Curriculum Vitae

Andrea Cintio

Personal details

Birth date and place

Marital status

Citizenship

Education

12.2011 Ph.D. degree - by Physics Department, University of Pisa (XXI Cycle)

thesis title:

Absorption of an ultrashort intense laser pulse as a few degrees of freedom Hamiltonian system;

advisor: Prof. Fulvio Cornolti.

10.2003 - 9.2004 Post-Graduate Specialization School for Secondary School Teaching (SSIS), University of Pisa.

9.2002 Graduate degree (Diploma di laurea vecchio ordinamento (V.O.)) - Physics Department, University of Pisa

graduation: 110/110 cum laude

thesis title:

Regole di somma per sistemi infiniti;

advisor: Dr. G. Morchio

7.1988 High school diploma

Research experience.

Postdoctoral Research

9.2019 - 9.2021 Institute for Chemical-Physical Processes (IPCF) - CNR, Pisa (research adviser: Giuseppe Annino), fellowship grant renewed after the first year

- Research fellow (assegno di ricerca) working on 'Caratterizzazione dielettrica ad alta frequenza e temperatura'. Call for selection: IPCF-AR-003-2019-PI prot. AMMCEN n. 0045981, date June 26th, 2019.

  Development of a methodology for the design of overmoded resonant cavities in reactors for microwave-assisted processes. The aim is the development of a rigorous numerical analysis that is necessary for the determination of the dimensions of the reactor chamber to ensure that optimal coupling conditions are reached for different samples and operating conditions, on the basis of the knowledge of both the dielectric properties of the sample and the resistivity of the chamber walls.

  Also, the research activity focused on the measurement of both the dielectric constant and the conductivity of crystalline silicon at microwave frequencies for temperatures from 25 up to 1200 °C.

1

2.2018 - 2.2019 Institute for Chemical-Physical Processes (IPCF) - CNR, Pisa (research adviser: Giuseppe Annino)

- o Research fellow (assegno di ricerca) working on 'Caratterizzazione dielettrica di materiali ad alta frequenza e temperatura' under the supervision of dott. Giuseppe Annino. Call for selection: n IPCF-004-2017-PI - Protocollo IPCF - CNR n.6288, date October 26th, 2017.

  The fellowship activity focused on dielectric characterizations *as functions of the temperature* of materials with very different properties (rubber samples and SIC-based ceramic composites). A method of resonant cavity measurement was adopted using an apparatus that allows to operate in a temperature range up to 1200 °C. The measurement procedure consists of an electromagnetic data acquisition and an extraction of the dielectric quantities from the data based on a *rigorous* modelling of the cavity field pattern. Different procedures were created in order to automate and speed up the data analysis, both for the electromagnetic curves and for the determination of the dielectric quantities.

3.2017 - 3.2017 Institute for Chemical-Physical Processes (IPCF) - CNR, Pisa (research adviser: Giuseppe Annino)

- o Project and manufacturing of quartz sample-holders with low insertion losses, suited for operating in vacuum conditions in microwave resonant cavities for high-temperature dielectric measurements. IPCF - CNR Prot. no. 0000009, date January 3rd, 2017.

1.2017 - 1.2017 Institute for Chemical-Physical Processes (IPCF) - CNR, Pisa (research adviser: Giuseppe Annino)

- o Manufacturing of quartz sample-holders with low insertion losses for high-temperature dielectric measurements in microwave resonant cavities. Microwave dielectric characterization of several samples at temperatures up to 1200 °C. IPCF - CNR Prot. no. 0000009, date January 3rd, 2017.

6.2016 - 9.2016 Collaboration agreement with the group of Mario D'Acunto at the Institute of structure of matter (ISM) - CNR, Roma.

- o Modeling and numerical simulation of the effects of nanoparticle dispersion on the mechanical properties of nanoparticle/polymer composites. Biological applications of metal nanoparticles.

5.2016 - 5.2016 Institute for Chemical-Physical Processes (IPCF) - CNR, Pisa (research adviser: Giuseppe Annino)

- o Project and manufacturing of quartz sample-holders with low insertion losses for high-temperature dielectric measurements in microwave resonant cavities. IPCF - CNR Prot. no. 0001912, date May 2nd, 2016.

1.2016 - 4.2016 Institute for Chemical-Physical Processes (IPCF) - CNR, Pisa (research adviser: Giuseppe Annino), under the research project HELM, High-frequency ELectro-Magnetic technologies for advanced processing of ceramic matrix composites and graphite expansion, June 2012 - May 2016.

- o Numerical modelling of the performance of a resonant microwave cavity for the heating of a planar sample of silicon carbide.

5.2014 - 1.2015 (8 months) Institute of Biophysics - CNR, Pisa (research adviser: Dr. Angelo Di Garbo) contratto di prestazione d'opera artt. 2222 e seguenti del c.c.

- o Numerical analysis of cerebral cortex signals in tetanus toxin models.

