Contribution ID: **335** Type: **Oral**

PHOTOPROTON REACTIONS ON ERBIUM ISOTOPES

Tuesday 2 July 2024 15:50 (10 minutes)

This work presents an experimental and theoretical study of photoproton reactions on erbium isotopes. Currently, the nuclear databases (EXFOR) only contain data on photoneutron reactions on a natural mixture of erbium isotopes [1] and on the isotope ^{166}Er [2]. No data on photoproton reactions is available.
The experiment was performed by irradiating a target made of a natural mixture of erbium isotopes with the bremsstrahlung of the racetrack pulsed microtron RTM-55 of the Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, with a beam energy of 55 MeV. The residual activity spectra were analyzed to identify isotopes formed from photonuclear reactions based on their gamma ray energy and half-life. The cross sections per equivalent photon for a natural mixture of erbium isotopes were calculated based on the induced activity in the target by formula:
\begin{equation}
\sigma_q^{prod}=\frac{\sum_{i} \eta_i \int_{E_{\text{thresh}}}^{E^{m}}\sigma(E)\cdot W(E,E^m)dE}{\frac{1}{E^{m}} \int_{0}^{E^{m}}E \cdot W(E,E^m)dE},
\end{equation}
where $W(E, E^m)$ is the bremsstrahlung spectrum of γ produced at the incidence of the beam of accelerated electrons with the energy E^m=55 MeV on the bremsstrahlung target, $\sigma(E)$ is the cross section of the studied photonuclear reaction, E is the energy of bremsstrahlung photons, E_{thresh} is the threshold energy of the reaction under study, η_i is the percentage of the initial nuclei in the natural mixture of Er isotopes and the index i corresponds to the number of the reaction contributing to the production of the studied isotope.
The experimental cross sections per equivalent photon were compared with calculations using the TALYS program [3] and the combined model of photonucleon reactions (CMPR) [4,5]. In contrast to the TALYS program, the CMPR accounts for the isospin splitting of the giant dipole resonance (GDR), which leads to increased cross sections of photoproton reactions. The comparison of experimental and theoretical data reveals that TALYS significantly underestimates the cross sections of photoproton reactions. The isospin splitting of the GDR should be considered for an accurate description of photonuclear reactions.

1. R. Bergère, H. Beil, P. Carlos, A. Veyssière, Nucl. Phys. A **133**, 417 (1969).
2. B.I. Goryachev, Y.V. Kuznetsov, V.N. Orlin, N.A. Pozhidaeva, V.G. Shevchenko, Yad. Fiz. **23**, 1145 (1976).
3. A.J. Konig, S. Hilaire, S. Goriely, Eur. Phys. J. A **59**, 131 (2023).
4. B.S. Ishkhanov, V.N. Orlin, Phys. At. Nucl. **74**, 19 (2011).
5. B.S. Ishkhanov, V.N. Orlin, Phys. At. Nucl. **78**, 557 (2015).

Section

Experimental and theoretical studies of nuclear reactions

Primary author: FURSOVA, Nadezhda (Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia; Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia)

Co-authors: KUZNETSOV, Alexander (Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia; Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia); PRISELKOVA, Anna (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia); ALIEV, Ramiz (Department of Chemistry, Lomonosov Moscow State University, Moscow, Russia; National Research Center "Kurchatov Institute", Moscow, Russia); BELYSHEV, Sergey (Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia; Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia); KHANKIN, Vadim (Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia)

Presenter: FURSOVA, Nadezhda (Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia; Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia)

Session Classification: Experimental and theoretical studies of nuclear reactions