Statistical Field Theory

Pisa, July 4, 2019

Pisa group:

E. Guadagnini, M. Mintchev, D. Rossini, E. Vicari, O. Zanusso

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ □臣 = のへで

Activity 2019:

 Scaling behaviour of quantum spin chains close to quantum transitions (D. Rossini, E. Vicari).

at equilibrium:

We focused on the finite-size scaling (FSS) at first-order quantum transitions in the presence of various boundary conditions. We also analysed the scaling of the ground-state fidelity.

away from equilibrium:

We unveiled the properties of the quasi-adiabatic dynamics driven by localized time-dependent perturbations. Then, we developed a dynamic FSS framework for the study of quenches at quantum transitions, and applied it to the scaling behavior of decoherence and energy flow in composite quantum systems. We also investigated the crossover from Kondo to weak-link regime in strongly interacting quantum spin chains with tunable bond impurities.

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > <

Activity 2019:

Study of critical theories using the methods of quantum field theory (O. Zanusso):

I apply methods of conformal field theory combined with the Schwinger-Dyson equation for the determination of the CFT data of critical points that exhibit conformal invariance. I also apply the methods of the renormalization group to the same problems in curved space.

Weyl semimetals (E. Guadagnini).

We derive the expression of the abelian axial anomaly in the so-called multi-Weyl and triple-point crossing semimetals by means of three different computation methods: the perturbative quantum field theory procedure which is based on the evaluation of the one-loop Feynman diagrams, the Nielsen-Ninomiya method, and the Atiyah-Singer index argument.

Microscopic features of quantum transport and entropy production (M. Mintchev)

The microscopic features of quantum transport in a non-equilibrium steady state, which breaks time reversal invariance spontaneously, is investigated. The analysis is based on the probability distributions, generated by the correlation functions of the particle current and the entropy production operator. It is shown that all moments of the entropy production distribution are non-negative, which provides a microscopic version of the second law of thermodynamics.

Activity 2020:

D. Rossini, E. Vicari:

Focus on systems which are coupled to an external bath and are thus subject to dissipation. In particular, it would be tempting to address the competition between unitary and dissipative quantum dynamics in many-body systems.

O. Zanusso:

Apply both RG and CFT to the general problem of the classification of critical theories with a multiple scalar order parameters. Involve the application of statistical methods to gravity in four dimensions and identify its universality class. Study the phenomenon of emergent supersymmetry at large scales.

E. Guadagnini, M. Mintchev:

Analyze the structure of the surface states and Fermi arcs of Weyl semimetals as a function of the boundary conditions parametrizing the Hamiltonian self-adjoint extensions of a minimal model with two Weyl points.

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > <

Richiesta fondi 2020:

Missioni: 5 FTE \times 2 KEur = 10 KEur

Publication 2018-2019:

- D. Rossini and E. Vicari, Phys. Rev. A 99, 052113 (2019)
- E. Vicari, Phys. Rev. A 99, 043603 (2019)
- D. Nigro, D. Rossini, and E. Vicari, J. Stat. Mech. (2019) 023104
- D. Rossini and E. Vicari, Phys. Rev. E 98, 062137 (2018)
- E. Vicari, Phys. Rev. A 98, 052127 (2018)
- A. Pelissetto, D. Rossini, and E. Vicari, Phys. Rev. E 98, 032124 (2018)
- A. Pelissetto, D. Rossini, and E. Vicari, Phys. Rev. E 97, 052148 (2018)
- A. Pelissetto, D. Rossini, and E. Vicari, Phys. Rev. B 97, 094414 (2018)
- H. Panagopoulos, A. Pelissetto, and E. Vicari, Phys. Rev. D 98, 074507 (2018)
- A. Pelissetto, A. Tripodo, and E. Vicari, Phys. Rev. E 97, 012123 (2018)
- D. Giuliano, D. Rossini, and A. Trombettoni, Phys. Rev. B 98, 235164 (2018)
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso, Eur. Phys. J. C79 (2019) no.4, 331
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso, Universe 5 (2019) no.3, 151
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso, Eur. Phys. J. C78 (2018) no.1, 30
- R. Martini, O. Zanusso, Eur.Phys.J. C79 (2019) no.3, 203
- S. A. Franchino-Vias, T. de Paula Netto, I. L. Shapiro, O. Zanusso, Phys.Lett. B790 (2019) 229-236
- S. A. Franchino-Vias, T. de Paula Netto, O. Zanusso, Universe 5 (2019) no.3, 67
- M. Mintchev, L. Santoni, P. Sorba, Annalen der Physik, 530 (2018) 1800170.
- L. Lepori, M. Burrello and E. Guadagnini, JHEP06 (2018) 110, 46.