



## *Curriculum Vitae*

### PERSONAL DATA

**Name\_:** Yiannis Contoyiannis

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### EDUCATION

- Department of Physics of the Aristotle University of Thessaloniki. (April 1981).
- **MSc** in Nuclear and Particle Physics. Department of Physics, University of Athens (January 1998).
- **PhD** in Physics of Critical phenomena with application to high energies. Department of Physics, University of Athens (June 2001). Thesis title: "The Theory of Critical Fluctuations in Quarks Matter".

### PROFESSIONAL EXPERIENCE

- From 1-3-2004 to 31-8-2006: Postdoctoral research in projects PYTHAGORAS Program (EPEAEK). Employer: University of Athens, Physics Department. Research field: "Experimental data Analysis of heavy ions collisions".
- From 1-3-2005 to 30-12-2006: Postdoctoral research in projects PYTHAGORAS II Program (EPEAEK). Employer: University of Athens, Physics Department. Research fields: (a) Mechanisms of self-organization in lattice models. (b) Production of mathematical maps describing the removal from the critical point (c) Critical behaviors in diode p-n.

- From 1-09-2013 to 31-12-2014: Postdoctoral research in the ARCHIMIDES III (NSRF) project. Employer: TEI of Athens.  
Research field: Analysis of pre-seismic E/M recordings.
- From 12-10-2017 to 1-3-2018 : Member of EDIP for laboratory, research and teaching in Department of Electronics Engineering, Technological Education Institute (TEI) of Piraeus.
  - Present : Member of EDIP for Laboratory, research and teaching in Department of Electrical and Electronics Engineering University of West Attica.

### **TEACHING-LABORATORY EXPERIENCE**

- Academic year 2002-2003: Scientific associate (at assistant professor level), Automation Department, TEI of Chalkida. Teaching subject: Electromagnetism – Optics.
- Academic years 2003-2004 to 2009-2010 consecutively, Scientific associate (Assistant Professor level), Mechanical Engineering Department, Technological Educational Institute of Chalkida. Teaching subject: Mechanics – Thermodynamics.
- Academic years 2004-2005 to 2006-2007 consecutively, Scientific associate (Assistant Professor level), Electrology Department, TEI of Chalkida. Teaching subject: Mechanics – Electricity.
- Academic years 1997-1998 to 2000-2001 consecutively, Laboratory Associate, Department of Physics, University of Athens. Teaching subject: Physics I, Physics II.
- Academic year 2018-19 in Postgraduate program of University of West Attica. Teaching object: Theory of complex systems.
- Academic year 2017-2018: Laboratory Associate, TEI Piraeus. Teaching object : Laboratory of Electronic Physics and Laboratory Control systems.
- Academic year 2018-19: Laboratory Associate , University of West Attica. Teaching object: Laboratories Physics I.
- Academic year 2000-2001. Educator at the annual training of the Ministry of National Education in Physics of Secondary Education that took place in the Department of Physics of the University of Athens.
- November and December of the academic years 2005-2006 to 2009-2010, Educator at Lamia PEK for Natural Science teachers.

