AN INVERSE-PROBLEM SOLVING BY THE EXAMPLE OF $^{238}U(n,2\gamma)^{239}U$ REACTION ANALYSIS

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As modern theory supposes that the wave function of any excited nuclear level includes both a quasi-particle and phonon components, interest has risen to study intra-nuclear processes experimentally. And just simultaneous obtaining of the nuclear-physical parameters, the nuclear level density ρ and partial widths Γ of emission products of a nuclear reaction, is very important for investigation of fundamental interaction between fermion and boson states of nuclear matter. As ρ and Γ enter into the measured spectra of indirect experiment as $\rho\times\Gamma$, there is a complicated problem of a search for inverse solution to extract these strong-correlated parameters simultaneously.

The empirical method, which is created and developed in Dubna in order to enable an investigation of dynamics of nuclear-structure change below the neutron binding energy in a nucleus, was applied to analyze the experimental γ-spectrum from the $^{238}U(n,2\gamma)^{239}U$ reaction measured using nearly 4π γ-ray calorimeter DANCE [1]. The Dubna method allows simultaneous extraction of the density of intermediate levels of the two-step γ-cascades in compound-nucleus and partial widths of dipole γ-transitions approximating the experimental intensities of only primary transitions of the two-step γ-cascades.

[1] J.L. Ullmann, T. Kawano, B. Baramsai, *et al*., Phys.Rev. C **96**, 024627 (2017).