10.2013 - 3.2014 (6 months)   Institute of Biophysics - CNR, Pisa (research adviser: Dr. Angelo Di Garbo) – contratto di prestazione d'opera artt. 2222 e seguenti del c.c.

- o Numerical analysis of the effects of environment on the signal scaling of cortex signals from mice in different environmental conditions.

- o Numerical simulations of seazure-like dynamics of the cortex-thalamus coupling in a realistic model of the corticothalamocortical network.

Doctoral Research

2.2006 - 12.2011   Physics Department, University of Pisa (research adviser: Prof. Fulvio Cornolti).

o One-degree of freedom models of the interaction of an intense, short, laser pulse with both solid and clustered matter.

Publications

Peer-reviewed journal papers

5. R. DAmbrosio, A. Cintio, A. Lazzeri, G. Annino
   Design of an overmoded resonant cavity-based reactor for ceramic matrix composites production
   Chem. Eng. J. **405** 126609 (2021). Accepted 9 August 2020. Available online 12 August 2020.

4. F. Vallone, E. Vannini, A. Cintio, M. Caleo and A. Di Garbo
   Time evolution of interhemispheric coupling in a model of focal neocortical epilepsy in mice
   Phys. Rev. E **94**, 032409 (2016).

3. F. Vallone, A. Cintio, M. Mainardi, M. Caleo and A. Di Garbo
   Existence of anticorrelations for LFPs recorded from mice reared in standard conditions and environmental enrichment   Phys. Rev. E **91** , 012702 (2015).

2. F. Vallone, A. Cintio, S.Chillemi, and A. Di Garbo
   Thalamic inputs modulate cortical activity: Possibility to control the generation and the termination of seizure-like behaviour   Neurocomputing **151**, 34 (2015)

1. A. Cintio, G. Morchio
   Sum rules and density waves spectrum for nonrelativistic fermions
   Journal of Mathematical Physics **50**, 042102 (2009)

Outline of contributions.

5. In the research activity whose results are described in the paper, I contributed to the development of the numerical model applied to the coupled electromagnetic and thermal problems. The numerical study is aimed at a rigorous evaluation of the electromagnetic fields in the cavity and a self-consistent computation of the heating dynamics of the sample. The comparison of the results with the measurements, in particular the fraction of power dissipated in the sample, allows to check the computation of the cavity volume, which is performed on the basis of general basic arguments and using semplifying hypotheses. A contribution to the design of the reactor is the determination of the cavity volume for which a given mode density is obtained.
   In addition, I collaborated on the microwave dielectric characterization of the SiC-based materials chosen in the densifying infiltration process and the material for the electrical and thermal isolations of the infiltrated preform.

4. My work was in the application of various tools of linear and nonlinear dynamics to the analysis of LFP signals detected from both hemispheres of mouse models of induced unilateral epilepsy so as to determine the evolution of the level of interhemispheric coupling.

3. I collaborated on the long range correlation analysis of LFP signals recorded from the motor and visual cortices of mice reared in environmental enrichment and standard conditions. The long range correlation is ascertained through the consistent values of three parameters (the factal dimension, the Hurst exponent and the scaling properties of the power spectrum) obtained using the Higuchi method, the detrended fluctuation analysis and the spectral analysis.

2. I collaborated to investigate a model of the cortico-thalamo-cortical network. In particular, manipulating some model parameters one try to understand how thalamic inputs can modulate seizure-like behaviours involved in the epilepsy.

1. I dealt with the computation of some frequency sum rules, in the limit of large wavelength, in extended quantum systems of nonrelativistic fermions. Energy spectra are expressed in terms of time derivatives of appropriate commutators with local Hamiltonians. More specifically, the limit of zero momentum follows from relations between frequency moments of the energy spectral measures associated with density waves excitations.

Books

A. Cintio (2020) *Il problema della previsione in un sistema deterministico classico*
In A. Marinucci, S. Salvia, L. Bellotti (eds) **Scienza e filosofia della complessità** (chapter 2), Roma IT, Carocci ed.

A. Marinucci, S. Salvia, A. Cintio (2015) *La meccanica classica. Storia, filosofia e fondamenti.*
In P. Pecere (ed.) **Il libro della natura** (chapter 6), Roma IT, Carocci ed.

M. D'Acunto, A. Cintio et al. (2016) *Near-Field identification of gold nanoshells inside cells.*
In A. Bianconi, A. Marcelli (eds.) **Atomically Controlled Surfaces Interfaces and Nanostructures** (pp 273-274), Roma IT, Superstripes Press

Submitted for publication

A. Cintio, F. Cornolti
Non-perturbative features of driven scattering systems (submitted to Chaos)
http://arxiv.org/abs/1206.1922

Conference presentations

Conference abstracts accepted as talks

3. R. D'Ambrosio, G. Annino, A. Cintio, A. Lazzeri
Design of a pilot-scale Microwave Heated Chemical Vapor Infiltration plant: An innovative approach -
10th International Conference on High Temperature Ceramic Matrix Composites., Bordeaux, France, Sept 22-26, 2019.

