

## **Unitary correlation in nuclear reaction theory: Separation of nuclear reactions and spectroscopic factors**

A. M. Mukhamedzhanov and A. S. Kadyrov<sup>1</sup>

<sup>1</sup>*ARC Centre for Antimatter-Matter Studies, Curtin University, GPO Box U1987, Perth, WA 6845, Australia*

Future exact many-body theory will allow us to calculate nuclear reactions based on the adopted NN and many-body nuclear potentials. But NN potentials are not observable and there are infinite number of the phase-equivalent NN potentials related via finite-range unitary transformations. We show that asymptotic normalization coefficients, which are the amplitudes of the asymptotic tails of the overlap functions are invariant under finite-range unitary transformations but spectroscopic factors are not. We prove also that the exact amplitudes for the (d,p), (d,pn) and (e,e'p) reactions determining the asymptotic behavior of the exact scattering wave functions in the corresponding channels, in contrast to spectroscopic factors, are invariant under finite-range unitary transformations. Moreover, the exact reaction amplitudes are not parametrized in terms of the spectroscopic factors and nuclear reactions in the exact approach cannot provide a tool to determine spectroscopic factors which are not observable. We call it separation of the exact reaction theory and SFs. This work has been published in Phys. Rev. C.