## **PUBLICATIONS**

### ***International Scientific Journals with referees***

- 1) "Strangeness in chiral QCD phase transition" N. Antoniou, **Y. Contoyiannis**, F. Diakonou, C. Ktorides and M. Lahanas. **J. Phys. G: Nucl. Part. Phys.** **23 (1997) 1953-1960.**
- 2) "Fractals at  $T=T_c$  due to instanton-like configuration" N. Antoniou, **Y. Contoyiannis**, F. Diakonou and C. Papadopoulos. **Phys. Rev. Lett** **81, 4289 (1998).**
- 3) "The critical point in QCD and pion fluctuations in heavy ion collisions" N. Antoniou, **Y. Contoyiannis** and F. Diakonou, **Nucl. Phys. A661 (1999) 399c-402c.**
- 4) "The fractal geometry of critical systems", N. Antoniou, **Y. Contoyiannis** and F. Diakonou. **Phys. Rev. E** **62, 3125(2000).**
- 5) "Criticality and Intermittency in the order parameter space", **Y. Contoyiannis** and F. Diakonou. **Phys. Lett. A** **268(2000) 286-292**
- 6) "Pion production from a critical QCD phase" N. Antoniou, **Y. Contoyiannis**, F. Diakonou, A. Karanikas, C. Ktorides. **Nucl. Phys. A** **693(2001) 799-824.**
- 7) "Intermittent dynamics of critical fluctuations" **Y. Contoyiannis**, F. Diakonou and A. Malakis. **Phys. Rev. Lett.** **89, 35701(2002).**
- 8) "Intermittent dynamics of critical preseismic electromagnetic fluctuations" . **Y. Contoyiannis**, F. Diakonou, P. Kaporis, A. Pearatzakis and C. Eftaxias. **Phys and Chem of the Earth.** **29(2004) 397-408.**
- 9) "Criticality in the relaxation phase of the spontaneous contracting atria isolated from the heart of the frog (*Rana ridibunda*)" **Y. Contoyiannis**, F. Diakonou, C. Papaefthimiou and G. Theophilidis. **Phys. Rev. Lett.** **93, 098101 (2004)**
- 10) "Critical QCD in nuclear collisions" . N. Antoniou, **Y. Contoyiannis**, F. Diakonou and G. Mavromanolakis. **Nucl. Phys. A** **761(2005) 149-161.**
- 11) "Monitoring of a preseismic phase from its electromagnetic precursors". **Y. Contoyiannis**, P. Kaporis and K. Eftaxias. **Phys. Rev. E** **71, 1(2005).**
- 12) "Abrupt transition in a sandpile model" **Y.F. Contoyiannis** and F.K. Diakonou. **Phys. Rev. E** **73, 031303 (2006).**
- 13) "Unimodal maps and order parameter fluctuations in the critical region" **Y.F. Contoyiannis** and F.K. Diakonou. **Phys. Rev. E** **76, 031138 (2007).**
- 14) "Evidence of fractional-brownian-motion type asperity model for earthquake generation by means of preseismic electromagnetic emissions" K. Eftaxias, **Y. Contoyiannis**, G. Balasis, K. Karamanos, J. Copanas, G. Antonopoulos, and C. Nomicos. **Natural Hazards and Earth System Sciences. Sci,** **8, 1-13, 2008.**
- 15) "Evidence of fractional-brownian-motion type asperity model for earthquake generation in candidate pre-seismic electromagnetic emissions" K. Eftaxias, **Y. Contoyiannis**, G. Balasis, K. Karamanos, J. Copanas, G. Antonopoulos, G. Koulouras and C. Nomicos. **Natural Hazards and Earth System Sciences. Sci,** **8, 2008 657-669.**

16) "Tsallis and Levy statistics in the preparation of an earthquake" **Y.F. Contoyiannis** and K. Eftaxias. **Nonlin. Processes Geophys.**, **15**, 1-10, 2008.

17) "Unfolding the procedure of characterizing recorded ultra low frequency, kHz and MHz electromagnetic anomalies prior to the L'Aquila earthquake as pre-seismic ones-Part 1" K.Eftaxias, L.Athanasopoulou, G. Balasis, M. kalimeri, S. Nikolopoulos, **Y. Contoyiannis**, J. Kopanas, G. Antonopoulos, and C. Nomicos, **Natural Hazards and Earth System Sciences.** **9**, 1-19,2009.

18) "Unfolding the procedure of characterizing recorded ultra low frequency, kHz and MHz electromagnetic anomalies prior to the L'Aquila earthquake as pre-seismic ones-Part 2" K.Eftaxias, L.Athanasopoulou, G. Balasis, M. kalimeri, S. Nikolopoulos, **Y. Contoyiannis**, J. Kopanas, G. Antonopoulos, and C. Nomicos, **Natural Hazards and Earth System Sciences.** **10(2010)**, 275-294.

19) "Critical features in electromagnetic anomalies detected prior to the L'Aquila earthquake" **Y.F. Contoyiannis**, C. Nomicos, J.Kopanas, G. Antonopoulos, L. Contoyianni, K. Eftaxias. **Physica A** **389 (2010)** 499-508.

20) "The Earth as a living planet : Human-type diseases in the earthquake preparation process" **Y. F . Contoyiannis**, S.M. Potirakis, K. Eftaxias, **Nat. Hazards Earth Syst. Sci** **13(2013)** 125-139.

21) "Recent Field Observations Indicating an Earth System in Critical Condition Before the Occurrence of a Significant Earthquake" S.M.Potirakis, **Y.Contoyiannis**, K.Eftaxias, G. Koulouras, and C. Nomicos. **IEEE Geoscience and remote sensing letters**, vol:12, issue:3, page:631-635, 25-09-2014.

