Oscillator expansion and R-matrix theory: parameters of resonances

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Since proton resonances are very narrow the position of a decaying state can be determined by applying the so-called L^2 stabilization technique. This method uses only square integrable functions, e.g. the harmonic oscillator basis. The R-matrix theory is also very suitable for the determination of proton resonances. The combination of the R-matrix and the oscillator expansion approach gives the possibility to determine the width of proton resonances using only square integrable functions. The parameters of resonances can be calculated invoking several methods based on different notions. The R-matrix, Gamow-state, and phase shift analysis are compared.