2. R. D'Ambrosio, G. Annino, A. Cintio, A. Lazzeri
   Design of an Overmoded Resonant Cavity-Based Reactor for SiC-Based Ceramic Matrix Composites Production - 17th International Conference on Microwave and High Frequency Heating AMPERE 2019, Valencia, Spain, Sept 9-12, 2019.

1. G. Annino, A. Cintio, R. D'Ambrosio, A. Lazzeri
   Dielectric Characterization of Si, SiC, SiC/SiC, and C/SiC Samples - 17th International Conference on Microwave and High Frequency Heating AMPERE 2019, Valencia, Spain, Sept 9-12, 2019.

Outline of contributions.

2.-3. I contributed to the building of the 3-D model of the reactor cavity adopted for solving the electromagnetic and thermal problems in the reactor design.

1. In the microwave dielectric characterization my contribution was in two ways: I collaborated on the measurement of the electromagnetic quantities of the cavity mode and on the data analysis, designed for materials with large variability of the dielectric properties when the temperature is changed.

Conference abstracts accepted as posters

A. Cintio, R. D'Ambrosio, A. Lazzeri, G. Annino
High temperature dielectric characterization of SiC-based Ceramic Matrix Composites - Poster contribution at 10th International Conference on High Temperature Ceramic Matrix Composites., Bordeaux, France, Sept 22-26, 2019.

G. Annino, A. Cintio and A. Lazzeri
Microwave dielectric characterization up to 1200°C - Poster contributions P-17 - Programme & Book of Abstracts - 9th International Conference on Broadband Dielectric Spectroscopy and its Applications, Pisa IT, Sept. 11-16 2016.

Seminar talks

12.12.2013 *Protein aggregation: mechanism, dynamics and models* - Institute of Biophysics CNR, Pisa.

Unpublished internal reports.

G. Annino, A. Cintio. *Electromagnetic and thermal profiles in the lab-scale hybrid radiant/MW CVI reactor* - Internal report of the HELM project, May 2016.

Conferences, Summer Schools attended.

Conference on Stability and Instability in Mechanical Systems: Recent Progress and Mathematical Theory, September 22 - 26 2008, CRM - Barcelona, Spain.

Advanced Course on Stability and Instability in Mechanical Systems. September 15 - 19 2008 , CRM - Barcelona, Spain. Courses taken on averaging, variational and topological methods in Hamiltonian systems, KAM theory and Normal Hyperbolic theory.

International School on Quantum Electronics, 43rd Course, "Matter in Super-Intense Laser Fields" June 27 - July 5 2006 , Erice, Italy. Courses taken on the interaction of atoms, molecules and clusters with super-intense laser pulses and few cycle laser pulses.

Teaching experience.

9.2017 - 2.2018 teaching mathematics at *Istituto agrario C. Cattaneo* in Cecina.

7.2017 - 7.2017 teaching mathematics and physics at *Liceo F. Enriques* (scientific High School) in Livorno.

5.2017 - 6.2017 teaching mathematics at *Liceo F. Cecioni* (scientif High School) in Livorno.

2.2017 - 3.2017 teaching mathematics and physics at *Liceo F. Cecioni* (scientific High School) in Livorno.

Abilities

Languages

Italian mother tongue

English upper intermediate

French basic

Informatics

Operating Systems: Linux/Unix, Windows

Typesetting packages: Latex, MSOffice, OpenOffice.

Mathematical and numerical packages: **Matlab, Matematica, IDL**.

Platform for Physics-Based Modeling and Simulation: **Comsol Multiphysics**.

Numerical skills: **Fortran, C programming languages; basics of Particle in Cell coding.**

Research background: applied mathematics - numerical modeling -experimental physics.

- Applications of Hamiltonian perturbation methods to models of laser - plasma interaction, with few degrees of freedom.

- *Hamiltonian perturbation theory*: KAM theory and Nekhoroshev's perturbation methods.

- *Chaotic scattering*: non-hyperbolic scenario.

- *Deterministic chaos.*

- *Algebraic approach to the quantum mechanics of infinite systems.* Dispersion relations in the limit for long wavelength in the fundamental and thermal representations of observable algebras generated by localized canonical variables.

- Numerical techniques and statistical methods for the analysis of temporal series data. Mathematical modelling of biological systems.

- Electromagnetic field theory in cavities and numerical analysis of microwave circuits and dielectric resonators:

    - modelling and simulation of electromagnetic field distributions and resonance effects in resonant cavities for addressing microwave heating phenomena and dielectric response of materials with conductivity properties depending on the temperature.

- Fundamentals of the theory and the numerical modeling of polymer/nanoclay composites.

- Characterization of both devices and materials in the microwave range through perturbation techniques.

    - Characterization of the dielectric properties of materials in a resonant cavity from room temperature to 1200°C.

    - Experimental investigation of both nonradiative field patterns and far-field ones of dielectric disk resonators.