Spectroscopy of neutron-deficient nuclei around ^{36}Ca

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An experiment was performed to find excited states in proton-rich Ca isotopes, and to search for the position of the proton drip-line at Z=20. In particular, the first excited state in ^{36}Ca was searched for in order to obtain information on the isospin dependence of the nucleon-nucleon interaction near the drip line from a comparison with its stable $T = 2$ mirror nucleus ^{36}S. Secondary beams of ^{37}Ca and ^{36}Ca were produced by fragmentation of a primary ^{40}Ca beam with an energy of $95 \cdot A$ MeV on a 270 mg/cm^2 C target in SISSI at GANIL. A variety of nuclei around ^{36,35}Ca was produced in a second fragmentation step by n- and p-removal in a secondary Be target at energies around $61 \cdot A$ MeV. The produced nuclei were identified using the spectrometer SPEG, and energies of prompt gamma rays were measured with the *Château de Cristal*. For ^{36}Ca, the energy of the first 2+ state has been determined as

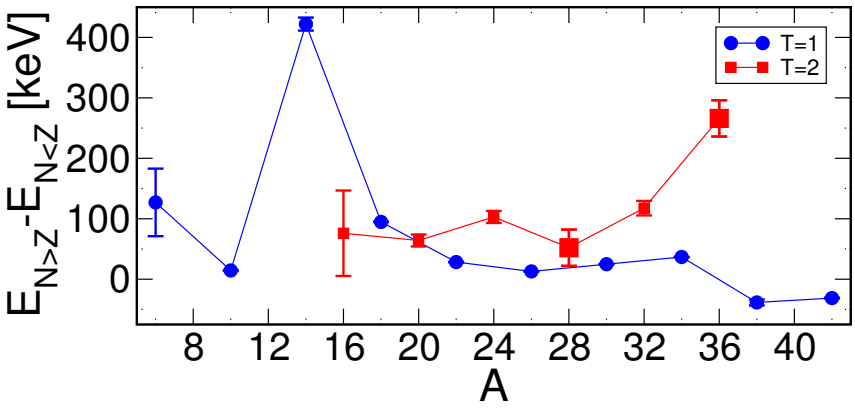

Figure 1: Mirror energy differences for $T = 1$ (circles) and $T = 2$ (squares) pairs. The values for ^{36}Ca ($A = 36$) and ^{28}S ($A = 28$) are shown with larger squares.

well as partial and total one-nucleon removal cross sections and momentum distributions. In addition, previously unknown transitions in other nuclei have been observed. Among them is the first excited state in ^{28}S, the mirror nucleus of ^{28}Mg, so that energy differences could be calculated for two pairs of $T = 2$ mirrors. This completes the systematics of $T = 2$ mirror energy differences, shown along with those for $T = 1$ in fig. 1, from $A = 16$ to up to $A = 36$.