Long lifetime components in the decay of excited super-heavy nuclei

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Evidences for long lifetime components (longer than 10^{-18}s) in the decay of excited super–heavy nuclei with Z = 120 and 124 have been obtained at GANIL by the blocking technique in single crystals [1]. As expected from these results, X_K fluorescence of atoms with Z = 120 formed in the reaction ^{238}U+^{64}Ni at 6.6 MeV per nucleon has been observed in a recent experiment [2]. X_K rays detected in coincidence with fission fragments from Z=120 have been unambiguously identified from their energies and from reaction mechanism analyses demonstrating that they are emitted by the compound nucleus (or its daughter nuclei, after neutron evaporation). Since X_K fluorescence results from the filling of K vacancies that have a lifetime of the order of 10^{-18}s for the element with Z = 120, the rather high measured fluorescence yield provides us with an additional confirmation of the existence of long lifetime components in the decay of the formed Z = 120 nuclei.

The very long fission times inferred, as well as the tiny cross-sections expected for evaporation residues, have been taken into account in the framework of a statistical decay model, considering temperature dependent fission barriers as predicted by Hartree–Fock–Bogoliubov calculations [3, 4]. The strong expected correlation between the fission barriers and the survival probability at long times provides us with a unique tool to explore super-heavy element stability far beyond the mass domain accessible by other experimental approaches.

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