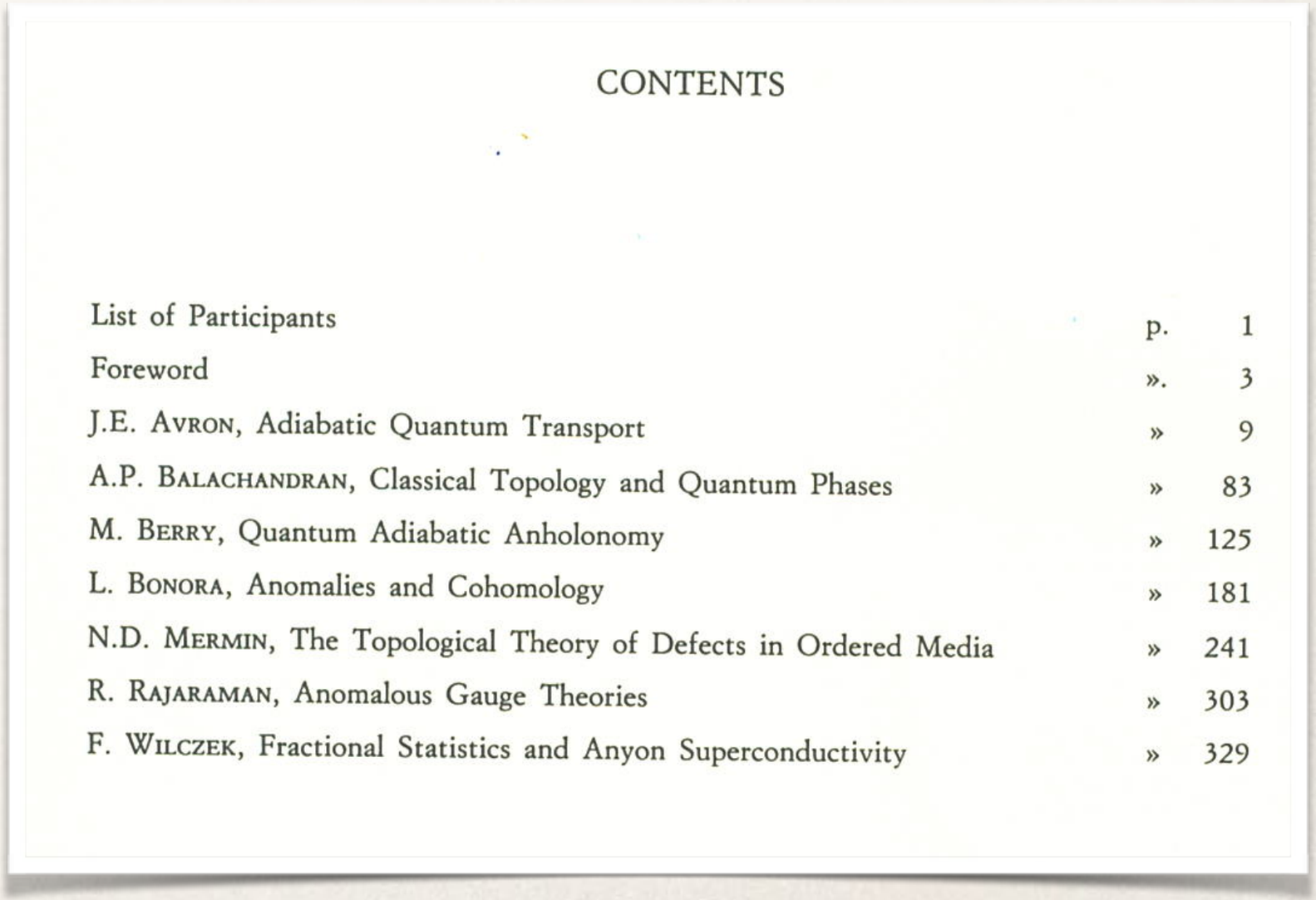
co-authors (1968-2015)

Anfuso F. - Arvind - Balachandran A.P. - **Bergia S.** - Bergonzoni C. - Biedenharn L.C. - **Campos Venuti L.** - Cariñena J.F. - **Celli V.** - Chaturvedi S. - Corbelli G. - **Dell'Aringa S.** - **Degli Esposti Boschi C.E.** - De Pasquale F. - **Di Dio M.** - Di Stasio M. - **E.E.** - **Fano G.** - Ferrario C. - Galleani D'Agliano E. - Horvathy P.A. - Ibort A. - Ivan J.S. - Johansson B. - Keiter H. - Liang J.Q. - Lovecchio G. - Marmo G. - Menossi E. - Merli G. - Missiroli G.F. - Mukunda N. - **Ortolani F.** - Ottaviani E. - Napoli F. - **Pasini S.** - **Pieri P.** - **Pisani L.** - Ratto C.F. - **Roncaglia M.** - **Righi R.** - Rubano C. - Sherrington D. - Simon R. - Simoni A. - Srivastava A.M. - Sudarshan E.C.G. - Tagliacozzo A. - Tombesi P. - Ventriglia F. - Zucchelli G.P.

