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Nuclear resonance fluorescence of ^{242}Pu

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The electromagnetic dipole response of ^{242}Pu was studied for the first time using the nuclear resonance fluorescence (NRF) method, hence with real photons. The experiment was performed at TU Darmstadt, where monoenergetic electrons are provided by the superconducting Darmstadt linear electron accelerator S-DALINAC to produce bremsstrahlung by impinging on a gold radiator target. A sample of PuO_2 with a total mass of about 1 g was irradiated by a bremsstrahlung beam, having a continuous energy distribution up to 3.7 MeV. Resonantly scattered photons were detected with two high-purity Germanium detectors at angles of 90° and 130° relative to the direction of the incident photon beam, which allows us to distinguish between dipole and quadrupole transitions based on their different angular distributions. The highly-enriched ^{242}Pu target was placed in a special container taking into account the sample's total radioactivity of about 370 MBq. To identify the NRF signals originating from the target, NRF spectra of an empty target container, γ -ray spectra of the sample's radioactivity, and background measurements were compared. Evidence for decays of photo-excited states of ^{242}Pu was found – making ^{242}Pu the heaviest nuclide for which NRF data is available for the moment. Details of the experiment, γ -ray spectra, and preliminary results will be presented.

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