Electron screening in $d(d, p)t$ for deuterated metals: temperature dependence — Francesco Raiola für die LUNA-Kollaboration — Institut für Experimentalphysik III, Ruhr-Universität Bochum, Germany

The electron screening effect in the $d(d, p)t$ reaction has been studied at the Ruhr-Universität Bochum for most of the metals and some insulators/semiconductors by using deuterated targets [1]. The deuterated targets were produced via implantation of low-energy deuterons. As compared to measurements performed with a gaseous target in combination with a 4×2 BGO summing crystal as well as with a solid target station in combination with a high resolution germanium detector. The different approaches allowed on one side a high efficiency measurement down to very low energies and on the other hand a high resolution experiment, which was able to discriminate clearly all different contributions to the total cross section. The final results of these measurements will be discussed.

The experimental program of the LUNA collaboration will be continued with the measurement of the reactions $^4\text{He}(\alpha, \gamma)^7\text{Be}$ and $^{25}\text{Mg}(\alpha, \gamma)^29\text{Al}$, which will start in 2005. The experimental status and the prospects of these experiments will be presented.

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Electron screening in $d(d, p)t$ for deuterated metals: temperature dependence — F. Raiola for the LUNA Collaboration — Institut für Experimentalphysik III, Ruhr-Universität Bochum, Germany

The electron screening effect in the $d(d, p)t$ reaction has been studied at the Ruhr-Universität Bochum for most of the metals and some insulators/semiconductors by using deuterated targets [1]. The deuterated targets were produced via implantation of low-energy deuterons. As compared to measurements performed with a gaseous D$_2$ target, a large effect has been observed for all metals. In particular work has been done to investigate the high solubility for the metals of groups III and IV and the late transition elements. In addition, the temperature dependence $T = 20\,^\circ\text{C}$ and a large screening became thus observable.

An explanation of the large effect in metals is provided by the plasma model of Debye applied to the quasi-free metallic electrons. A first evidence of the applicability of Debye’s model is that the deduced number of free electrons per metallic atom agrees with the calculated number from the Hall coefficient [2], for all metals investigated. A critical test of the classical Debye model is the temperature dependence $U_e \propto T^{-1/2}$. This temperature dependence measurement is in progress and new results will be presented.


The total S factor of $^{14}\text{N}(p, \gamma)^{15}\text{O}$ — J. N. Klug, C. E. Rolfs, F. Schumann, F. Strieder, and H. P. Trautvetter — Ruhr-Universität Bochum

The $(p, \gamma)^{15}\text{O}$ reaction is the slowest reaction in the hydrogen burning CNO cycle and thus of high astrophysical interest. The reaction rate determines the CNO neutrino spectrum of our sun and influences the age determination of globular clusters. A recent work [1] done at the LUNA facility at the Laboratori Nazionali del Gran Sasso at energies below 400 keV shows that R-matrix fits to the existing data reveal good agreement for the energy regime below 500 keV. Nevertheless, a precise determination of the astrophysical S factor at zero energy depends strongly on the data above 500 keV. Therefore a new measurement of $^{14}\text{N}(p, \gamma)^{15}\text{O}$ in the energy range of 500 to 2000 keV was performed at the Dynamitron Tandem Laboratory (DTL) of the Ruhr-Universität Bochum in order to remove systematic uncertainties in the existing data, e.g. summing corrections. supported by BMBF (05CL1PC1/1)


The Electron Asymmetry A in the Decay of free neutrons — Daniela Mund, Hartmut Abele, Stefan Baessler, Markus Breim, Jochen Krempl, Michael Kreuz, Bastian Markisch, Alexander Petoukhov, Marc Schuman, and Torsten Soldner — Physikalisches Institut Universität Heidelberg

The Electron Asymmetry $A$ in the decay of free neutrons from A and the neutron lifetime $\tau$, you can derive the first element of the quark mixing CKM matrix, $V_{ud}$. Previous experimental values on $V_{ud}$ and $V_{us}$ violate the unitarity condition of the first row of this matrix. Hence we seek for clarification with this measurement.

Our spectrometer PERKESO was placed at the ILL neutron beam PF1B. We improved our setup in systematics, like polarisation, background and detector function, and in statistics. We will report about our experiment and its results.

Loss and Depolarization Studies of Ultra-cold Neutrons —
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Storage and depolarization of ultra-cold neutrons (UCN), although important for numerous experiments in fundamental and particle physics, is still not fully understood. We have carried out an experiment based on a cylindrical storage vessel with a magnetic shutter on the bottom, gravity and material walls. The loss and depolarization probability per wall interaction of the stored UCN was measured as a function of energy and temperature. We tested diamond-like carbon (DLC) coatings on Aluminum and quartz as wall materials and compared them to Beryllium. We also made a storage container using DLC coatings on plastic and Aluminum foil. We found the DLC loss parameters to be comparable to Beryllium.