conferences & schools

- Geometrical Methods in Theoretical Physics (Ferrara 1987)





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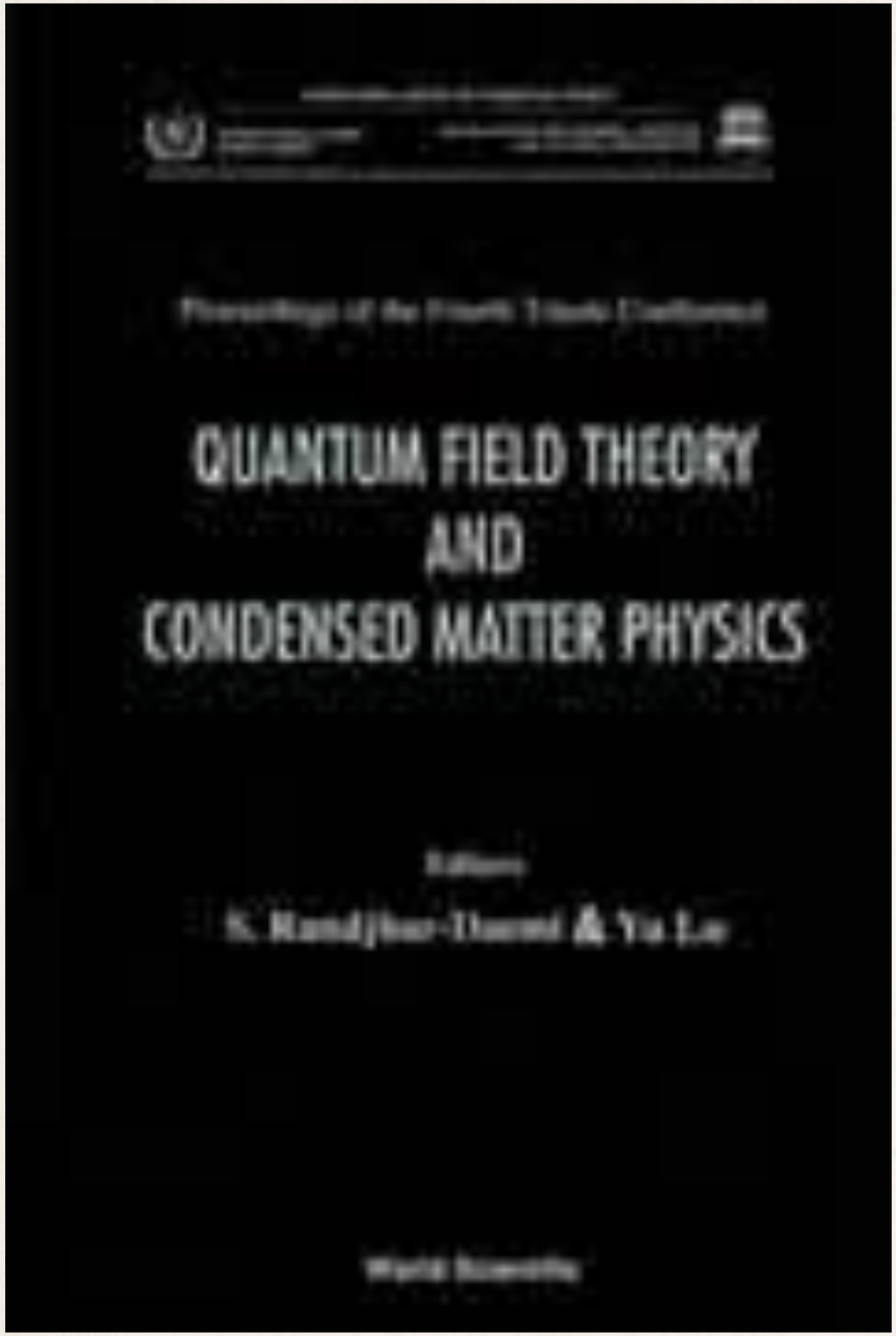
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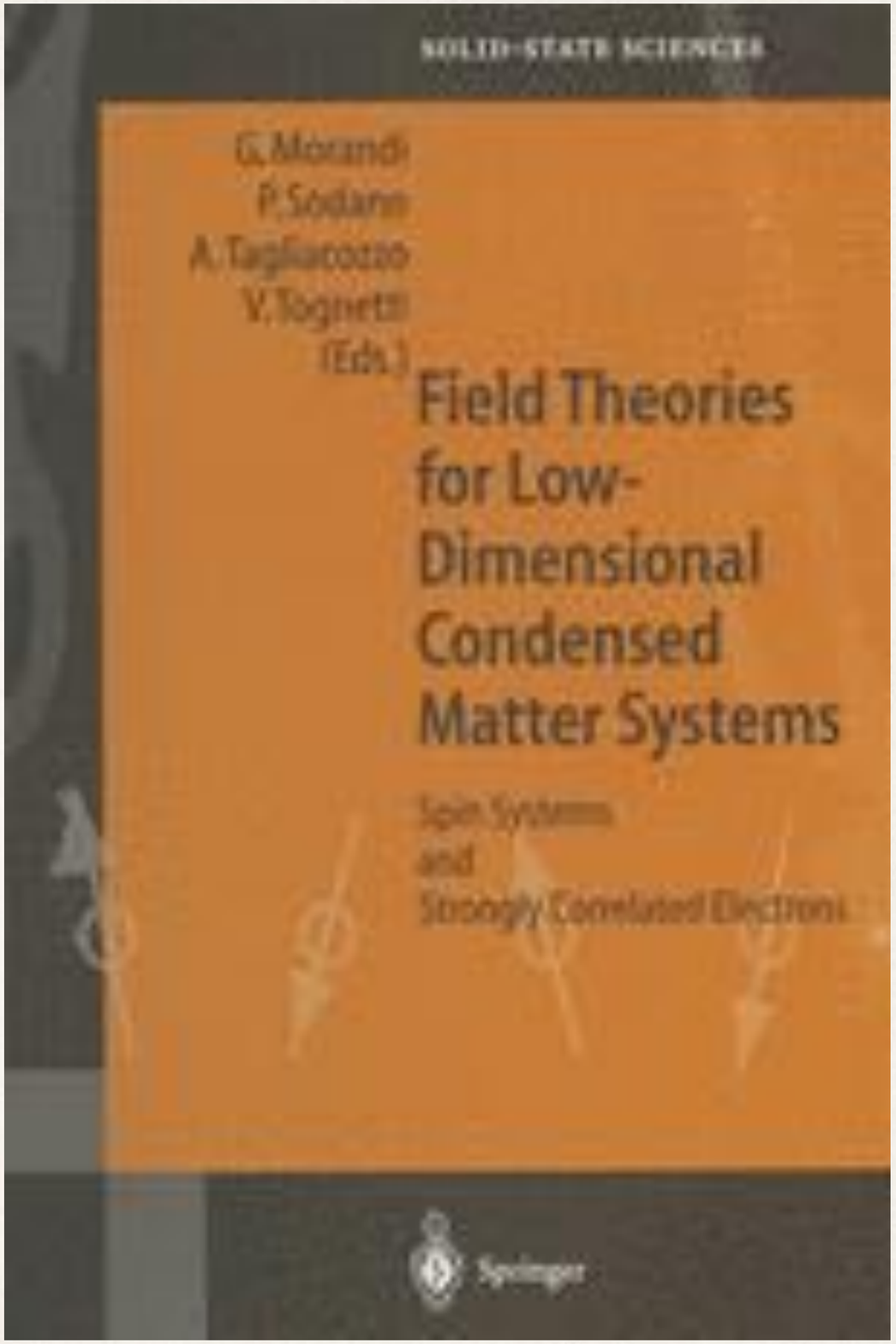