22) "Intermittency in Stock Market Dynamics" A.Ozun, **Y.Contoyiannis**, F.Diakonos, L.Magafas and M.Hanias. **Journal of Trading. Summer 2014, Vol 9, No 3, pp26-33.**

23) "Tricritical crossover in earthquake preparation by analyzing preseismic electromagnetic emissions" **Y. F Contoyiannis**, S.M Potiraks, L. Contoyianni, K. Eftaxias. **Journal of Geodynamics**, (2015) pp40-54.

24) "Magnetic field fluctuations in an array of randomly directed circular currents". V. Anagiannis, **Y. Contoyiannis**, F. Diakonos. **The European Physical Journal B.** **November 2013, 86;460.**

**25) Recent seismic activity at Cephalonia island (Greece): a study through candidate electromagnetic precursors in terms of nonlinear dynamics**

SM Potirakis, **Y Contoyiannis**, NS Melis, J Kopanas, G Antonopoulos, ...

**Nonlin. Processes Geophys. Discuss 2, 1587-1629,2015**

26) "Intermittent criticality revealed in ULF magnetic fields prior to the 11 March 2011 Tohoku earthquake ( )" **Y. Contoyiannis**, S.M Potirakis, K. Eftaxias, M. Hayakawa, A. Schekotov. **Physica A** **452(2016)**19-28.

27) "Recent seismic activity at Cephalonia (Greece): a study through candidate electromagnetic precursors in terms of non-linear dynamics", S.M. Potirakis, **Y.Contoyiannis**, N.S. Melis, J.Kopanas, G.Antonopoulos, G. Balasis, C. Kontoes, C. Nomicos and K.Eftaxias. **Nonlin. Processes Geophys.** **23, 1-18, 2016.**

- 28) “Intermittency-induced criticality in a resistor-inductor-diode circuit” Stelios M. Potirakis, **Yiannis Contoyiannis**, Fotios K. Diakonos, and Michael P. Haniias. **Physical Review E** **95**, 042206 (2017).
- 29) “Intermittency-induced criticality in the lower ionosphere prior to the 2016 Kumamoto earthquakes as embedded in the VLF propagation data observed at multiple stations’. Stelios M. Potirakis, □, **Yiannis Contoyiannis**, Tomokazu Asano, Masashi Hayakawa. **Tectonophysics** **722** (2018) 422–431 (impact Factor: 2.693)
- 30) “Observation of intermittency-induced critical dynamics in geomagnetic field time series prior to the intense magnetic storms of March, June and December 2015” G. Balasis, I. A. Daglis, **Y. Contoyiannis**, S. M. Potirakis, C. Papadimitriou, N. S. Melis, O. Giannakis, A. Papaioannou, A. Anastasiadis, C. Kontoes, **Journal of Geophysical Research: Space Physics**, **123**. (2018), 1-20, doi: 10.1002/2017JA025131 (impact factor 3.44).
- 31) “ Traits of criticality in membrane potential fluctuations of pyramidal neurons in the CA1 region of rat hippocampus “ [Efstratios K. Kosmidis](#), [Yiannis F. Contoyiannis](#) , [Costas Papatheodoropoulos](#) , [Fotios K. Diakonos](#) . **European Journal of Neuroscience** , <https://doi.org/10.1111/ejn.14117> (2018). (impact factor 2.832)
- 32) “Signatures of the symmetry breaking phenomenon in pre-seismic electromagnetic emissions” **Yiannis Contoyiannis**, Stelios M. Potirakis . **JSTAT\_027P\_0618** (2018) (impact factor 2.404)
- 33) “Analysis of the ultra-low frequency magnetic field fluctuations prior to the 2016 Kumamoto (Japan) earthquakes in terms of the method of critical fluctuations” Stelios M. Potirakis, **Yiannis Contoyiannis** , Alexander Schekotov , Tomokazu Asano Masashi Hayakawa . **Physica A** **514** (2019) 563–572. (impact Factor: 2.243)
- 34) [Four-Stage Model of Earthquake Generation in Terms of Fracture-Induced Electromagnetic Emissions: A Review](#). K Eftaxias, SM Potirakis, **Y Contoyiannis** . **Complexity of Seismic Time Series**, 437-502.
- 35) “On Possible Electromagnetic Precursors to a Significant Earthquake ( $M_w = 6.3$ ) Occurred in Lesvos (Greece) on 12 June 2017”. Stelios M. Potirakis , Alexander Schekotov , **Yiannis Contoyiannis** , Georgios Balasis , Grigorios E. Koulouras , Nikolaos S. Melis , Adamantia Zoe Boutsis , Masashi Hayakawa , Konstantinos Eftaxias and Constantinos Nomicos . **Entropy** **2019**, **21**, 241; doi:10.3390/e21030241.( impact Factor: 2.305)

