Symmetry Energy and the Isoscaling Properties of the Fragments in Multifragmentation of $^{40}$Ca$^{+58}$Ni, $^{40}$Ar$^{+58}$Ni and $^{40}$Ar$^{+58}$Fe Reactions. (May 2007)

Jennifer Ann Iglio, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Sherry Yennello

The symmetry energy and the isoscaling properties of the fragments produced in multifragmentation of $^{40}$Ar, $^{40}$Ca + $^{58}$Fe, $^{58}$Ni reactions at 25, 33, 45 and 53 MeV/nucleon, were investigated within the framework of statistical multifragmentation model. The isoscaling parameters $\alpha$ from the hot primary and cold secondary fragment yield distributions were studied as a function of the excitation energy, isospin (neutron-to-proton asymmetry), and fragment symmetry energy. It is observed that the isoscaling parameter $\alpha$ decreases with increasing excitation energy and decreases with decreasing symmetry energy. The parameter $\alpha$ is also observed to increase with increasing difference in the isospin of the fragmenting system. The sequential decay of the primary fragments into secondary fragments show very little influence on the isoscaling parameter when studied as a function of excitation energy. The symmetry energy however, has a strong influence on the isospin properties of the hot fragments. The experimentally observed scaling parameters can be explained by symmetry energy that is significantly lower than that for the ground state nuclei near saturation density. The results indicate that the properties of hot nuclei at excitation energies, densities, and isospin away from the normal ground state nuclei could be significantly different.