Contribution ID: **43** Type: **Invited talk**

78Ni: Doubly magic nuclei at the onset of deformation

Tuesday, 1 August 2023 11:00 (25 minutes)

78Ni, which has 28 protons (Z = 28) and 50 neutrons (N = 50), 14 additional neutrons to the last stable nickel isotope 64Ni, is one of the most intriguing isotopes in the chart of nuclei. It is the most neutron-rich, exotic "doubly magic"nucleus that can be produced at present state-of-the-art facilities. The excited states of 78Ni have been investigated at the Radioactive Isotope Beam Factory, RIBF, by measuring their de-excitation γ rays after one and two-proton knock-out reactions from 79Cu and 80Zn beams. A 10 cm-thick liquid hydrogen target with a recoil proton tracking system, MINOS, and a surrounding NaI(Tl) based γ-ray detection array, DALI2 were employed. Eventually, 310 and 222 events with at least one detected γ-ray with more than 300 keV with the (p,2p) and the (p,3p) reactions, respectively, were obtained. As a result, at least two excited 2+ states and other higher-lying states were found. This casts a question about the nature of the shell closure in 78Ni and implies the possibility of shape coexistence.

The experimentally deduced level scheme was interpreted by comparison with several state-of-the-art theoretical predictions: Large-scale shell model, beyond mean-field, and ab initio calculations. Though the doubly magic nature was confirmed, at the same time, the shell gap is anticipated to vanish beyond 78Ni. In addition to the γ-ray analysis, particularly small inclusive cross sections of 79Cu(p,2p)78Ni and 80Zn(p,3p)78Ni were observed compared to neighbouring nuclei. To investigate this phenomenon, the cross sections to the excited states and the ground state deduced experimentally were compared with reaction theory based on a DWIA formalism.

In this presentation, the structural information of 78Ni will be discussed in detail with the obtained level scheme and the recent theoretical calculations.

[1] R. Taniuchi et al., Nature **569**, 53-58 (2019).

Primary author: TANIUCHI, Ryo (Department of Physics, University of York)

Presenter: TANIUCHI, Ryo (Department of Physics, University of York)

Session Classification: Shell structure around 78Ni isotope