

Abstract Submitted
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Studying the 3 alpha reaction in hyperspherical harmonic approach NGOC NGUYEN, NSCL, Michigan State University, FILOMENA NUNES COLLABORATION, IAN THOMPSON COLLABORATION — In this work, the 3 alpha reaction is studied by using the Faddeev hyper-spherical harmonic (HH) method [1]. Starting from a three body model, we derive the analytical formulas for the quadrupole strength function $B(E2)$ as well as the reaction rate which is well known for the two particles but not for three particle system. The $2+$ state and the $0+$ resonance are well reproduced but we consider the contributions of the nonresonant continuum states to the reaction rate in a consistent manner. Considering only Coulomb interaction for the three alpha scattering problem we can obtain analytical continuum wave functions for the $0+$ states. At low temperature our calculations agree very well with NACRE and there is an expected increase in the reaction rate at high temperature due to the nuclear contribution (resonant process). A full calculation with the R-matrix method in hyper-spherical coordinate space is being done to include nuclear and coulomb in equal footing. Final results and a detail physical analysis of the reaction mechanism will be presented and compared with [2,3]. [1] I. J. Thompson, F. M. Nunes, B. V. Danilin, *Comput.Phys.Comm.* 161, 87-107 (2004). [2] K.Ogata, M.Kan, M.Kamimura, *Prog. Theor. Phys.* 122, 1055 (2009). [3] R. de Diego, E. Garrido, D.V. Fedorov, A.S. Jensen, *EPL*. 90, 52001(2010).

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