SOLID-STATE SCIENCES
G. Morandi
P. Sodano
A. Tagliacozzo
V. Tognetti
(Eds.)
Field Theories
for Low-
Dimensional
Condensed
Matter Systems
Spin Systems
and
Strongly Correlated Electrons
Springer

research topics

Scientific Background on the Nobel Prize in Physics 2016

1 Introduction

Michael Kosterlitz - David J. Thouless - F. D. M. Haldane

2 Background

antiferromagnets - ordered phase - staggered magnetization - Bose–Einstein condensation - critical temperature T_C - London length λ_L - topological defect - superfluid density

3 The Kosterlitz-Thouless phase transition

4 Quantum Hall conductance and topological band theory

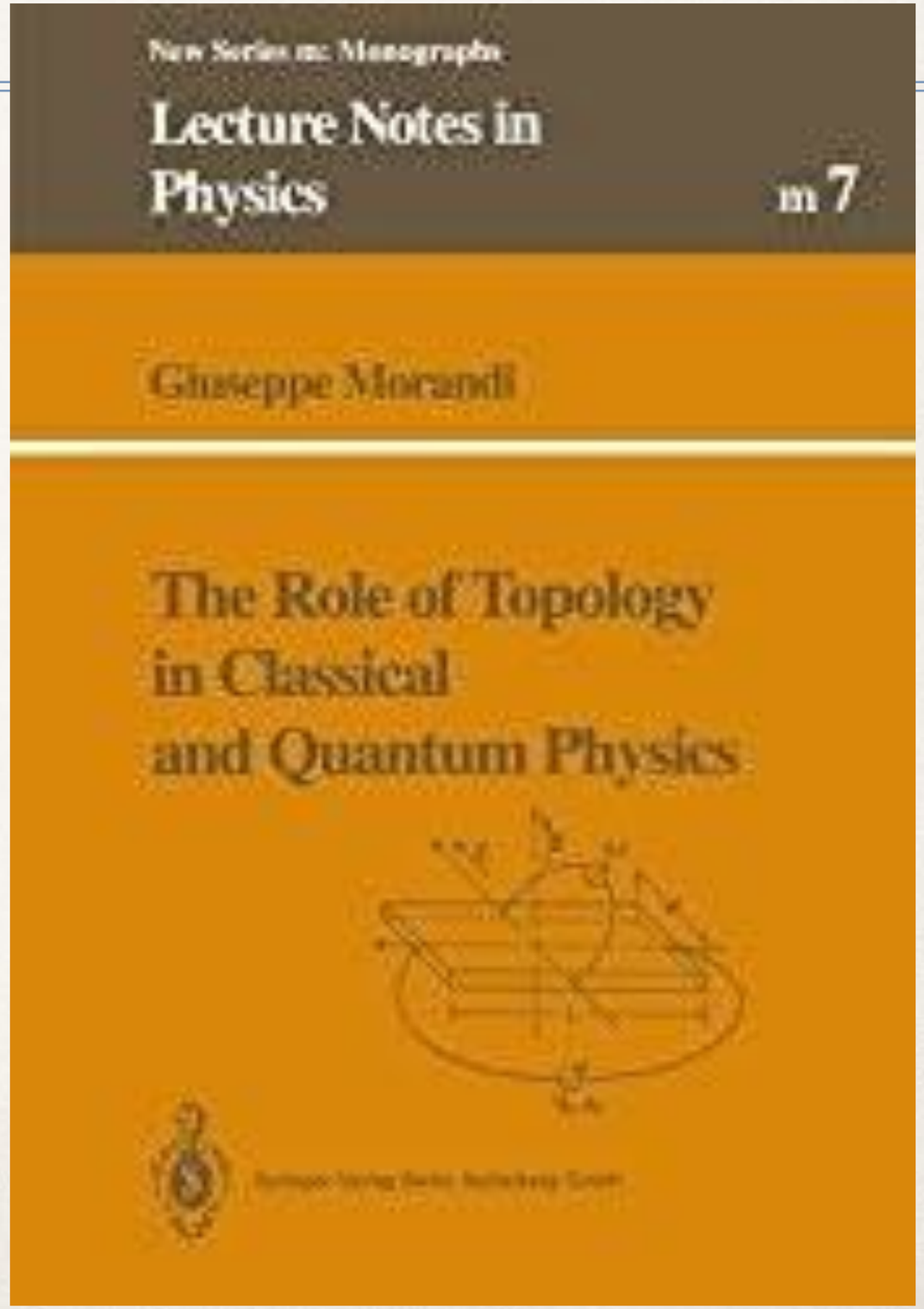
5 Quantum spin chains and symmetry-protected topological phases of matter

