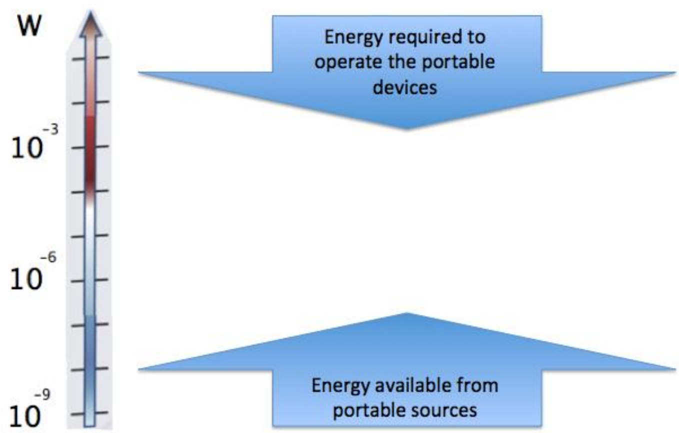
ENERGY HARVESTING AT MICRO AND NANOSCALE

Luca Gammaitoni

*NiPS Laboratory, Dipartimento di Fisica, Università di Perugia and INFN Perugia
I-06123 Perugia (IT)
Luca.gammaitoni@nipslab.org

EXTENDED ABSTRACT

It is a common understanding that ICT is the key engine of growth in modern society. Most importantly ICT is becoming strategic to improve energy efficiency by managing energy demand and use. The energy consumption and carbon dioxide emission from the expanding ICT use, however, is unsustainable. New methods are required to make ICT technology more energy efficient but also the development of new self-powered, energy-harvesting technologies that would enable micro- and nano-scale systems that consume ZEROPOWER through the harvesting of waste energy from the environment are required. Such technologies provide an opportunity for Europe to lead and generate significant economic benefit whilst simultaneously addressing climate change, healthcare and manufacturing efficiency benefits. Developing ZEROPOWER energy harvesting technology will be key for Europe to meet many of the Europe 2020 targets [1].



In this talk we will briefly address the two sides of the ICT-Energy problem: the decrease of energy dissipation in present ICT devices and the increase of energy efficiency in harvesting technologies [2]. We need to solve these two problems in order to bridge the gap between energy demand and energy request in mobile ICT devices. Both tasks require advances on the very same scientific topic: the management of energy transformation processes at nanoscale.

Ambient energy harvesting has been in recent years the recurring object of a number of research efforts aimed at providing an autonomous solution to the powering of small-scale electronic devices. Among the different solutions, micro scale vibration energy harvesting has played a major role due to the almost universal presence of mechanical vibrations mainly in the form of random fluctuations, i.e. noise. In this talk we specifically focus our attention to the possibility to harvest them by employing nonlinear dynamical systems[3, 4]. We will show that nonlinear vibration harvesters can beat linear vibration harvesters. The reason is twofold: on one side nonlinear harvesters can collect energy that is widely spread over the frequency spectrum (a typical condition of random vibrations available at micro and nano scales) with more efficiency compared to linear harvesters that can collect only in a narrow band around their resonance frequency. On the other side nonlinear harvesters can harvest energy in the low frequency part of the spectrum where usually most of the energy is, while linear harvesters can hardly be built with resonance frequency in the low frequency part due to mechanical constraints.

REFERENCES

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