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# Large electron screening effect in 1H(7Li,$\alpha$)4He and 1H(19F,$\alpha\gamma$)16O reactions in different environments

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In reactions between nuclei at very low energies, when the energy of the incident beam in the center of mass system is far below the Coulomb barrier, the only way the reaction can happen is by tunneling. In this case, since the projectile has to penetrate through the huge potential barrier, the reaction rate is very low and sensitive to electronic properties of target materials. The electrons surrounding the reacting nuclei can increase the tunneling probability through the Coulomb barrier leading to an enhancement of nuclear reaction rates. Thermonuclear reactions are important in understanding the nucleosynthesis of elements in the universe and the energy generation in stars. But considering the fact that atoms in the stellar interior are in most cases in highly stripped states and nuclei are immersed in a sea of free electrons which tend to cluster closer to the nucleus than in atoms, we do not expect that the electron screening effect observed in the laboratory should be equal to electron screening in the stars. To be able to explain the electron screening in the stars, it is important that we first understand the electron screening effect under laboratory conditions.

But unfortunately, our understanding of electron screening is still poor. Even nowadays the very nature of this effect is unclear. The latest studies suggest that it is not a static, but rather a dynamic process [1]. What is known from previous experiments is that the amplitude of electron screening potential is much higher when the reaction takes place inside a metal than in an insulator or semiconductor [1-5]. Significant differences of the amplitude of the screening potential were observed between various host metals and the origin of this is not yet understood. Also, the experimental results indicate a dependence of the electron screening potential on the proton number Z of the projectile, but the form of this dependence is not known.

With the motivation to contribute to these investigations of the electron screening effect and to provide a deeper understanding of this topic, we studied the 1H(7Li,$\alpha$)4He and 1H(19F,$\alpha\gamma$)16O reactions in inverse kinematics on hydrogen implanted C, Pd, and W targets. Contrary to expectations, large electron screening potential was found in all three targets. From our results we also tried to deduce the dependence of the electron screening potential on the proton number Z of the projectile. Preliminary results show that this dependence is not linear.

[1] J. Gajević et al., Eur. Phys. J. A 49, 70 (2013).
[2] F. Raiola et al., Eur. Phys. J. A 19, 283 (2004).
[3] J. Cruz et al., Phys. Lett. B 624, 181 (2005).
[4] K. U. Kettner et al., J. Phys. G 32, 489 (2006).
[5] M. Lipoglavšek et al., Eur. Phys. J. A 44, 71(2010).

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