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About Atomic Spectrum in Quantum Mechanics

Abstract

In non-relativistic quantum mechanics for k electron atom/ion of nuclear charge Z one can construct the celebrated 1/Z expansion for energy, proposed by E Hylleraas about 100 years ago for helium atomic sequence.

At small Z at around (k-1) there exists a critical charge Z_B for which the Schroedinger equation ceases to have no bound states. At critical Z_B one can construct the Puiseux expansion at (Z-Z_B) which contains integer and half-integer powers ONLY.

Straightforward matching of those two expansions into a simple function allows to reach in energy of any state an extremely high accuracy for any integer Z > Z_B.

It is illustrated for low-lying states of helium/lithium sequences where the accuracy 10-14 figures are easily reached.