PARTICLE TUNNELING AND SCATTERING IN A THREE-DIMENSIONAL POTENTIAL WITH A HARD CORE AND AN EXTERNAL POTENTIAL BARRIER

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The non-relativistic particle tunneling and scattering through a spherical three-dimensional potential barrier (either rectangular, or Coulomb repulsion), containing a spherical potential rectangular well with a hard core inside, had been studied. The explicit analytical expressions for the S-matrix of elastic scattering and all probability amplitudes (external and internal reflections, tunneling inside and tunneling outside) for zero angular momentum and for relations between them had been firstly obtained. In conclusion, unlike to the typical simplified one-dimensional approximation, utilized for low-energy astrophysical nuclear-fusion reactions, we underline the necessity to consider the three-dimensional picture which brings to the multiple internal reflections from internal barrier wall and also to the more strict penetration factor.

Keywords: three-dimensional tunneling, scattering, barrier, potential well, hard core.