6.1 What states of matter are there?

6.2 Quantum simulations, and artificial states of matter

books


QUANTUM HALL EFFECT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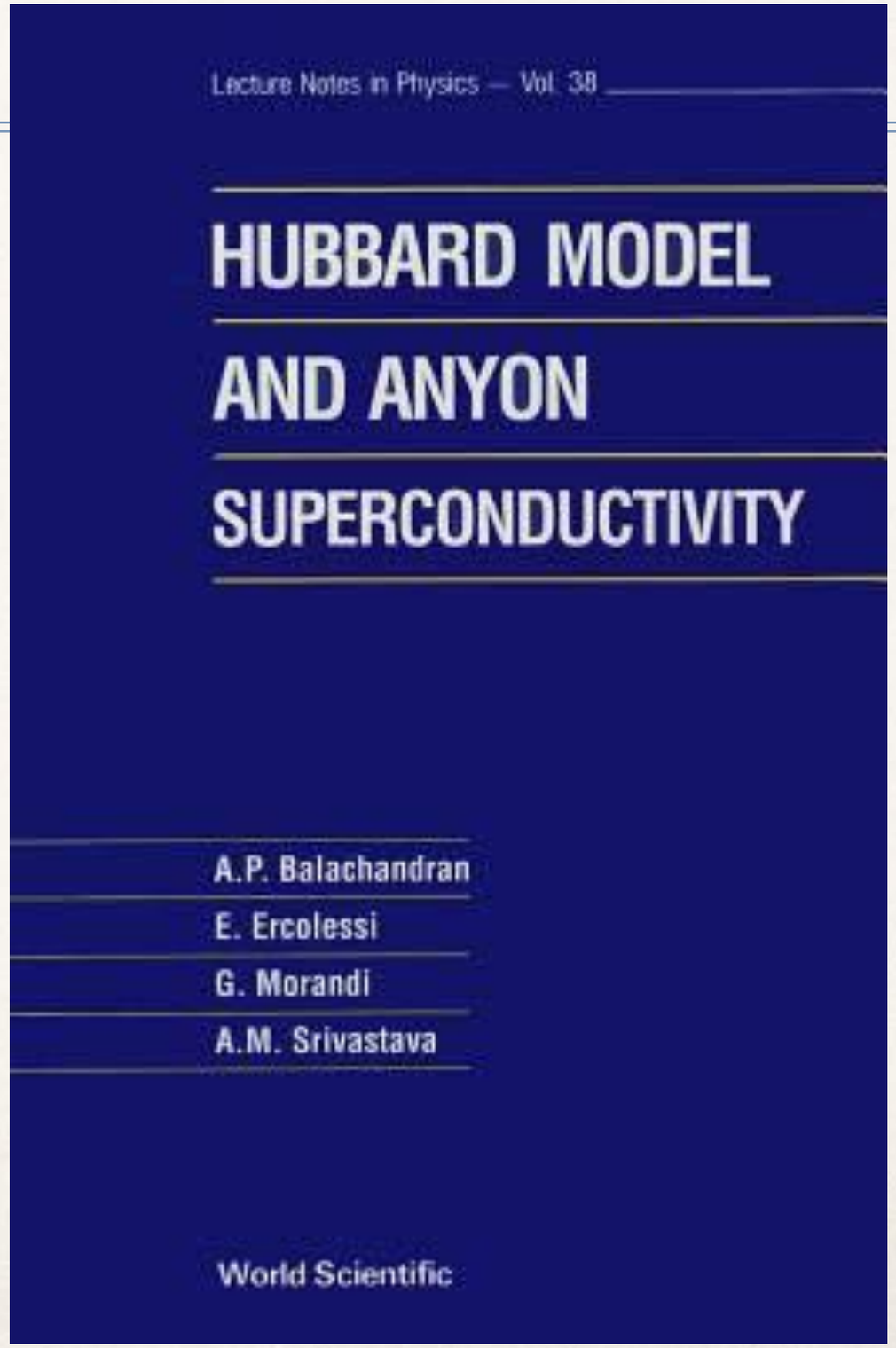
