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Configuration space techniques to solve multiparticle scattering problem by using trivial boundary conditions

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The main difficulty to solve the scattering problem in configuration space is related to the fact that the scattering wave functions are not localized. One is therefore obliged to find solutions for multidimensional differential equations, which satisfy extremely complex boundary conditions. Finding a method which enables us to solve the scattering problem without an explicit use of the asymptotic form of the wave function is of great importance. In this talk I will present two configuration space formalisms [1-3], namely complex scaling and complex energy methods, which allow to solve rigorously scattering problem but still avoiding complex boundary conditions. Limitations of the two methods will be discussed, as well as some "lucky" cases.

Several applications will be provided for complex-scaling method proving its efficiency in describing elastic and three-body breakup reactions for Hamiltonians which may combine short-range, Coulomb as well as optical potentials. For the first time this formalism will be applied to solve four-nucleon scattering problem above the break-up threshold using realistic interactions.

[1] A. Deltuva et al., PPNP 74 (2014) 55.
[2] J. Nuttal and H. L. Cohen. Phys. Rev., 188 (1969) 1542.
[3] F. A. McDonald, J. Nuttall, Phys. Rev. Lett. 23 (1969) 361.

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