Contribution ID: **3** Type: **not specified**

Measurement of the bound-state beta decay of bare 205-Thallium and its nuclear astrophysical implications

Friday, 25 March 2022 18:45 (30 minutes)

We report on the first direct measurement of the bound-state beta decay [1] of $^{205}Tl^{81+}$ ions, an exotic decay mode, in which an electron is directly created in one of the empty atomic orbitals instead of being emitted into the continuum. One of the most awaited and pioneering experiments was realized in the spring beamtime at GSI, Darmstadt in 2020, wherein the entire accelerator chain was employed. $^{205}Tl^{81+}$ ions (with no electron) were produced with the projectile fragmentation of ^{206}Pb primary beam on ^{9}Be target, separated in the fragment separator (FRS), accumulated, cooled, and stored for different storage times (up to 10 hours) in the experimental storage ring (ESR). The experimentally measured half-life value [2] draws a 4.7σ [3] and 7σ [4] tension with the theoretically predicted values, which could influence our understanding of the abundance of chemical elements in the early universe. In this contribution, the authors aim to present the s-process motivation and a preliminary value of the $^{205}Tl^{81+}$ half-life.
This research has been conducted in the framework of the SPARC, ILIMA, LOREX, NucAR collaborations, experiment E121 of FAIR Phase-0 supported by GSI. The authors received support from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (Grant Agreement No. 682841 "ASTRUm").

References

[1] R. Daudel *et al.*, J. Phys. Radium, **8**, 238, 1947.
[2] Ragandeep Singh Sidhu, Ph.D. Thesis, Ruprecht-Karls-Universität, 2021.
[3] K. Takahashi *et al.*, Phys. Rev. C, **36**, 1522, 1987.
[4] S. Liu *et al.*, Phys. Rev. C, **104**, 024304, 2021.

Primary authors: SIDHU, Ragandeep Singh (School of Physics and Astronomy, University of Edinburgh, EH9 3FD Edinburgh, United Kingdom); Dr CHEN, Rui-Jiu (Max-Planck-Institut für Kernphysik, D-69117 Heidelberg, Germany); Prof. LITVINOV, Yu. A. (GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany); AND THE E121 COLLABORATION

Presenter: SIDHU, Ragandeep Singh (School of Physics and Astronomy, University of Edinburgh, EH9 3FD Edinburgh, United Kingdom)