- 36) *“Lévy and Gauss statistics in the preparation of an earthquake”* Stelios M. Potirakis, **Yiannis Contoyiannis**, Konstantinos Eftaxias, Physica A: Statistical Mechanics and its Applications. Pg 121360, 2019/5/8. **(impact Factor: 2.243)**
- 37) *Evidence of critical dynamics in various electromagnetic precursors* S. M. Potirakis, **Y. Contoyiannis**, A. Schekotov, T. Asano, K. Eftaxias, M. Hayakawa. EPJ special issue to be published (in 2019).

### Under review

1. Criticality as a resonant phenomenon. Y. F. Contoyiannis, S. Potirakis, F. Diakonou
2. Criticality and phase transitions in nanoscale UTBB 1 FD-SOI MOSFETs. Y. Contoyiannis, S.M. Potirakis, S.G. Stavrinos, M.P. Hanias, D.H. Tassis
3. Criticality in hybrid models produced from thermal spin systems and artificial neural networks. Y. F. Contoyiannis, S. M. Potirakis\*, F. K. Diakonou, E.K. Kosmidis

### PREPRINT

- 1) On the recent seismic activity at Ioannina (Greece): Pre-earthquake electromagnetic emissions with critical and tricritical behavior  
Y Contoyiannis, SM Potirakis, J Kopanas, G Antonopoulos, K Eftaxias, ...  
arXiv preprint arXiv:1610.06220 (2016)
- 2) Domain magnetization approach to the isothermal critical exponent  
AM Tsopelakou, G Margazoglou, YF Contoyiannis, PA Kalozoumis, ...  
arXiv preprint arXiv:1601.06306 (2016)
- 3) On the recent seismic activity at eastern Aegean Sea: Analysis of fracture-induced electromagnetic emissions in terms of critical fluctuations  
Y Contoyiannis, SM Potirakis, J Kopanas, G Antonopoulos, G Koulouras, ...  
arXiv preprint arXiv:1708.00320 (2017)
- 4) *“Preliminary results concerning the fracture induced electromagnetic emissions recorded prior to the Mw Earthquake on October 25, 2018 south of Zakynthos (Greece)”*. S. M. Potirakis **Y. Contoyiannis** S. Melis G. Koulouras J. Kopanas G. Antonopoulos, K. Eftaxias, C. Nomicos. **arXiv preprint arXiv:1811.11015 (2018/11/24)**.

- 5) *“Two Dimensional Poincare Maps constructed through Ginzburg-Landau Theory of critical phenomena in Physics”*. YF Contoyiannis, arXiv preprint [arXiv:1904.05194](https://arxiv.org/abs/1904.05194) ( 2019/3/28).
- 6) *Self-Similarity and Criticality in the Boson (pions) field produced according to dynamic cascade models*. Yiannis Contoyiannis and Myron Kampitakis. arXiv preprint [arXiv:1905.00326](https://arxiv.org/abs/1905.00326) (2019)
- 7) *The degeneration of critical point in Z (3) spin system. A proposal for QCD confinement-deconfinement phase transition in the color space* Y Contoyiannis, M Kampitakis - arXiv preprint [arXiv:1904.09176](https://arxiv.org/abs/1904.09176), 2019
- 8) *Wavelet based detection of scaling behaviour in noisy experimental data* . [Yiannis F. Contoyiannis](https://arxiv.org/abs/1905.01153), [Stelios Potirakis](https://arxiv.org/abs/1905.01153), [Fotios K. Diakonos](https://arxiv.org/abs/1905.01153) .Apr 27, 2019 - 16 pages . [arXiv:1905.01153](https://arxiv.org/abs/1905.01153)
- 9) “Neurobiological reality simulation through an Artificial Neural Network at criticality “. Yiannis Contoyiannis and Myron Kampitakis. [arXiv:1905.04527](https://arxiv.org/abs/1905.04527) [physics.bio-ph] (2019)

