

Fusion using radio active ion beams

A.M.Vinodkumar^{1*}

¹*Department of Physics, University of Calicut, Kerala - 673635, INDIA*

The fusion excitation function for ${}^9\text{Li} + {}^{70}\text{Zn}$ [1] and ${}^9\text{Li} + {}^{208}\text{Pb}$ [2] systems were measured for near barrier energies using ISAC1 and ISAC2 facilities at TRIUMF. The α emitting evaporation residues (${}^{211-214}\text{At}$) were stopped in the ${}^{208}\text{Pb}$ target and their decay was measured. The isotopic yields are in good agreements with the statistical model prediction using HIVAP code. The measured excitation function shows evidence for large enhancements in the sub-barrier energies, which is not accounted by current theoretical models. Also, suppression of the above barrier cross section with respect to these theoretical models have been seen. The implication of these measurement for studying the fusion of ${}^{11}\text{Li}$ with ${}^{208}\text{Pb}$ will be discussed.

The capture-fission cross section were measured for the collision of the massive nucleus ${}^{132}\text{Sn}$ with ${}^{96}\text{Zr}$ [3] at near barrier energies and compared with ${}^{124}\text{Sn}$ with ${}^{96}\text{Zr}$ [4]. This study was able to give insight into fusion enhancement and hindrance in the systems involving neutron rich nuclei. The coupled channel calculations were able to describe the data if the surface diffuseness is allowed to be 1.10 fm instead of 0.6 fm. The dinuclear system model (DNS) calculations were able to describe the excitation function reasonably well and if we use this barrier heights predicted by this model we can conclude that fusion hindrance (represented by extra push energy) is greater for the more neutron rich systems.

This work is performed in collaboration with Prof. W. Loveland, P.H. Sprunger, J. Neeway (Oregon State University), M. Trinczek, M. Dombisky, P. Machule (TRIUMF), Prof. J. J. Kolata, A. Roberts, and T. Spencer (University of Notre Dame), D. Peterson (ANL) and J. F. Liang, D. Shapira, R. L. Varner, C. J. Gross (ORNL).

References

- [1] W. Loveland, **A.M. Vinodkumar**, R.S. Naik, P.H. Sprunger, B. Matteson, J. Neeway, M. Drinks, M. Dombisky, P. Machule, D. Ottewell, D. Cross, K. Gagnon, and W. J. Mills, *Phy. Rev. C* **74**,064609(2006).
- [2] **A.M. Vinodkumar** et al., *Phy. Rev.* (accepted)(2009).
- [3] **A.M. Vinodkumar**, W. Loveland, J.J. Neeway, L. Prisbrey, and P.H. Sprunger D. Peterson, J.F. Liang, D. Shapira, C.J. Gross, and R.L. Varner, J.J. Kolata, A. Roberts and A. L. Caraley, *Phy. Rev. C* **78**,054608(2008).
- [4] **A.M. Vinodkumar**, W. Loveland, P.H. Sprunger, D. Peterson, J. F. Liang, D. Shapira, R. L. Varner, C. J. Gross and J. J. Kolata, *Phy. Rev. C* **74**,064612(2006).

*Electronic address: attukalathil@gmail.com