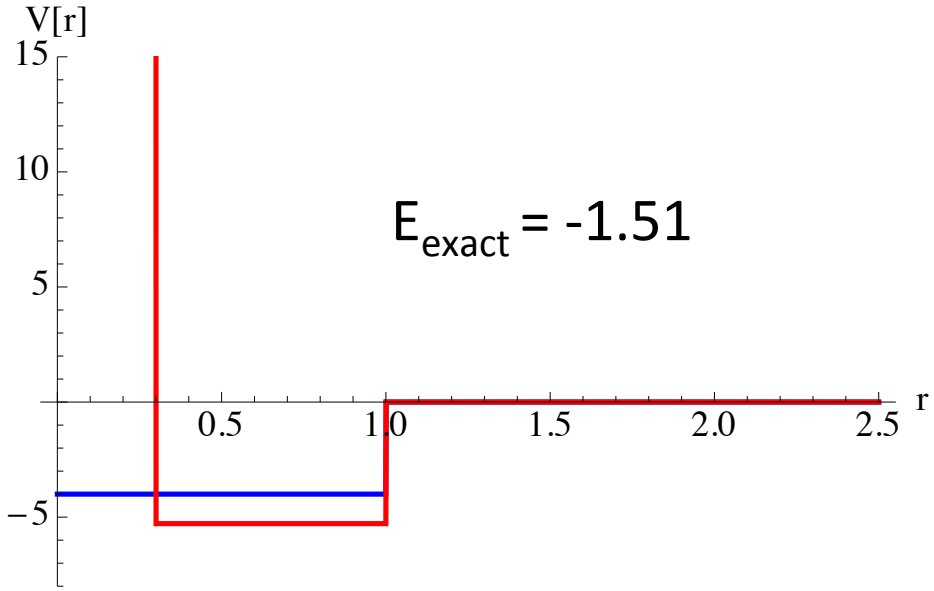
Expanding wave functions in an HO basis

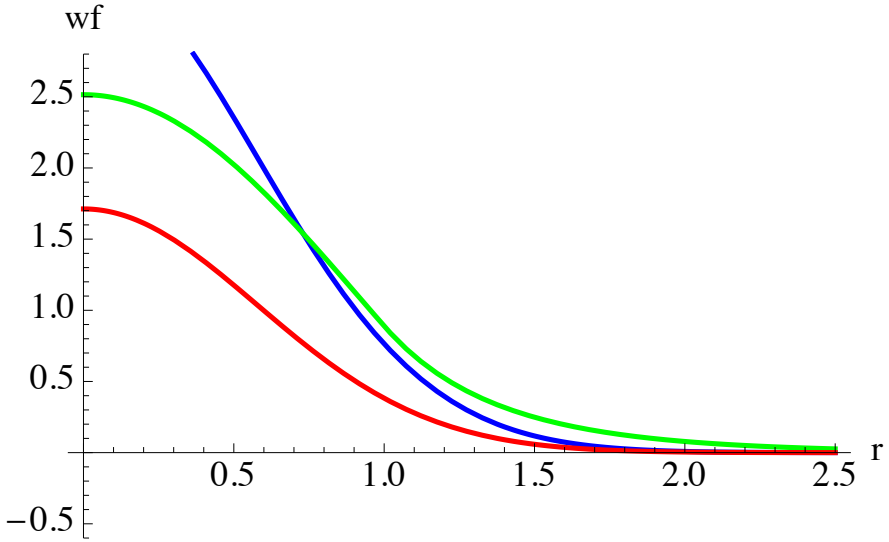
- Single-particle radial wf $\psi(r)$
- Expand in harmonic oscillator wfs:

