



INFN Sezione di Napoli



Majorana Lectures Quarta serie

Ettore Majorana - olio su tela di Cristiano Ceroni

Dipartimento di Fisica, Università di Napoli Federico II

Aula Caianiello, 9,10, 12,13 Febbraio 2015

Ore 10:30

Gerard 't Hooft

Institute for Theoretical Physics, Utrecht University
and Spinoza Institute

**“From Standard Model to Black Hole Complementarity
and Back Again”**

A fundamental domain of the natural world is fundamentally unknown and not understood: what are the laws of nature that control the ultra short distances, or equivalently, what happens with subatomic particles when they collide with amounts of energy that cannot, or not yet, be obtained in the largest experimental facilities that we have at present? A good physical principle that could aid us towards answering this question is missing. In these lectures, we focus on two lines of attack: first, we know that gravitational forces, by causing space and time to be curved, will have to be taken into account, in particular when they become so strong that black holes are formed. Ultra tiny black holes will cause unavoidable complications, but they also point to a revolutionary possibility: the existence of a space-time symmetry connecting the small with the large: conformal symmetry.

Another approach is to address the quantum question: should quantum mechanics continue to rule the world of small things, no matter how small? There are reasons for doubt, and here also, the suspicion of the existence of more powerful principles might help us to obtain better understanding of the sub-micro world. Much of this is speculation, but we can work at the mathematical equations that must be handled, and at least these are clear. In the lectures, the math is exhibited.