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Neutron beam facilities for Nuclear Data measurements

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In two lectures I will discuss the neutron producing reactions that are used in neutron beam facilities and present several facilities with their beam properties and latest developments:

Photonuclear and spallation reactions can produce a wide spectrum of neutron energies with high intensity. Whereas from the fusion of hydrogen isotopes e.g. $D(t,n)^3He$ or transfer reactions like $^7Li(p,n)^7Be$ quasimonoenergetic neutrons can be produced. The use of a pulsed beam allows to determine the neutron energy by measuring the time of flight of the neutrons with a known flight path. To study nuclear reactions in the range of several keV kinetic energy, the neutrons produced by these reactions need to be slowed down by elastic collisions with light nuclei. Nuclear fission can also be a very intense source of neutrons of thermal or cold neutrons that are mainly to be used for material research or the study of neutron capture at thermal energies in the meV range. Photoneutron sources use typically an electron linear accelerator to create intense pulses of bremsstrahlung in a heavy metal target that also acts as the neutron radiator in which neutrons are produced by (γ,n) reactions with the heavy nuclei. Examples for photoneutron sources are Gelina of IRMM, Geel, Belgium and nELBE at HZDR, Dresden, Germany. At CERN a spallation neutron source is driven by the proton synchrotron beam for the nTOF experiment. The neutrons for science project at GANIL will use the LINAG deuteron beam to create fast neutrons from a Be,C converter or quasimonoenergetic neutrons using a proton beam with a 7Li target.