Generalized Laguerre Polynomial Solutions for Central Potentials in Quantum Mechanics

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With the help of associated Laguerre polynomial with arbitrary power of its argument, general central potential in the radial Schrödinger equation has been studied. With the appropriate power of its argument the Schrödinger equation with Coulomb, Harmonic and other potential forms and their eigen values have bee obtained. We consider here the general solution of the radial Schrödinger equation as,

$$u(\varrho) = \varrho^{l+1} e^{-\varrho^p/2} L_n^k(\varrho^p)$$

For different choices of p, we obtain the potential forms as well as the eigen value expressions satisfying

$$-\frac{\hbar^2}{2m}\frac{d^2u(\varrho)}{d\varrho^2} + \left(\frac{\hbar^2}{2m}\frac{l(l+1)}{\varrho^2} + V(\varrho) - E\right) u(\varrho) = 0.$$

Joint work with P C Vinodkumar.