Curriculum Vitæ of Raffaele Resta (2013)

PERSONAL DATA

- Born in Genova, Italy, 21 february 1947.
- Italian citizenship; one daughter and two granddaughters.
- **Violon d'Ingres:** Sailing (dinghy racing, offshore racing. cruising, & teaching). See separate **Sailing C.V.** in Italian.
- **Home address:** via S. Laghi 2, I-34123 Trieste.
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EDUCATION

1965 "Maturità Classica", Liceo C. Colombo, Genova, Italy.
1969 "Laurea in Fisica", University of Pisa (*cum laude*).
1969 "Diploma", Scuola Normale Superiore, Pisa, Italy.

LANGUAGES

- Italian: mother tongue.
- English: professional level.
- French: very fluent.
- Latin: poor (despite eight years of classes).

POSITIONS

1969-71 Assistente incaricato, University of Pisa.
1971-83 Assistente ordinario, University of Pisa.
1973-74 on leave, serving as Second Lieutenant in the Italian Army (draft).
1975-83 Professore incaricato, University of Pisa.
1981-83 Professore incaricato, *Fisica dei Semiconduttori*, International School for Advanced Studies (SISSA), Trieste.
1983-94 Professore associato, *Fisica dei Semiconduttori*, International School for Advanced Studies (SISSA), Trieste.
1994– Professore ordinario, *Struttura della Materia*, University of Trieste.

TEACHING

Present:

- Course of "Introduzione alla Fisica della Materia", mandatory for all third year undergraduates in Physics at the University of Trieste.

– Course of "Geometria e Topologia nella Teoria della Struttura Elettronica", for fifth-year students in Physics at the University of Trieste (set of original lecture notes available).

Previous (undergraduate):

– University of Pisa;
– Ecole Politechnique Fédérale, Lausanne, Switzerland.
– University of Trieste.

Previous (graduate):

– International School for Advanced Studies (SISSA), Trieste;
– Troisième Cycle de la Physique en Suisse Romande: 1990, 1995, and 1999 (three sets of original lecture notes available).
– Cycles of lectures at the national graduate schools (Dottorato) of Pavia, Napoli, Bari, and Cagliari.
– Cycles of lectures at several international summer schools.

MANAGEMENT & ORGANIZATION (most relevant functions)

1983-95 Permanent member of the International Programme Committee of the "International Workshop on Computational Condensed Matter Physics".
1986-93 Member of the Consiglio Direttivo (board of directors) and member of the Giunta (core steering committee) of the Istituto Nazionale di Fisica della Materia (INFM).
1989-09 Organizer of 9 workshops at the Centre Européen de Calcul Atomique et Moléculaire (CECAM), first in Orsay, then in Lyon, and lately in Lausanne.
1990-2000 Member of the Conseil Scientifique de l'Institut Romand de Recherche Numérique en Physique des Matériaux (IRRMA).
1998-2010 Member of the Steering Committee and of the "Core Group", Programme "Electronic Structure Calculations for Elucidating the Complex Atomistic Behaviour of Solids and Surfaces", European Science Foundation.
2002-08 Divisional Associate Editor for Physical Review Letters.
2006– Fellow of the American Physical Society.
2010 Selected as "Outstanding Referee" by the American Physical Society.

RESEARCH

Since the beginning of my professional life, my main interest has been in the theory of materials. I have investigated over the years a large number of different materials and of different physical problems. I have used a variety of approaches, ranging from analytical theories and models to first–principle computations.

In the first part of my career the activity was centered in electronic band structure of crystalline materials and related topics (impurities, excitons, screening), with a few contributions to molecular physics. Within the latter, I was a coauthor of the first ab-initio calculation ever of the many-body Green's function for a molecule (1976). Another significant achievement is the interpretation of the excitonic spectra of solid rare gases, which

were being measured at the time (late 1970s) at the early synchrotron radiation facilities. Also worth mentioning from this early period is a widely quoted model dielectric function for semiconductors (1977).

Since the birthdate (about 1980) of the modern computational theory of materials, my mainstream research activity has been in the area of computational physics. I have worked both at the development of new methods and at actual computations, with a taste for those materials which display nontrivial and possibly unexpected features. In most of this work real materials (and their measurable/measured properties) were chosen as case studies, and described at the first–principle level, using state–of–the–art technical ingredients. I have most often addressed crystalline semiconductors and insulators, focussing on properties such as lattice dynamics, dielectric response, piezoelectricity, ferroelectricity, flexoelectricity. A part of my activity (mostly about the band–offset problem in semiconductors) has been performed in close collaboration with experimental groups.

I have been a coauthor of the first ab-initio calculation ever of (i) dielectric constants (1986), (ii) piezoelectric constants (1989), (iii) spontaneous polarization in pyroelectrics (1990) and (iv) ferroelectrics (1993).

Several times in my career a computer experiment—performed on a specific case study—has unveiled features of quite general relevance, and/or some unexpected exact results: a novel "theorem" often came *after* the computation, prompted by the analysis of the numerical data. An important part of my present work belongs to what could be defined as "computational physics light": a computer experiment of moderate workload (performed on a workstation) is the key to interpret an experiment, to explain a microscopic mechanism, to understand a general trend, and sometimes (as said above) to discover a new "theorem".

I am a coauthor of the so-called "modern theory of polarization", based on a Berry phase (1992 onwards). This has revolutionized the common wisdom about polarization even as a matter of principle, besides providing a powerful computational tool. The Berry phase is now implemented as a standard option within most electronic–structure code packages. I am also a coauthor of the analogous "modern theory of orbital magnetization" (2005 onwards); its implementation at a first-principle level has started in 2010.

Since 1998 I have developed a novel general theory of the insulating state of matter, spawned by polarization theory. This theory is based on a novel concept of electron localization, expressed in geometrical terms; it completes the program initiated by W. Kohn in 1964 with his revolutionary "theory of the insulating state".