Isospin Distillation and the Reduced Nucleon Densities in ^{40}Ar, ^{40}Ca + ^{58}Fe, ^{58}Ni Reactions at 25, 33, 45 and 53 MeV/nucleon

D.V. Shetty, J. Iglio, S.J. Yennello, G.A. Souliotis, M. Jandel, A.L. Keksis, S.N. Soisson, B.C. Stein, S. Wuenschel and A.S. Botvina[1]

[1]*Institute for Nuclear Research, Russian Academy of Science, Moscow, Russia*

The Liquid-Gas phase transition in isospin asymmetric nuclear matter may result in an inhomogeneous distribution of the neutrons and the protons within the system (isospin distillation), where a dilute neutron-rich (N/Z > 1) gas (light clusters) and a dense and symmetric (N/Z ~ 1) liquid (heavy fragments) is formed [1]. In this work, the composition of the gas phase in ^{40}Ar + ^{58}Fe and ^{40}Ar + ^{58}Ni reactions with respect to ^{40}Ca + ^{58}Ni reaction were studied at 25, 33, 45 and 53 MeV/nucleon. Figure 1 below shows the relative neutron and proton densities in the gas phase obtained from the measured isotope and isotone yield ratios as a function of the difference in N/Z of the composite systems. It is observed that the neutron content of the gas phase is sensitive to both the isospin (N/Z) of the initial colliding nuclei and the excitation energy. The asymmetry (difference in the neutron and the proton density) in the gas phase increases with increasing difference in N/Z of the composite systems, and decreases with increasing beam energy. The asymmetry is observed to decrease from ~ 1.0 at 25 MeV/nucleon to ~ 0.6 at 45 MeV/nucleon for the Ar + Fe and Ca + Ni pair of reaction. The observed decrease indicates a decrease in the sensitivity of the isospin effect with increasing temperature. The observed result is in good agreement with those determined in the past using the Ni, Fe + Ni, Fe reactions at 30, 40, and 47 MeV/nucleon.

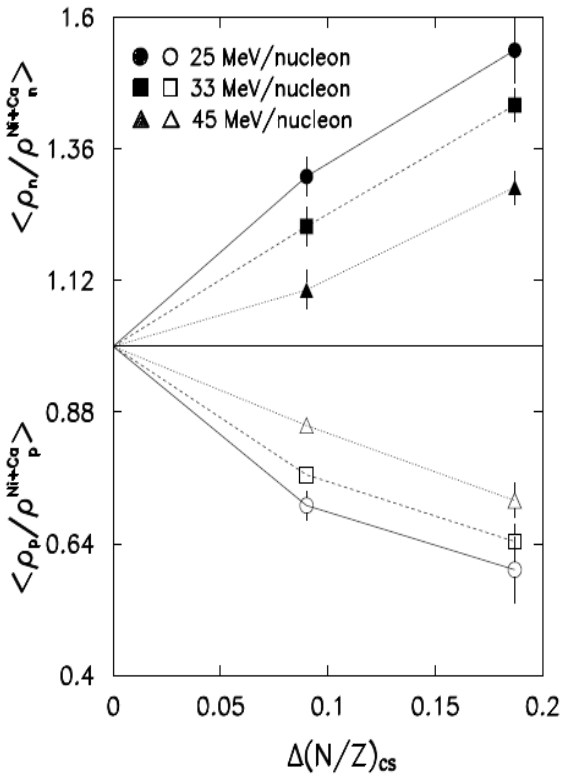

Figure 1. Relative neutron (top) and proton densities (bottom) as a function of the difference in N/Z of the composite systems for various beam energies.

[1] D.V. Shetty *et al.*, Phys. Rev. C **68**, 021602 (2003).

[2] J. Iglio *et al.*, Phys. Rev. C (Submitted).