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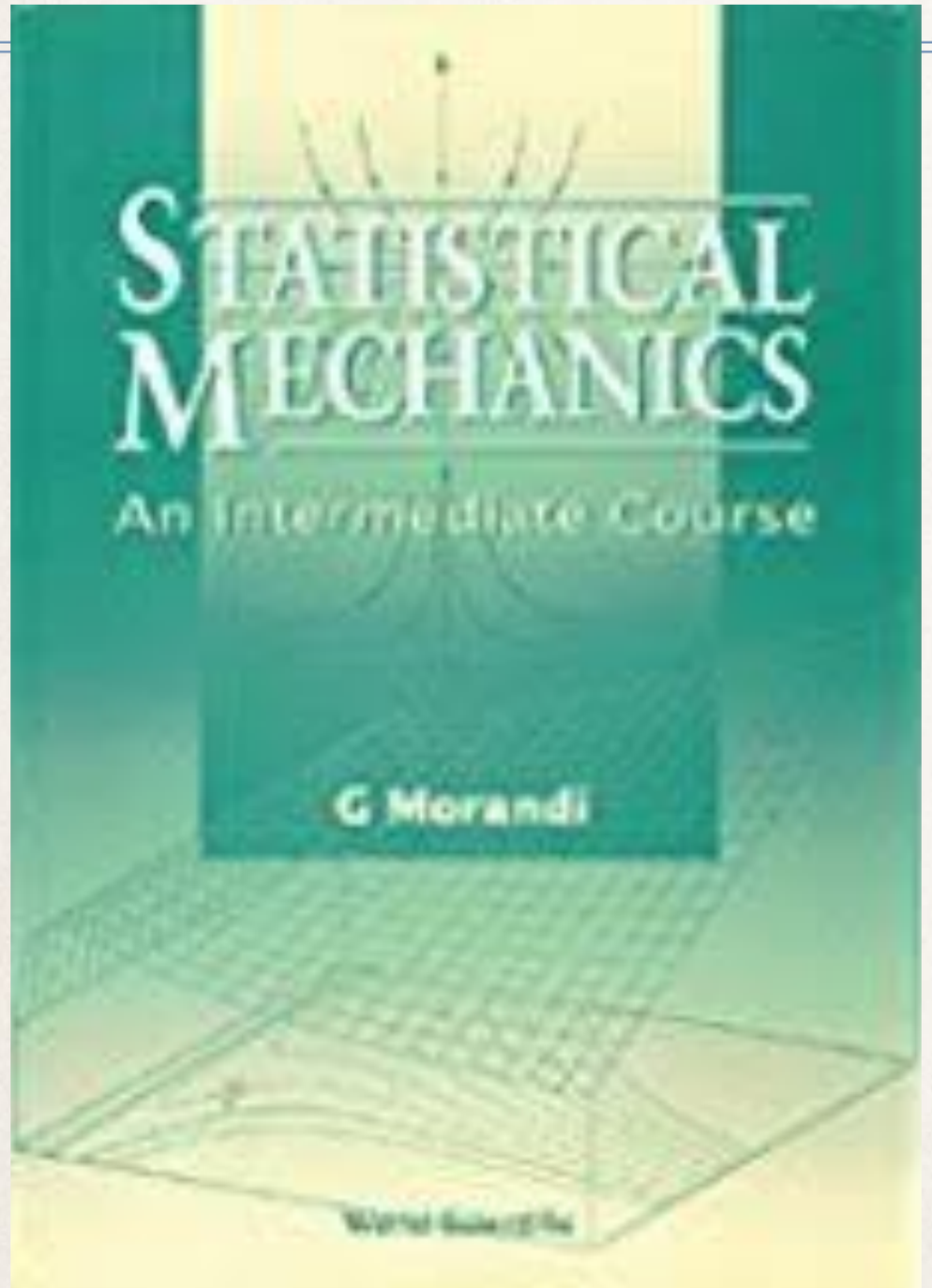
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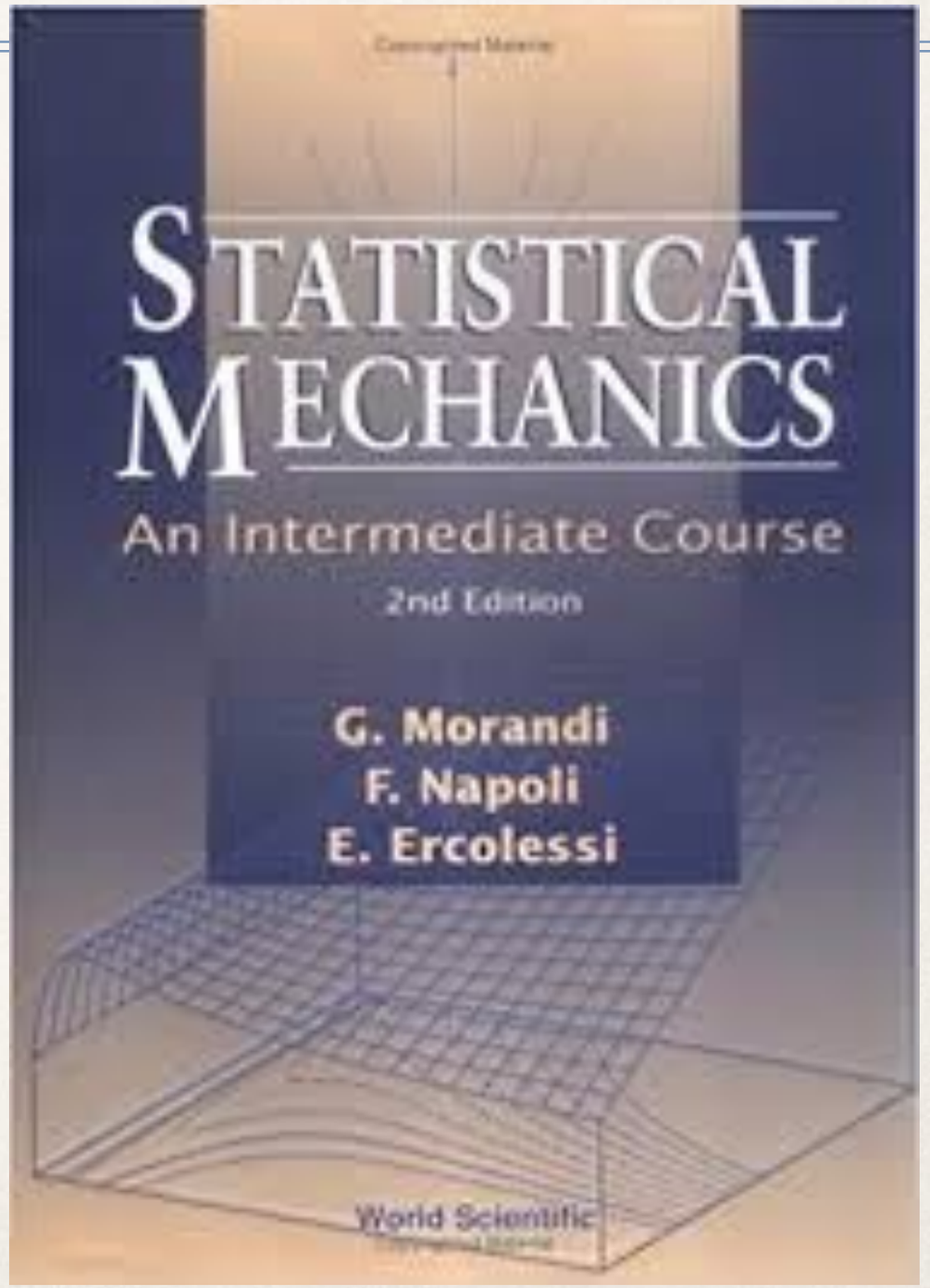
