# FIRST SPECTROSCOPY OF THE DOUBLY-MAGIC $^{78}$NI

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More than a half century has passed since the discovery of magic numbers of nuclei: when the number of either protons or neutrons is equal to 2, 8, 20, 28, 50, 82 or 126, nuclei were found to have closed shells and to exhibit a local maximum of stability. However, after the innovation with accelerators to produce nuclei far from stability, the magic numbers turned out not to be universal but rather highly dependent on isospin. $^{78}$Ni, which has 28 protons and 50 neutrons, is one of the most intriguing nuclei because it is the most neutron-rich/exotic "doubly-magic" nucleus that we

can produce at present.

Excited states of $^{78}$Ni has been investigated at the RIBF by measuring their de-excitation γ-rays after one and two proton knock-out reactions from $^{79}$Cu and $^{80}$Zn beams, respectively, selected in the BigRIPS fragment separator. To achieve a high γ-ray yield, the detection system is comprised of a 10 cm-thick liquid hydrogen target with a recoil proton tracking system MINOS and a large NaI(Tl) based γ-ray detection array DALI2. In this presentation, the structure of $^{78}$Ni will be discussed with comparing the deduced exclusive reaction cross-sections to the reaction models combined with large scale shell model calculations.