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Double differential charged particle emission cross sections and stopping power calculations for some structural fusion materials

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In fusion reactors, neutron induced radioactivity strongly depends on the irradiated material. So, a proper selection of structural materials will limit the radioactive inventory in a fusion reactor. First-wall and blanket components have high radioactivity concentration due to being the most flux-exposed structures. The main objective of fusion structural material research is the development and selection of materials for reactor components with good thermo-mechanical and physical properties, coupled with low-activation characteristics. Double differential light charged particle emission cross section, which is a fundamental data to determine nuclear heating and material damages in structural fusion material research, for some elements target nuclei have been calculated by the TALYS 1.6 nuclear reaction code at 14.8 MeV neutron incident energy and compared with available experimental data in EXFOR library. Direct, compound and pre-equilibrium reaction contribution have been theoretically calculated and dominant contribution has been determined for each emission of proton, deuteron and alpha particle. Penetrating distance and stopping powers also have been calculated for the alphas, deuterons and protons using GEANT4 code and compared each other.

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Gauge proximity influence of fields on extended states

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A proximity influence of a magnetic field on adjacent regions in flat 2D space is shown to be a natural consequence of the Aharonov-Bohm effect combined with the non-existence of magnetic monopoles. This influence is confirmed through a recent theory that goes beyond the standard Dirac phase factor (and that incorporates wave-function-phase-non-localities) and affects numerous results in the literature on extended arrangements with inhomogeneous magnetic fields. There seems to be a gauge-ambiguity remaining that has been over-looked in all previous works. The deep origin of this annoying feature is explained and it is shown that it can be removed when outside (remote) fluxes are properly quantized. This suggests natural ways to eliminate the artificial effect for confined systems, leading to quantization of macroscopic quantities in a wide range of systems of current interest. Examples include applications (i) to a spherical geometry, that leads to the standard Dirac quantization of magnetic monopoles, (ii) to a cylindrical configuration, by additionally invoking Axion Electrodynamics, that naturally leads to quantization of dyons (the Witten effect), as well as quantization of Witten current, leading in turn to the quantization of Hall conductance, either (a) in whole or (b) in half integral units of e^2/h (corresponding to conventional Quantum Hall Effect systems and to exotic magneto-electric phenomena in topological insulators, respectively). Similar considerations with adjacent t-dependent electric fields lead to the possibility of manufacturing of interesting quantum devices (that induce Integral Quantum Hall Effect and other topological phenomena in novel time-dependent ways from outside the system).

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