Neutrons in contemporary physics

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Since its discovery (Chadwick,1932), the neutron has rapidely triggered our understanding of the nucleus (Heisenberg 1932), and it revealed very soon (Hahn, Meitner 1938) the possibility of chain reaction what lead to the fast development of military and civil applications of fission during World War II.

Present as a drawback in CERN experiments where it threatens micro-electronic systems, the neutron appears on the other hand in a rich spectrum of scientific questions, as a probe in magnetism (cold neutrons), as a signal in neutrino physics or dynamics of fission, as a healing beam in some therapy schemes, as a driver in futuristic uranium-free reactors or for transmutation, but also as an object of fundamental research (gluon/quark spins, electric dipole moment).

Neutrons are also a growing concern of safety in cyclotrons or other nuclear installations, and the dosimetry of neutrons is a very active field of research.

The first part of the course will go systematically through all these aspects of physics, being fundamental or applied. The second part will be devoted more specifically to instrumental questions, neutron sources and detection systems, and also dosimetry and survey (radioprotection of people and concerns in electronics).

1 Part I

1.1 Early history; Fission and applications

1.2 Spallation, transmutation and the Rubbiatron

1.3 Cold neutrons for magnetism; Neutron radiography

1.4 QM, Magnetic dipole, EMC, fisson dynamics, EDM,...

2 Part II

2.1 Sources, beams and bottles

2.2 Detectors: active/passive; solid/liquid/gaseous

2.3 Neutron dosimetry; Simulation codes

2.4 Concerns for silicon detectors and micro-electronics

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