G Morandi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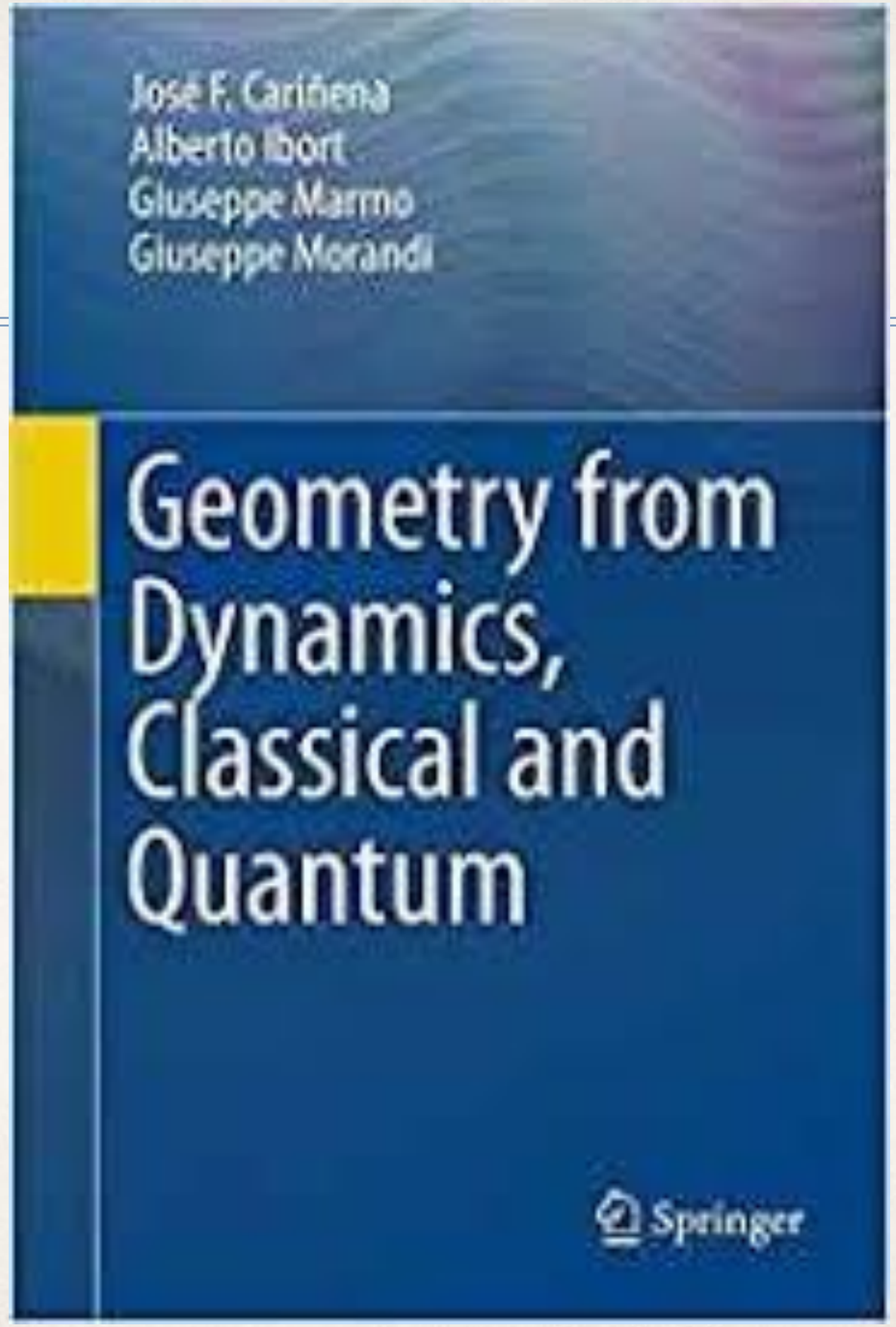
José F. Cariñena
Alberto Ibort
Giuseppe Marmo
Giuseppe Morandi
Geometry from Dynamics, Classical and Quantum
Springer

