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High-temperature 205Tl decay clarifies 205Pb dating in early Solar System

At the boundary between atomic physics and nuclear physics one can find exotic decay modes such as the case of 205-Tl. Being a stable nuclear species on earth, 205-Tl starts to beta decay, when it is fully ionized. This so-termed bound-state beta decay plays an indirect, yet crucial role in dating our solar system via the nuclear chronometer 205Pb. In order to make use of the long-lived decay (17.3 My) for dating, the unknown half-life of the bound-state beta decay had to be measured first.
The complex experiment was carried out at GSI/FAIR using the ESR storage ring. It involved the production of 205Tl from a stable 206Pb beam as well as accumulation and storage of high intensities in the ESR. Finally, the ratio of mother-to-daughter nuclei after different waiting times was measured using non-destructive Schottky detectors and enabled the evaluation of a half-life of 291 days for this exotic decay.

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