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# Lifetime of the hypertriton

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Recent relativistic heavy ion (RHI) collision experiments have extracted conflicting values of the hypertriton ($^{3}_{\Lambda}$H) lifetime ($\tau(^{3}_{\Lambda}\mathrm{H})$). While the ALICE Collaboration's reported $\tau(^{3}_{\Lambda}\mathrm{H})$ is comparable to the free $\Lambda$ lifetime, the STAR Collaboration's reported value is considerably shorter. A similarly large spread of values has been obtained also in earlier measurements.

Recently, we revisited theoretically this $^{3}_{\Lambda}$H lifetime puzzle [1], using $^{3}_{\Lambda}$H and $^{3}$He wave functions computed within the *ab initio* no-core shell model employing interactions derived from chiral effective field theory to calculate the two-body decay rate $\Gamma(^{3}_{\Lambda}\mathrm{H} \to {}^{3}\mathrm{He} + \pi^{-})$. We found significant but opposing contributions arising from $\Sigma NN$ admixtures in $^{3}_{\Lambda}$H and from $\pi^{-} - {}^{3}\mathrm{He}$ final-state interaction, as well as substantial theoretical uncertainties attributed to (hyper)nuclear structure uncertainties. To derive $\tau(^{3}_{\Lambda}\mathrm{H})$, we evaluated the inclusive $\pi^{-}$ decay rate $\Gamma_{\pi^-}(^{3}_{\Lambda}\mathrm{H})$ by using the measured branching ratio $\Gamma(^{3}_{\Lambda}\mathrm{H} \to {}^{3}\mathrm{He} + \pi^{-})/\Gamma_{\pi^-}(^{3}_{\Lambda}\mathrm{H})$ and added the $\pi^{0}$ contributions through the $\Delta I = \frac{1}{2}$ rule. The resulting $\tau(^{3}_{\Lambda}\mathrm{H})$ varies strongly with the rather poorly known $\Lambda$ separation energy $E_{\mathrm{sep}}(^{3}_{\Lambda}\mathrm{H})$ and it is possible to associate each one of the distinct RHI $\tau(^{3}_{\Lambda}\mathrm{H})$ measurements with its own underlying value of $E_{\mathrm{sep}}(^{3}_{\Lambda}\mathrm{H})$.

[1] A. Pérez-Obiol, D. Gazda, E. Friedman, A. Gal, *Revisiting the hypertriton lifetime puzzle*, Phys. Lett. B 811, 135916 (2020).

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