Isoscaling in Central Heavy Ion Collisions at Intermediate Energy

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The isoscaling of intermediate mass fragments (IMFs) has been studied in ^{64,70}Zn, ^{64}Ni + ^{232}Th, ^{197}Au, ^{112,124}Sn, ^{58,64}Ni reactions at 40MeV/nucleon. IMFs were measured by a Si quadrant telescope, backed by four CsI detectors at 20º. The Si telescope consisted of four 5cm x 5cm area detectors, having thicknesses of 129, 300, 1000, 1000 micro-meters. Isotopes of IMFs are clearly identified up to Z=12 with an energy threshold of about 4-8 MeV/nucleon, depending on Z of IMFs. In order to determine the isotope ratio between two different reactions, the ratio is plotted as a function of IMF energy.

In Fig. 1, the differential multiplicities of ^{10}B (left) and ^{24}Mg (right) isotopes (upper) and their yield ratios (bottom) are shown for the two reactions, ^{70}Zn + ^{124}Sn (solid line) and ^{64}Zn + ^{112}Sn (dashed line). The yield ratios depend slightly on the IMF energy. For all the cases the ratios show a rather flat distribution from 10 to 30 MeV/nucleon, in which the contribution from a nucleon-nucleon source component is dominant at this angle.

In Fig. 2, the isotopic yield ratios of IMFs for the two reactions ,^{70}Zn + ^{112}Sn and ^{64}Zn + ^{112}Sn (left) and for ^{64}Ni + ^{124}Sn and ^{64}Zn + ^{112}Sn (right) are shown by symbols as a function of atomic number Z (upper) or neutron number N (lower). The errors correspond to the maximum deviation from the average value in the given energy range (about 10 to 30MeV/nucleon). The ratios are fit by the function:

$$Y1/Y2 \sim \exp(\alpha N+\beta Z)$$

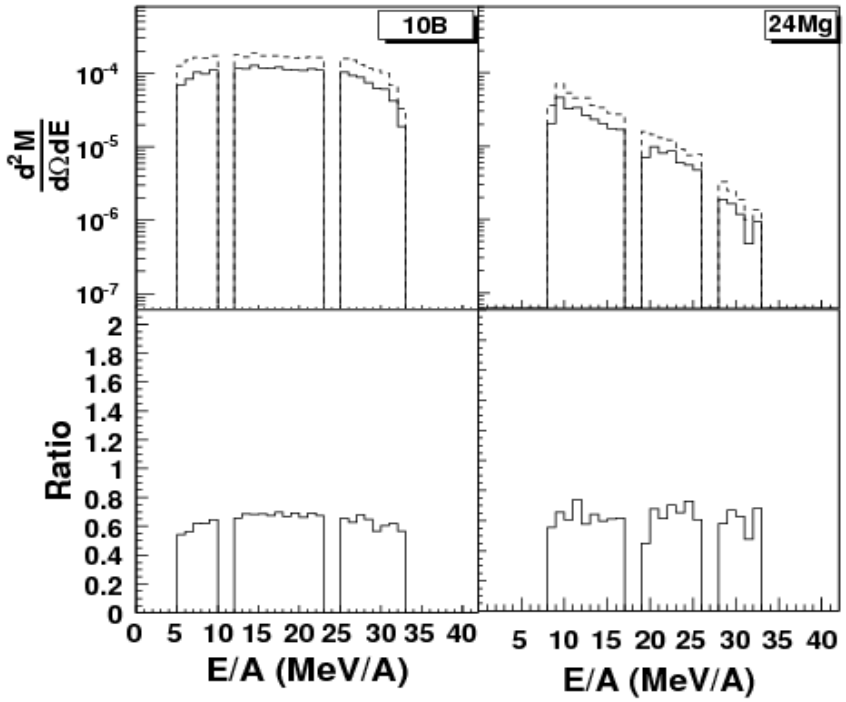

Figure 1. ^{10}B and ^{24}Mg multiplicity distributions (upper) and isotope yield ratios (bottom) for 40 Mev/nucleon ^{70}Zn + ^{124}Sn (solid line) and ^{64}Zn + ^{112}Sn (dashed line)

The solid lines indicate the results obtained for individual fits for a fixed Z or a fixed N. The dashed lines correspond to the results with parameters obtained by averaging over those of the individual fits. A good fit with a unique parameter set of α and β indicates that an isoscaling relationship holds for the entire range of IMFs observed for these reactions. This feature is also observed for all combinations of other reactions performed in this experiment.

More detailed analysis is now underway.

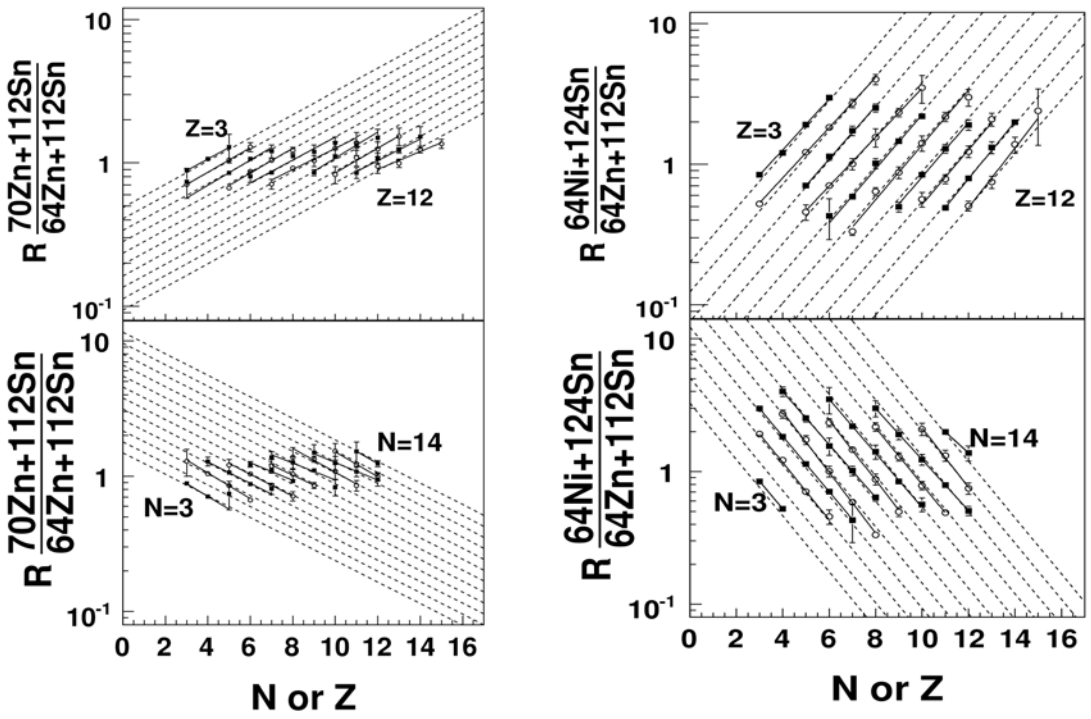

Figure 2. Isotopic yield ratios for 40MeV/nucleon $^{70}Zn+^{112}Sn/^{64}Zn+^{112}Sn$ (left) and $^{64}Ni+^{124}Sn/^{64}Zn+^{112}Sn$ (right)