A Possibility for Electron Capture in Low-Energy Nuclear Reactions

Ryoji Furui
Nano Fusion Design
info@nanofusion.design

Abstract

We explore the possibility of electron capture by protons as a means to trigger low-energy nuclear reactions (LENR), which could potentially produce neutrons in research settings.

We present a calculation of electron capture (EC) based on energy-momentum conservation before and after the EC event. At our LENR site, we believe that hydrogen atoms in their ground state are situated within plasmonic flow, wherein electrons possess enough energy (greater than or equal to 13.6 eV). Consequently, low-energy protons become confined within plasmons, which feature a Coulomb potential conducive to capturing electrons. We consider the interaction of EC as follows:

$$p + e \rightarrow\ n\ +\ \nu_e \tag{1}$$

Where a proton p captures an electron e, then a neutron n and a neutrino ν_e is produced.

Here, we set a condition before EC that the proton is at rest and the electron moves towards the proton with velocity v. After EC, we set the neutron to be at rest and the neutrino to not be produced. Therefore, we can derive the minimum energy required for EC. The total energy-momentum E before EC is calculated by applying relativistic velocity to the electron and electric potential energy, which is given by:

$$E = m_p c^2 + m_e c^2 \frac{1}{\sqrt{1 - \left(\frac{v}{c}\right)^2}} + k\frac{|e_p||e_e|}{r} \tag{2}$$

In this equation, m_p represents the mass of a proton, c is the speed of light, m_e is the mass of an electron, k is the Coulomb constant, e_p is the charge of a proton, e_e is the charge of an electron, and r represents the distance of separation between the two particles.

As Coulomb potential can be infinite, Equation (2) allows for the possibility of EC with any value of v that satisfies the relevant quantum properties. We propose an interpretation where infinite potential in classical theory corresponds to the 99.999… % probability of an event in quantum mechanics. This implies that EC always occurs when an electron settles onto the surface of a proton.

Finally, our analysis suggests that optimizing the condensation of both electrons and protons at moderate energy levels may activate the Coulomb force and increase EC, which could result in the formation of LENRs. We plan to investigate this phenomenon more thoroughly by computer simulations in future research.