#### Conference Journals with referees

- 1) “Instantons and fractals in critical systems”. N. Antoniou, Y,Contoyiannis, F. Diakonos. **Procc. Correlations and Fluctuations 98 ; World Scientific (1999) 463.**
- 2) “Fractal clusters and intermittency in relativistic heavy ion collisions”. N. Antoniou, Y. Contoyiannis and F. Diakonos. **Procc. International Symposium on Multiparticle Dynamics 98; World Scientific (1999) 110.**
- 3) “Probing the QCD critical point in nuclear collisions” N. Antoniou, Y.Contoyiannis, F. Diakonos, G. Georgopoulos, A. Petridis and M. Vassiliou. **Procc. XXIX International Symposium on Multiparticle Dynamics. USA 8-13 August 1999; World Scientific (2000).**
- 4)“The dynamical analogon of 3d critical systems at equilibrium”. Y.Contoyiannis and F. Diakonos. **Procc. International Workshop on Condensed Matter Theories. Ithaca, Greece 17-23 June 1999. Nova Science Publishers. Inc. Vol 15, (2000) 117.**
- 5) The isothermal critical exponent of the 3–D Ising universality class\*. NG ANTONIOU, YF CONTOYIANNIS, FK DIAKONOS,**Procc, Correlations & Fluctuations in QCD: Proceedings of the 10th International Workshop on Multiparticle Production, Crete, Greece, 8-15 June 2002**

6) “Prospects of detecting the QCD critical point”. N. Antoniou, **Y. Contoyiannis**, F, Diakonou and A. Kapoyannis. **Procc. On the 10<sup>th</sup> International Workshop on Correlations and Fluctuations in QCD. Crete, Greece, 8-15 June 2002. World Scientific (2003) 190.**

7) “Description of pre-seismic MHz electromagnetic in analogy with a thermal second order phase transition: the reproducibility of results”

**Y Contoyiannis**, J Kopanas, G Antonopoulos, L Contoyianni, K Eftaxias  
**EGU General Assembly Conference Abstracts 11, 2435 (2009)**

8) “Are there credible earthquake electromagnetic precursors?”

K Eftaxias, G Balasis, **Y Contoyiannis**, M Kalimeri, C Papadimitriou, ...  
**EGU General Assembly Conference Abstracts 12, 12282 (2010)**

9) “Statistical similarities of pre-earthquake electromagnetic emissions to biological and economic extreme events”. SM Potirakis, **Y Contoyiannis**, J Kopanas, A Kalimeris, G Antonopoulos, ..**EGU General Assembly Conference Abstracts 16 (2014)**

10) “Recent fracture induced electromagnetic field measurements revealing an Earth system in second order phase transition before the occurrence of significant earthquakes”. SM Potirakis, **Y Contoyiannis**, J Kopanas, G Antonopoulos, C Nomicos,

**EGU General Assembly Conference Abstracts 17 (2015)**

11) “Intermittent criticality revealed in the ENIGMA magnetometer array time series prior to the strongest magnetic storms of the present solar cycle”

G Balasis, IA Daglis, **Y Contoyiannis**, SM Potirakis, C Papadimitriou, ...  
**EGU General Assembly Conference Abstracts 19, 8899 (2017)**

**H index : May 2019 : Google Scholar 18, Scopus 14**

### **SCIENTIFIC LECTURES-CONFERENCES-SESSIONS**

1) **Lecture "Introduction to Theory and Wavelet Applications"**, Nuclear Physics Lecture Room, University Of Athens. 13/1/1997.

2) **Lecture "Critical fluctuations like- instanton in heavy ions relativity processes"**, Nuclear Physics Lecture Room, University Of Athens. 13/1/1998.

3) **Lecture “Fractals produced by instantons in thermal phase transition”**. 11th Summer School/Hellenic Congress of Nonlinear Dynamics and Chaos. Leivada July 1998.

4) **Lecture “Chaotic maps and critical systems”**. 12th Summer School / Hellenic Conference of non-linear dynamics Complexity and chaos. Patras, July 1999.

5) **Poster "Can unimodal Chaotic Maps describe critical systems?"**, International Workshop on Condensed Matter Theories. Ithaca, Greece, June 17-23, 1999.



