Fundamental constants and tests of theory in Rydberg states of hydrogen-like ions

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Abstract

Comparison of precision frequency measurements to quantum electrodynamics (QED) predictions for Rydberg states of hydrogen-like ions can yield information on values of fundamental constants and test theory. In this talk, simplifications in the theory for Rydberg states that allow a substantial impovement in the accuracy of the predicted levels, will be described. For these states, the fact that the wave function is small near the nucleus results in the finite nuclear size correction being completely negligible. Also, for Rydberg states, the higher-order terms in the QED corrections are relatively smaller than they are for S states, so theoretical expressions with a given number of terms are more accurate. With these improvements, the uncertainty in the predictions is dominated by the uncertainty in the Rydberg constant, the electron-nucleus mass ratio, and the fine-structure constant.