



Contribution ID: 352

Type: **Contributed Oral Presentation**

The Connection Between the β^- decay of ^{92}Rb , the Reactor Antineutrino Anomaly, and the Pygmy Dipole Resonance

Friday, 30 May 2025 09:25 (15 minutes)

The β^- -decay of neutron-rich nuclei generated during the fission processes at the cores of nuclear reactors have played a key role in our understanding of neutrino physics and are the source of energy production following reactor shut down known as decay heat. Measurements of the antineutrino flux produced from the beta decay of these nuclei had shown a 6-10% discrepancy between the measured antineutrino flux compared to modern theoretical predictions and has led to intense activity involving multiple approaches to investigate this phenomenon. This Reactor Antineutrino Anomaly (RAA) prompted much excitement as possible evidence for hypothetical sterile neutrinos however recent evidence points towards deficiencies within the model predictions themselves rather than new physics. As the source of these antineutrinos, it is essential that the beta decay of these nuclei is well understood. However, our current understanding of the decay of any of these nuclei is still unsatisfactory.

The β^- -decay of ^{92}Rb is one of the main contributors to the reactor high-energy antineutrino spectrum and, consequently, is an important contributor to the RAA. Its decay has been recently studied in Total Absorption Spectroscopy (TAS) and shows significant differences with previous High-Resolution Spectroscopy performed in the early 70s, which can be attributed to the so-called pandemonium effect, when β^- decay branching ratios are poorly measured or even unknown especially for the isotopes that decay with large Q_{β^-} values.

We have thus revisited the β^- -decay of ^{92}Rb ($J^{\pi} = 0^-$; $t_{1/2} = 4.48(3)$ s) with the GRIFFIN spectrometer at TRIUMF that consists of up to 16 Compton-suppressed HPGe clover detectors. Due to the high intensity radioactive beam of ^{92}Rb of 106 pps and the high efficiency for detecting β^- rays of GRIFFIN we have obtained an unparalleled picture of ^{92}Sr with over 180 levels and 850 β^- -ray transitions up to and beyond the neutron separation energy of ~ 7.3 MeV, and performed comprehensive β^- -ray spectroscopy, including angular correlations to assign spins to the new states.

The decay the $J^{\pi} = 0^-$ ground state of ^{92}Rb takes place with a large Q_{β^-} value of 8095 keV and populates numerous high-lying 1^- levels in ^{92}Sr . These 1^- states are situated in the region of the Pygmy Dipole Resonance (PDR) that manifests as an enhancement of $B(E1)$ strength below the neutron separation energy, located at the low-energy tail of the Giant Dipole Resonance. The PDR is interpreted as an out-of-phase oscillation between the neutron-skin and an isospin saturated core, however, this remains a matter of debate. The new information of nuclear levels in ^{92}Sr points to the possibility of to investigate the PDR via β^- -decay experiments.

The results of this study are also compared to recent TAS experiments and with theoretical shell model calculations and show a great agreement despite of the large density of levels and fragmented decay in ^{92}Sr .

Primary authors: ANDREOIU, Corina (Simon Fraser University); SUHONEN, Jouni (University of Jyväskylä); SCHECK, Marcus (UWS); RAMALHO, Marlon (University of Jyväskylä); SPAGNOLETTI, Pietro (University of Liverpool); TÄHTELÄ, Samuli (University of Jyväskylä)

Co-authors: GARNSWORTHY, Adam (TRIUMF); NANNINI, Adriana (INFN - Sezione di Firenze); RADICH, Allison (UoGuelph); GREAVES, B. (University of Guelph); OLAIZOLA, Bruno (TRIUMF/IEM); SVENSSON, Carl (UoGuelph); GRIFFIN, Chris (TRIUMF); NATZKE, Connor; Prof. PETRACHE, Costel (IJClab, Université Paris-Saclay and CNRS/IN2P3); TORRES, D. A. (Universidad Nacional de Colombia); HYMERS, D. (University of Guelph); Dr

KALAYDJIEVA, Desislava (University of Guelph); ANNEN, Dominic (Simon Fraser University); KASANDA, E. (University of Guelph); WADGE, Elliot (Simon Fraser University); GYABENG FUAKYE, Eric (University of Regina); GARCIA, Fatima (SFU); BENZONI, Giovanna (INFN Milano); BALL, Gordon (TRIUMF); HACKMAN, Greg (TRIUMF/SFU); GRINYER, Gwen (University of Regina); BIDAMAN, H. (University of Guelph); DJIANTO, I. (Simon Fraser University); DILLMANN, Iris (TRIUMF); ORTNER, K. (Simon Fraser University, Canada); MASHTAKOV, Konstantin (University of Guelph); KAPOOR, Kushal; SINGH, M. (Saint Mary's University, Canada); SATRAZANI, Magda (KU Leuven); ZIELINSKA, Magda (CEA Paris-Saclay); ROCCHINI, Marco (INFN); SICILIANO, Marco (Argonne National Laboratory); POLETTINI, Marta (GSI); MARCHINI, Naomi (INFN - Florence section); SAEI, Nastaran; GARRETT, Paul (UoGuelph); COLEMAN, R. (University of Guelph); KANUNGO, R. (Saint Mary's University, Canada); UMASHANKAR, Rashmi (TRIUMF/UBC); CABALLERO-FOLCH, Roger (TRIUMF); DEVINYAK, S. (TRIUMF); BHATTACHARJEE, S. S (TRIUMF); BUCK, Samantha (University of Guelph); ZIDAR, Tammy (University of Guelph); VEDIA, Victoria (TRIUMF); BILDSTEIN, Vinzenz (UoGuelph); KORTEN, Wolfram (CEA Saclay); AHMED, Z. (University of Guelph)

Presenter: ANDREOIU, Corina (Simon Fraser University)

Session Classification: Parallel Session

Track Classification: Nuclear Structure