- 6) **Lecture "Instantons in Quantum Chromodynamics"**, Nuclear Physics Lecture Room, University Of Athens. 6/11/2000.
- 7) **Lecture "Fractality and intermittency in critical systems"**, 13th Summer School/Hellenic Conference of non-linear dynamics Complexity and chaos. Chania, July 2000.
- 8) **Lecture "Critical Dynamics, Effective Action and Intermittency in the 3d-Ising Model"**, 14th Summer School / Hellenic Congress of Nonlinear Dynamics Complexity and Chaos. Patras, July 2001.
- 9) **Lecture "Isoscalar Condensate Structures at the Critical Point of the QCD"**, Nuclear Physics Lecture Room, University Of Athens. 13/12/2002.
- 10) **Poster "Fingerprints of Intermittent and Critical Behavior of Earthquake in Electromagnetic Anomalies"**, 27th General Assembly of the European Geophysical Society. Nice, France, April 21-28, 2002.
- 11) **Lecture "The method of critical fluctuations in pre-seismic processes"**. Summer School/Hellenic Conference of non-linear dynamics Complexity and Chaos, Chalkida, July 2003.
- 12) **Lecture "The Method of critical fluctuations"**, Athens, Physics Department, 23/2/2005.
- 13) **Poster "Criticality in Neurons"**, Kosmidis E.K., Contoyiannis Y.F. Papatheodoropoulos C., Diakonos F.K., Theophilidis G., Panhellenic Congress of Neurosciences, Crete, September 2006.
- 14) **Poster "Tsallis and Levy statistics in the preparation of an earthquake"**. Scientific Conference of the Faculty of Physics, Athens, 26 May 2008.
- 15) **Poster "Criticality in single neuron membrane potential fluctuations"**. Kosmidis EK, Contoyiannis YF, Papatheodoropoulos C, Diakonos FK. International Congress of Neurosciences FFRM 2015, Thessaloniki 7-10-2015 to 10-10-2015.

### **Reviewer in Journals-Conferences**

- Reviewer at the International Scientific Journal GRSL (Geoscience and Remote Sensing Letters) in paper titled "Seismic data denoising using adaptive empirical wavelet transform".
- Referee at the 2<sup>nd</sup> International Conference for Innovation in Education, Larisa, 21-23 October 2016.
- Referee within the framework of the Institution of Excellence at the program "Education and Lifelong Learning", Ministry of Education, Academic year 2012-13.

### **AUTHORING**

- PHYSICS II "Electromagnetic theory- Wave-Optics". TEI of Chalkis 2002. Educational notes
- PHYSICS II "Mechanics". TEI of Chalkida 2003. Educational notes
- PHYSICS "Topics-Answers". TEI of Chalkida 2008. Educational notes

- **Book: Complexity of seismic time series . ISBN:978-12-813138-1. "Four-stage model of earthquake generation in terms of fracture-induced electromagnetic emissions : A Review. K. Eftaxias, SM Potirakis, Y. Contoyiannis. 437-502 (2018).**
- "The Higgs Particle". Popularized physics e-book, Chalkida 2012.
- Popularized physics articles in newspapers.

## **LECTURES**

- "CERN Experiments". April 2008, Municipality of Avlidas.
- "CERN's Big Experiments and Scientific Discovery of the First Moments of the Universe". February 2013, Evia Laboratory of Natural Sciences (EKFE).
- "From the very small to the very large and from heartbeat to seismic vibrations". The Unification of Nature through the Critical State, November 2013, Kanithos High School, Chalkida.
- "NOBEL Physics 2013 Award for the Higgs Boson. The Great Moment in Physics". February 2013, Kanithos High School, Chalkida.
- "The paradoxes of quantum physics", February 2014, Kanithos High School, Chalkida.
- "Where the history of the world begins. The human principle". Department of Cultural Affairs, Secondary Education, Evia, May 2014.
- "The Quantum Universe" Karystos Primary School, June 2014.
- "How close we are to forecasting earthquakes", February 2016, Kanithos High School, Chalkida.

## **SCIENTIFIC INTERESTS**

- Field Theories (Classical-Quantum)
- Complex systems, Critical phenomena and phase transition
- Non-linear dynamics and Chaos
- Signal time-series analysis using linear-nonlinear methods with various applications, such as pre-seismic process, biological signals, electronic physics, stock market, social data,....
- Mechanisms of Self-organization
- Physics Popularization.