



# Dottorato in Fisica

## Special Lectures

### Monday, 15 April 2019

**14:30 Massimo Porrati, New York University**

*Symmetries of asymptotically flat space-time: soft charges, canonical transformations and factorization of dynamics with a few applications*

In this lecture I will review the definition of asymptotic quantization and of the simplest infinite-dimensional symmetries of asymptotically flat space-time: large  $U(1)$  gauge transformations and BMS symmetry. I will show that there exist dynamical variables conjugate to the symmetry charges, which allow to construct new canonical variables. IR dynamics becomes trivial in these new "dressed" variables. A few noteworthy applications of this result will be discussed in some details.

**16:00 coffee break**

**16:30 Raffaele Ferrari, Massachusetts Inst. of Technology**

*Ocean Heat Uptake and Climate Change*

The goal of this lecture is to illustrate, through basic physical principles, the role of the ocean circulation in modulating climate change. First we will discuss the energy budget of the atmosphere and the concept of climate sensitivity to greenhouse gases concentrations. Then we will include the coupling of the atmosphere with the ocean and investigate how this coupling affects the surface temperature change in response to variations in atmospheric greenhouse gases concentrations. Finally we will show that these simple energy budgets provide a very useful framework to interpret the results of much more complex numerical models of the full Earth's climate system.

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