Concluding remarks

UPoN 2015 Barcelona

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Unsolved Problem of Noise

Noise stems for statistical physics and fluctuations

Unique character of UPoN stressing unsolved Problems in contrast with their solutions

In analogy with Hilbert 23 unsolved problems in Mathematics (Paris, 1900) UPoN presented about 2.000 unsolved problems in its 7 edition

History and future of UPoN

- 1 - 1996 Hungary (Szeged)
- 2 - 1999 USA (Washinfton)
- 3 - 2002 Australia (Adelaide)
- 4 - 2005 Italy (Lecce)
- 5 - 2008 France (Lyon)
- 6 - 2012 India (Calcutta)
- 7 - 2015 Spain (Barcelona) 27 members of SC
- 8 - 2018 Poland to be confirmed

Competing Conference

EDISON 2017 USA (Buffalo)

ICNF 2017 Lithuania (Vilnius)

Comment: competitions among similar Conferences on noise and fluctuations serve to improve the quality of UPoN

COMMENTS

- Wide spectrum of subjects requires more effort to be understood by a general audience

- More efforts to identify and formulate the unsolved problems.

- Last slide should be devoted to a clear list of the most important unsolved problems.

- The difficulty of finding a publisher fitting the main objectives of the Conference and of relevant impact within the international scientific community.

- The fundamental role of the scientific committee in working for the success of the Conference

9 Topics

1. **About 50 unsolved problematics**

1. - Theoretical trends in noise and fluctuations

Stochastic resonance,
Chaos,
Vacuum fluctuations.
Fluctuation theorems for out of equilibrium systems

2.- Quantum noise and coherence

Noise, decoherence and weak measurements,
Quantum fluctuations in far-from-equilibrium systems,
Origin of quantum noise,
Security or non-security of quantum key distribution?
Are quantum number generators provably random?

3.- Fluctuations in materials and devices

Fluctuations in Resistive Switching devices

Conductance noise in graphene connected to a circuit

Percolation noise exponents in good/bad conductor phase transitions

Noise and plasma waves in semiconductor

Origin of 1/f and Random Telegraph Noise in devices

Origin of 1/f noise and internal dissipation in mechanical systems

4.- Fluctuations in biological systems

Effect of long-range interactions among biomolecules on diffusion

Coherence in photosynthesis (how plants control quantum noise)

Stochasticity of neural spikes and brain signals

Stochastic permeation of biological ion channel Couplings and interactions of noisy oscillators in the brain

Molecules in a crowded noisy cell

Noise in neuromorphic systems

5.- Noise in complex and non-linear systems/circuits

Phase and amplitude relationships and synchronization for noisy autonomous and non-autonomous systems

Coloured noise (sources and spectra) in circuits

Coupling functions between noisy nonlinear oscillators

Fluctuations in human group interactions

Fluctuations in turbulent flows & applications to climate study

6.- Fluctuations in econophysics and financial markets

Volatility forecasting in turbulent times.
Forecast of stock market crash and financial bubble
Manipulations by the few or a random dynamics?

7.- Applications of noise

Noise radars

Brownian ratchets and motors

Search in the presence of random false targets

Noise as a precursor of high-frequency instabilities

Noise for sensing and security

Reliability of calibrations through thermal noise measurement

8.- Experimental frontiers of noise and fluctuations

Measurement of noise and fluctuations at very high frequencies (THz)
Measurement of noise and fluctuations at nanoscale
Dark matter and energy: real or not?
Measurement of thermal noise at cryogenic temperatures
Background radiation of the universe

9.- Other topics of noise and fluctuations

Earthquake forecast

Weather forecast

Attractive topics

- Diffusion (Definition, Brownian, anomalous, non-Hermitian, etc)
- Fluctuations theorem and its applications (does entropy fluctuates ?)
- Paradoxes (Parrondo series of the type no+no = yes)

- Driven fluctuations of energy levels as a source of an excess quantum noise

Acknowledgments at UPoN 2015

The success of the Conference has been unanimously recognized by all the partecipants This success is the best award for the Barcelonaa team, the Barcelona city, the Spain.

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