PhD second year report

Marcello Scanavino

Supervisors:

Nicodemo Magnoli

Andrea Amoretti

During last academic year, I attended the following courses:

- "Holographic quantum matter" (A. Amoretti) with final assay on "Holographic Charge Density Wave'
- "Quantum optics: from photons to electrons" (D. Ferraro) with final assay on "The electronic Hanbury-Brown-Twiss interferometer"

I joined the following PhD schools:

- "LACES2018" at Galileo Galilei Istitute, Arcetri (Florence)
- "XV Modave Summer School in Mathematical Physics" in Modave (Belgium)

For what concerns the research activity, in collaboration with N. Magnoli, M. Caselle, M. Panero and A. Nada, I published the paper:

- "Conformal perturbation theory confronts lattice results in the vicinity of a critical point", DOI: 10.1103/PhysRevD.100.034512

The aim of this work is to study the accuracy and predictive power of conformal perturbation theory by a comparison with lattice results in the neighbourhood of the finite-temperature deconfinement transition of SU(2) Yang-Mills theory. We found that the conformal perturbation theory gives reliable results in both the phases of matter (confining and deconfined) if compared with lattice results. The good results obtained, make us hope to extend the procedure also to the SU(3) case, which is much more similar to real QCD.

In collaboration with N. Magnoli, A. Amoretti and G. Costagliola I am working on applying conformal perturbation theory on the Ising model with a confining potential coupled to the energy operator, by studying correlators both analytically and numerically in 2 and 3 spatial dimensions.

In collaboration with A. Amoretti, D. Brattan and N. Magnoli I am studying a class of holographic models that can be used to get some insights on the behavior of the so-called Charge Density Wave (CDW). This system arises (for example in superconductors) when the translational symmetry of the fluid of electrons in a material is broken, either explicitly (by the underlying lattice) or, more interestingly, spontaneously. Since electrons in CDW are usually strongly coupled, it could be a very hard task to find a reliable description of their properties within a "standard" field theory approach. Thanks to Gauge/Gravity duality instead, one can reach the strong coupling regime, by considering a classical theory of gravity in one dimension more, that is usually easier to treat.

Finally, I did the following tutoring activities:

- 35 hours of "Tutorato didattico" for the courses in Naval Engineering.
- 20 hours of "Supporto alla didattica" in Physics for Civil and Environmental Engineering.