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Antiprotonic helium: the Bethe Logarithm for resonant states.

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A numerical method to calculate the Bethe logarithm for resonant states is developed. To this end we exploit the Complex Coordinate Rotation (CCR) formalism to describe resonances as time-independent solutions of the Schroedinger equation. To get a proper expression for the Bethe logarithm calculations we apply the generalization of the second order perturbation theory to isolated CCR eigenstates. Using the elaborated method we perform a systematic calculation of the Bethe logarithm for metastable states in the antiprotonic helium atoms with precision of about 7 significant digits. This precision eventually results in a relative uncertainty of ro-vibrational transition frequencies at a level of 10^{-11} .

Primary author: Dr KOROBOV, Vladimir (Joint Institute for Nuclear Research)

Presenter: Dr KOROBOV, Vladimir (Joint Institute for Nuclear Research)

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