Developed Theory for The Hydrogen Atom

Theory of the Hydrogen Atom

For any hydrogenic ion with nuclear charge Z

$V(\mathbf{r}) = -Ze^2/r$

$V(\mathbf{r}) = -e^2/r$

Eigenfunctions in spherical coordinates:

$\Psi_{e\ell m}(r,\theta,\varphi) = R_{e\ell}(r)\ Y_{\ell m}(\theta,\varphi) = U_{e\ell}/r\ Y_{\ell m}(\theta,\varphi)$

Derived from first principles the wave equation of an electron in the hydrogen atom.

- Start with Dirac Notation
- Replace with known general functions
- transform to eigenvalue equation in position space
- replace pieces with function F and find derivatives

  $F = \sum C_k \rho^k$

pic 3 first take had factors that needed to be fixed

- Led to the Laguerre Polynomials

  These are infinite, though, so
- Force Laguerre Polynomial solutions to truncate