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Gamma-spectroscopy of Neutron-rich ^{79}Cu Through Proton Knockout

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Nuclear shell structure is evolving when going into more and more exotic regions. As a consequence, the conventional magic numbers can be different far from stability. Over the last years, the RIB factory at RIKEN has become available, providing primary beam of uranium with intensities that are now sufficient for gamma spectroscopy of neutron-rich copper isotopes next to ^{78}Ni ($Z = 28$, $N = 50$).
We shall present the results of the in-beam spectroscopy of ^{79}Cu (N=50), produced through the ^{80}Zn(p,2p)^{79}Cu knockout reaction at RIKEN. A ^{238}U beam, with an energy of 345 MeV/nucleon, was sent on a ^{9}Be target, creating a cocktail of radioactive isotopes. These isotopes went through the BigRIPS spectrometer, for identification and selection, and reached MINOS [1], a liquid-hydrogen target surrounded by a TPC used for proton tracking, where the knock-out reactions took place. The isotopes produced went through the ZeroDegree spectrometer for identification. The DALI2 scintillator array was surrounding MINOS for γ-ray detection. γ-γ coincidences permitted to build the first level scheme of ^{79}Cu, with levels up to 4.6 MeV, and the results were compared to Monte-Carlo shell-model calculations [2]. We show that the ^{79}Cu nucleus can be described in terms of a valence proton outside a ^{78}Ni core, implying the magic character of the latter.
References:
[1] A. Obertelli et al., Eur. Phys. J. A 50, 8 (2014).
[2] Y. Tsunoda, T. Otsuka, N. Shimizu, M. Honma, and Y. Utsuno, Phys. Rev. C 89, 031301(R) (2014).

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