



Ettore Majorana - olio su tela di Cristiano Ceroni

Majorana Lectures, 6th series

February 20-21-22, 2017

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Challenges in early- and late-time cosmology

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| February 20, 10:30 – 13:00 | <i>The concordance model of cosmology after Planck</i> |
| February 21, 10:30 – 13:00 | <i>Big bang or big bounce?</i> |
| February 22, 10:30 – 13:00 | <i>Inhomogeneities and precision cosmology</i> |

OUTLINE

The following is an approximate outline of the three slots (the boundary between the first two being somewhat preliminary):

Lecture 1 I will start by reviewing why we need to abandon the old Hot Big Bang scenario in favor of a new, broadly-defined, inflationary paradigm. I will then argue that, in the absence of quantum mechanics, inflation would not be a viable alternative to the old paradigm and briefly review the mechanism by which a calculable spectrum of cosmological perturbations of quantum origin is generated.

Lecture 2 I will first illustrate the successes of the particular implementation of the inflationary idea known as slow-roll inflation. I will then illustrate a possible alternative to slow-roll inflation suggested by string theory. A comparison of the relative merits of those two implementations of the inflationary paradigm will conclude the early-cosmology part of the course.

Lecture 3 I will discuss the way in which inhomogeneities in the recent and present Universe may affect the determination of basic cosmological parameters. A new adapted coordinate system simplifies considerably the study of light-like signals propagating in an inhomogeneous Universe. I will illustrate this on the so-called Hubble (redshift vs. distance) diagram claiming that inhomogeneities cannot replace dark energy as an explanation for cosmic acceleration. I will conclude with the amusing example of calculating time-of-flight differences for ultra relativistic particles propagating in a non-homogeneous Universe.