



Ettore Majorana
olio su tela di Cristiano Ceroni

5th series of Majorana Lectures

March 14-16, 2016

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"Double beta decay and neutrino masses"

March 14, 14:30 - 16:30

Theory of double beta decay

March 15, 14:30 - 16:30

Nuclear matrix elements for
double beta decay

March 16, 10:30 - 12:30

Current limits on neutrino masses

Recent experiments indicate that neutrinos have a nonzero mass. A direct measurement of the average neutrino mass can be obtained from the observation of neutrinoless double β decay, a process in which a nucleus X decays into a nucleus Y with the emission of two electrons (or positrons). In 1937, Majorana suggested that neutral particles could be their own antiparticles. Neutrinoless double β decay can only occur if the neutrino is a Majorana particle. Several experiments are under way in an attempt to observe neutrinoless double β decay.

Lecture 1: The theory of double β decay, both with and without the emission of neutrinos, will be briefly reviewed.

Lecture 2: Recent results in the calculation of the nuclear matrix elements needed for the determination of the average neutrino mass will be presented.

Lecture 3: The nuclear matrix elements will be combined with phase space factors to make predictions for half-lives and obtain limits on the average neutrino mass from current experiments. Other scenarios, in addition to the standard 3-neutrino scenario, will also be considered including the emission of a scalar particle, called the Majoron, in honor of Majorana, and the presence of sterile neutrinos, that is neutrinos with no standard model interactions, as suggested in 1957 by Pontecorvo.