Contribution ID: **7** Type: **Contributed Oral**

Lifetime of a muon bound to a light nucleus

Friday, 13 February 2026 20:30 (15 minutes)

A muon bound in the 1S state of a hydrogen-like ion can decay into an electron and a pair of neutrinos. For small nuclear charge Z, Überall (1960) predicted a suppression of the total rate relative to the free-muon width, 1−Γ/Γ0≈(αZ)^2/2, α≈1/137. The first all-orders numerical calculation in αZ (Watanabe et al., 1993) reported for oxygen (Z=8) Γ/Γ0=0.994, in tension with Überall's analytic expectation ≈0.998. This 4×10^−3 discrepancy is too large to be explained by the next term O((αZ)^3), which is ~2×10^−4.
In this work we revisit the calculation and trace the discrepancy to slow convergence of the partial-wave sum. Truncation at κ=31 underestimates the rate; extending the sum to κ=59 and controlling the tail yields Γ/Γ0=0.9976 for Z=8, now consistent with Überall's prediction within expected O((αZ)^3) effects. Our result resolves the long-standing conflict and clarifies the numerical requirements for reliable bound-state QED calculations.It also supports analogous expansion methods used in heavy-quark physics.

Your current academic level

PhD student

Your email address

davydov@ualberta.ca

Affiliation

University of Alberta

Supervisor email

andrzejc@ualberta.ca

Supervisor name

Andrzej Prus-Czarnecki

Primary author: DAVYDOV, Artem (University of Alberta)

Presenter: DAVYDOV, Artem (University of Alberta)

Session Classification: Nuclear Physics

Track Classification: Nuclear physics