Séminaire

PHYSIQUE NUCLÉAIRE
NUCLEAR PHYSICS

Study of core-collapse supernovae : new experimental constraints on the nuclear physics inputs

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Zoom:
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The uncertainties on the microphysical ingredients of the core-collapse supernova (CCSN) modelization, e.g. the nuclear masses and the electron capture rates, may conduct to differences in the compositions of the core and in the collapse dynamics. In order to reduce these uncertainties, high precision mass measurements were performed using a double Penning trap at the IGISOL facility : ^{67}Fe, ^{69,70}Co, ^{74,75}Ni and ^{76,77,78}Cu and ^{79}Zn. The experimental values of the nuclear gaps for Z=28 and N=50 have been compared with the results predicted by DZ10 and HFB-24 mass models. A moderated impact of the mass model on the composition of the collapsing core was found, while the dynamics of collapse is more sensitive to the electron capture model.

The latter can be better constrained by means of beta decay studies with total absorption spectroscopy and nuclear charge exchange experiments. A recent ^{14}O(d,^{2}He)^{14}N charge exchange experiment in inverse kinematic, using the Active-Target Time Projection Chamber at NSCL facility, demonstrated a very promising way of constraining the electron capture rates of radioactive nuclides. During this talk I will discuss the effect of the nuclear masses and the electron capture rates in a CCSN simulation as well as their recent experimental constraints.