QMFPA 2006

Bertinoro (Italy), December 4-7, 2006

CONFERENCE

REGISTRATION/ACCOMODATION

TALKS/POSTERS

PROGRAM

NEW File of the TALKS NEW

NEW PICTURES of the Conference NEW

Erwin Schrödinger (1927)

The **Conference** on

QUANTUM MECHANICS:

FROM FUNDAMENTAL PROBLEMS TO APPLICATIONS

will be held at Centro Residenziale Universitario, Bertinoro (Italy), from December 4 to December 7, 2006.

The conference will focus on quantum mechanical applications, decoherence and entanglement, quantum phase transitions, quantum information and computation, semiclassical limit. Emphasis will be given to physical implementations (BECs, atomic and molecular systems, spin sytems, solid-state applications).

Monday - December 4, 2006	
9:00-9:25	**welcome**
9:25–10:00	Cirillo
10:00-10:35	Lindner
10:35-11:00	Chiarello
11:00–11:25	**coffe break**
11:25-12:00	Illuminati
12:00-12:35	Benenti
12:35-13:00	Pupillo
13:00-15:00	**lunch**
15:00-15:35	Johansson
15:35-16:10	Sodano
16:10-16:35	Giorgi
16:35-17:00	Ciccarello
17:00-17:25	**coffe break**
17:25-18:00	Groenbech-Jensen
18:00-18:35	Antezza
18:35–19:00	Miyamoto

Tuesday - December 5, 2006	
9:00 - 9:35	Bimonte
9:35 - 10:10	Degli Esposti
10:10 - 10:35	Manko M
10:35 - 11:00	Plastina
11:00–11:25	**coffe break**
11:25 - 12:00	Yuasa
12:00 - 12:35	Facchi
12:35 - 13:00	Porzio
13:00–15:00	**lunch**
15:00 - 15:35	Zanardi
15:35 - 16:10	Montangero
16:10 - 16:35	Buscemi
16:35-17:00	Abdel-Aty
17:00-17:25	**coffe break**
17:25 - 18:00	Morsch
18:00 - 18:35	Verrucchi
18:45-20:00	**poster session**

Wednesday - December 6, 2006	
9:00 - 9:35	Kurizki
9:35 - 10:10	Marzoli
10:10 - 10:35	Di Giuseppe
10:35 - 11:00	Retzker
11:00–11:25	**coffe break**
11:25 - 12:00	Petruccione
12:00 - 12:35	Pieri
12:35 - 13:00	Sciarrino
13:00–15:00	**lunch**
15:00 - 15:35	Manko V
15:35 - 16:10	Lamine
16:10 - 16:35	Lupo
16:35-17:00	Paternostro
17:00-17:25	**coffe break**
17:25 - 18:00	Mataloni
18:00 - 18:25	Paladino
18:25 –18:50	Hartmann
18:50-19:15	Genoni

Thursday - December 7, 2006	
9:00 - 9:35	Filipp
9:35 - 10:10	Ota
10:10 - 10:35	Shumovsky
10:35 - 11:00	Chung
11:00–11:25	**coffe break**
11:25 - 12:00	Minardi
12:00 - 12:35	Brambilla
12:35 - 13:00	Sergi
13:00–15:00	**lunch**
15:00 - 15:35	Smerzi
15:35 - 16:10	Scala
16:10 - 16:35	Krivitsky
16:35-17:00	Pietreanu
17:00-17:25	**coffe break**
17:25 - 18:00	Giovannetti
18:00	**Closing rem.**

Bertinoro 2006