

LABORATORI NAZIONALI DEL GRAN SASSO

SEMINAR ANNOUNCEMENT

Alberto Salvio
(Scuola Normale Superiore, Pisa)

**Superconductivity,
superfluidity and
holography**

In this talk we will discuss holographic models for superfluids and superconductors. In a first part we will use effective field theory methods to introduce superconductivity and superfluidity in a model independent way. On the one hand, this will serve as an introduction to the main part of the talk, on the other hand it will allow us to identify the predictions of the holographic models. After that we will briefly review the gauge/gravity correspondence (i.e. holography) and its simplest realization (the Anti de Sitter / Conformal Field Theory correspondence). We will then focus on models at finite temperature and density of a conserved $U(1)$ current and having in the spectrum a charged scalar operator: the simplest realization of holographic superfluids and superconductors. Some observable quantities will be discussed, such as the conductivity, both in the normal and superfluid phases. While for homogeneous configurations superconductivity and superfluidity can be essentially identified as there is a mapping between the two, for non-homogeneous configuration they are physically different: the $U(1)$ symmetry is global for superfluids and gauged for superconductors. We will discuss in detail this point and consider vortex solutions as the main example of non-homogeneous solutions. Finally, we will extend the discussion to models presenting an insulator/superconductor transition, as observed in cuprate high-temperature superconductors.

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