s-Orbitals for the Hydrogen Atom

\[ \Psi_{2s} = \frac{1}{4\sqrt{2\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \left(2 - \frac{Zr}{a_0}\right) e^{-Zr/2a_0} \]

(normalization) (polynomial) (asymptotic form)

\[ \Psi_{3s} = \frac{1}{18\sqrt{3\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \left(6 - \frac{4Zr}{a_0} + \frac{4Z^2r^2}{9a_0^2}\right) e^{-Zr/3a_0} \]

(normalization) (polynomial) (asymptotic form)

2s-node: \( \Psi_{2s} = 0 \) \( 2 - \frac{Zr}{a_0} = 0 \) \( \text{or} \) \( r = 2a_0/Z \)

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