# On history of the Fermi pseudopotential concept

# in Atomic and Neutron Physics

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It is revealed already in history, that in the same year, 1934, when the Fermi group just discovered the influence of the Hydrogen substances on the radioactivity produced by neutrons, Enrico Fermi published /*Fermi-1934*/ his concept of the pseudopotential in atomic physics, which explained their results /*Amaldi and Segre-1934*/ on the light absorption spectra of alkaline vapors. However, according to numerous reviews and books in neutron physics, Enrico introduced pseudopotential for the first time in his historic paper of the year 1936 /Fermi-1936/ on physics of thermal neutrons behavior in medium like paraffin or water. In an attempt to understand this situation we will report and compare details of both papers, such as introducing the scattering lengths, their application in place of strong but poorly known electron-atom or particle-nuclei interaction potentials and, finally, reducing the problem to an effective potentials but weak enough in magnitude for the application of the first Born approximation to calculate scattering amplitudes and cross sections. Experimentalists accepted this approach trustfully, while theorists - critically enough and started to work on a more 'mathematically correct' ones /*Blatt and Weisskopf-1952*/. The references, which will be provided, show that this work continues. In a parallel developing in Atomic and Molecular Physics the important experimental finding and theoretical approaches /Zinner-2012/, related to Fermi pseudopotentials for neutral ultracold atoms in magneto-optical traps, appeared in the present century. Finally we will draw attention to the status of Ultracold Neutron Physics /*Abele, Lemmel, Jenke-2019*/, where the so-called 'optical' potential based on the Fermi approach is widely used and serves nowadays in precision studies of neutron beta-decay for the Standard Model tests and searches for a 'new physics'.

Key References:

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