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低能聚变反应中的电子屏蔽效应

@连刚$中国原子能科学研究院核物理研究所!北京102413

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摘要 简要介绍了天体物理感兴趣能区带电粒子核反应中的电子屏蔽效应的实验及理论研究。为深入了解电子屏蔽效应的机制 ,在鲁尔大学DTL实验室 1 0 0kV加速器上采用一系列氘化金属靶、氘化绝缘体靶和氘化半导体靶进行了D(d ,p)T反应的研究。实验结果表明 ,大多数氘化金属靶中的电子屏蔽效应较大 ,而氘化绝缘体靶和氘化半导体靶中的电子屏蔽效应相对较小。在对金属中的电子做准自由近似后 ,应用经典的德拜模型可对氘化金属靶的结果给出一种合理的解释 ,验证实验正在进行中。从实验数据中还可得到有关各种材料对氘的吸附能力方面的信息。

关键词 电子屏蔽效应 天体物理S(E)因子 德拜模型

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Electron Screening Effects in Fusion Reactions at Low Energies

LIAN Gang (China Institute of Atomic Energy, P.O.Box 275-46, Beijing 102413, China)

Abstract The experimental and theoretical studies of the electron screening effects in charged-particle induced reactions at energies of astrophysical interest are summarized briefly. For a deep understanding of electron screening effects, the D(d,p)T reaction has been studied in a series of deuterated metal-, insulator- and semiconductor targets using the 100 kV accelerator of the Dynamitron-Tandem-Laboratorium at the Ruhr- University-Bochum. As compared to measurements performed with a gaseous D 2 target, a large effect has been observed in most metals, while a comparatively small effect is found in the insulators and semiconductors. A reasonable explanation of the large effect in metals is possibly provided by the classical plasma screening of Debye applied to the quasi-free metallic electrons. The subsequent experiments are already in progress to prove this explanation. The data also provided some information on the solubility of hydrogen in the samples.

Key words electron screening effects astrophysical S(E) factor Debye model

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通讯作者