

Lectures on Neutrino Physics 6-7th of April 2010  
Vrije Universiteit Brussel

Prof. Pierre Vilain (ULB) & Prof. Gaston Wilquet (ULB)

**“An experimental review of Neutrino Physics”**

After a short historical summary, the role of neutrino experiments in the development of the electroweak Standard Model will be described. Deep inelastic scattering of neutrinos on nucleons has also provided valuable information on the nucleon structure, complementary to the results obtained with electron and muon probes. In the main part of the course, the convincing evidences that neutrinos are massive will be presented and the future prospects towards a complete determination of the masses and the mixing matrix will be discussed. A related fundamental question, possibly within experimental reach, is whether neutrinos are Dirac or Majorana particles. Another quite active field of research is the study of neutrinos from astrophysical origin. The last part of the course will try to give a description of this field together with the possible connections between neutrino physics and cosmology.

**Location: Vrije Universiteit Brussel – Campus Oefenplein – 1.G.003 (1<sup>st</sup> level of building G, room 003; large seminar room of the IIHE)**

**Lecture 1 : Neutrinos in the Standard Model (6<sup>th</sup> of April; 14:00-17:00)**

Including for example: first detection of neutrinos, parity violation, V-A theory, discovery and measurements of neutral currents, GIM mechanism and the third family, neutrinos as probes of the nucleon structure, ...

**Lecture 2 : Neutrino masses and mixing (7<sup>th</sup> of April; 10:00-13:00 & 14:00-15:30)**

Including for example: theoretical background, effective masses, oscillations in vacuum, flavour transitions in matter, review of oscillation experiments, neutrino-less double beta decay, experimental programme for neutrinos, ...

**Lecture 3 : Neutrinos in astrophysics and cosmology (7<sup>th</sup> of April; 16:00-17:30)**

Including for example: geo-neutrinos, supernovae, high energy neutrino sources, indirect searches of Dark Matter, primordial neutrinos, ...

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