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BOOK OF ABSTRACT

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finiteness and the presence of inhomogeneities. At continuous phase transitions, characterised by the development of diverging correlations at criticality, the theories of finite-size scaling (FSS) and trap-size scaling (TSS) can account for the modified critical behaviours of systems in finite and inhomogeneous conditions, respectively.
Systems that undergo first-order (or discontinuous) phase transitions are characterised by discontinuities of thermodynamic quantities across the transition and do not develop diverging correlations at the transition in the thermodynamic limit. Nevertheless, finite-size effects do affect these systems, in the form of a rounding and smoothing of the transitions' discontinuities.
After reviewing our understanding of scaling behaviours at continuous transitions, we show that sensible theories of FSS and TSS can be put forward in the context of finite or inhomogeneous systems undergoing first order quantum transitions (FOQT). Our results are confirmed by numerical simulations on the quantum Ising chain in transverse and parallel fields and on the q-state quantum Potts chain with q>4, both affected by FOQT. Our theory is especially important in the interpretation of experimental or numerical data, providing tools to discriminate between a smoothed discontinuous transition and a genuine continuous transition.

#P121 - Functional connectivity modulation induced by transcranial direct current stimulation of the motor network investigated by resting state fMRI

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During rest the brain network is not idle, but rather shows a vast amount of spontaneous activity that is highly correlated between multiple brain regions. Resting state functional Magnetic Resonance Imaging (rs-fMRI) analyses focuses on spontaneous low frequency fluctuations (< 0.1 Hz) in the BOLD signal and investigates synchronous activations between regions that are spatially distinct (functional connectivity, FC), occurring in the absence of a task or stimulus.
Transcranial Direct Current Stimulation (tDCS) is a non-invasive brain stimulation technique that is known to modulate cortical activity and FC among brain regions, as measured by functional Magnetic Resonance Imaging. It is well established that motor response (motor evoked potentials, MEP) is enhanced by anodal tDCS stimulation and reduced after catodal tDCS stimulation, for a period of about 5 minutes. Further studies showed different patterns of FC modulation after tDCS, depending on polarity but also on the regions studied, but little is known about the duration of the effect.
This study is aimed at measuring the variation of functional connectivity between cortical brain regions after tDCS along time. For this purpose we enrolled 20 healthy right-handed subjects. All subjects underwent 4 sessions RS-fMRI (10’ each, TR 2’’, 300 volumes, 1.5T scanner): 2 immediately before and 2 after 20’ tDCS over left M1. 12 of them received real (anodal) tDCS, 8 received sham stimulation. Data from 6 subjects (5 real, 1 sham) have been excluded for movement artifacts or other technical problems. We analyzed FC between left and right M1 with two different statistical analyses: *Seed-based Correlation Analysis* (SCA) and the *Temporal Concatenation Group ICA* (TC-GICA).
Seed-based Correlation Analysis showed a significant decrease of FC during the first fMRI acquisition immediately after anodal tDCS stimulation(p=0.005), that got back to baseline during the last fMRI session. This behavior was not found in subjects who underwent sham stimulation (p=0.12).
The *Temporal Concatenation Group ICA* (TC-GICA) showed that immediately after anodal stimulation the average value of voxels decreases significantly (p <0.05) whereas there is no significant decrease in the case of sham tDCS stimulation.
Our results shows that anodal tDCS is able to induce connectivity changes within motor network, that is reversible in a period lasting between 10’ and 20’ after stimulation.

#P122 - A fourth-order method for the calculation of Casimir-Polder forces in terms of vacuum fluctuations and radiation reaction field

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We consider two two-level atoms interacting with the relativistic scalar field in the vacuum state or in a thermal state. We extend to the fourth order in the coupling constant the general procedure by Dalibard, Dupont-Roc and Cohen-Tannoudji [1], in order to evaluate the dispersion interaction energy between the atoms and separate it in contributions from vacuum fluctuations and radiation reaction field. This method can be also easily generalized to the electromagnetic field and to other states of the field. By considering the rate of change of an arbitrary atomic observable $G_{A/B}$ given by the Heisenberg equations (A and B indicate the two atoms), we exploit the possibility to split the field and atomic operators in a free and a source part. We thus obtain two different contributions to the evolution rate of $G_{A/B}$ with a clear physical origin: a *vacuum fluctuations* contribution that can be interpreted as due to field fluctuations inducing correlated polarizations on the two atoms,