$$\psi_{N_{\max}}(r) = \sum_{\alpha=0}^{N_{\max}} c_\alpha \phi_\alpha(r)$$

- Find c_αs by diagonalizing $\hat{H}\Psi = E\Psi$

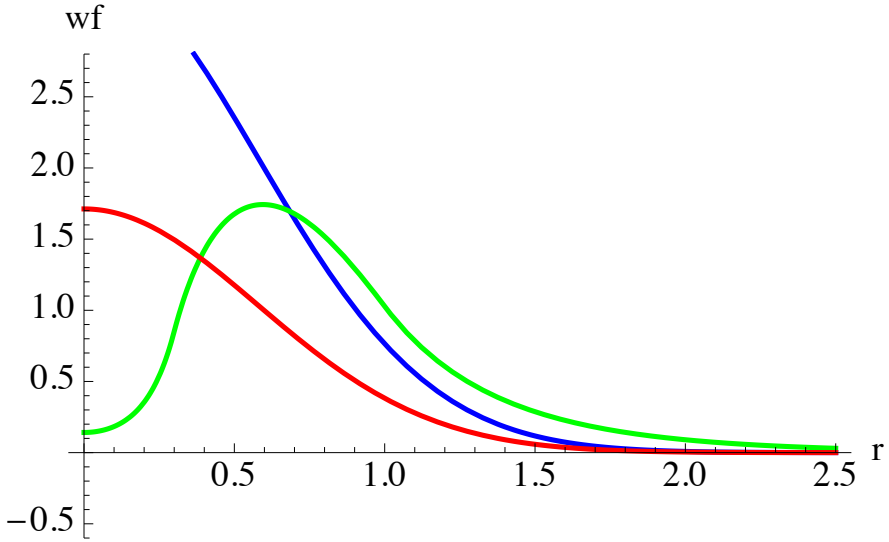


$\psi_{\text{exact}}(r)$, $\psi_0(r)$, $0.5 * \phi_0$



$N_{\max} = 0$, $E_0 = -1.30$

$\psi_{\text{exact}}(r)$, $\psi_0(r)$, $0.5 * \phi_0$



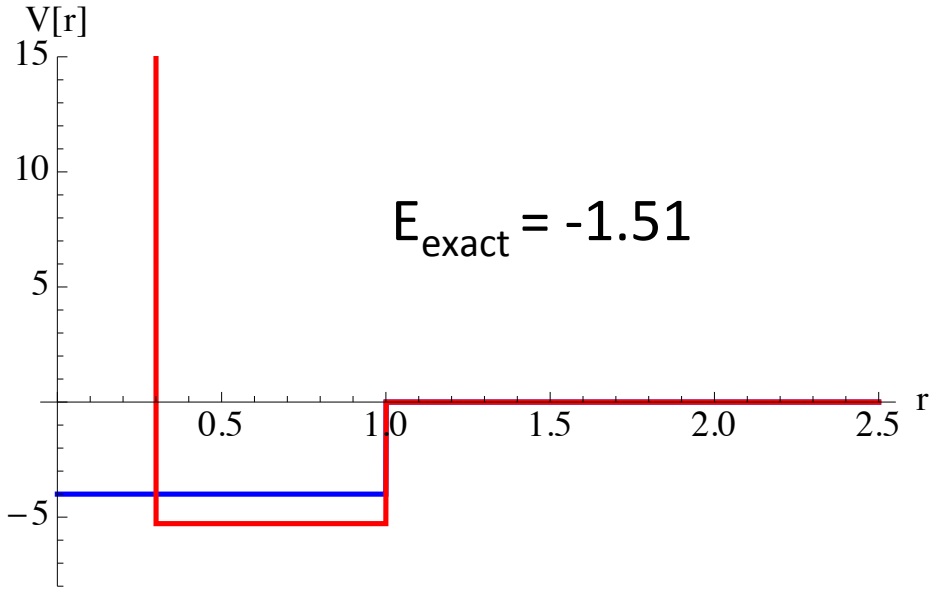
$N_{\max} = 0$, $E_0 = +5.23$

Expanding wave functions in an HO basis

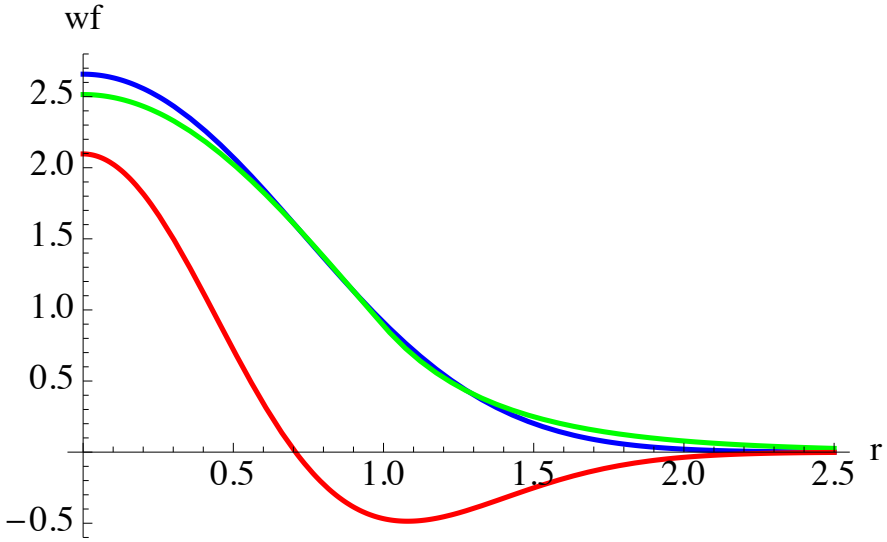
- Single-particle radial wf $\psi(r)$
- Expand in harmonic oscillator wfs:

$$\psi_{N_{\max}}(r) = \sum_{\alpha=0}^{N_{\max}} c_\alpha \phi_\alpha(r)$$

- Find c_αs by diagonalizing $\hat{H}\Psi = E\Psi$

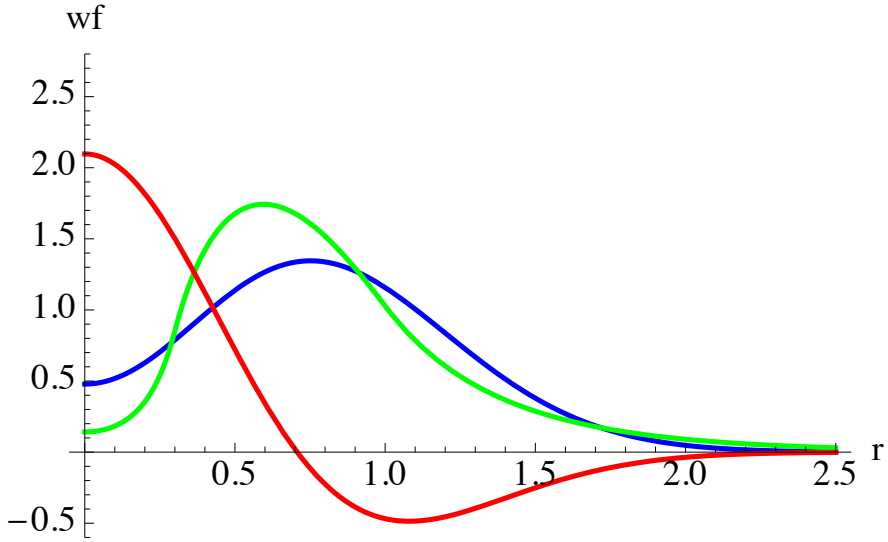


$\psi_{\text{exact}}(r)$, $\psi_2(r)$, $0.5 * \phi_2$



$N_{\max} = 2$, $E_2 = -1.46$

$\psi_{\text{exact}}(r)$, $\psi_2(r)$, $0.5 * \phi_2$



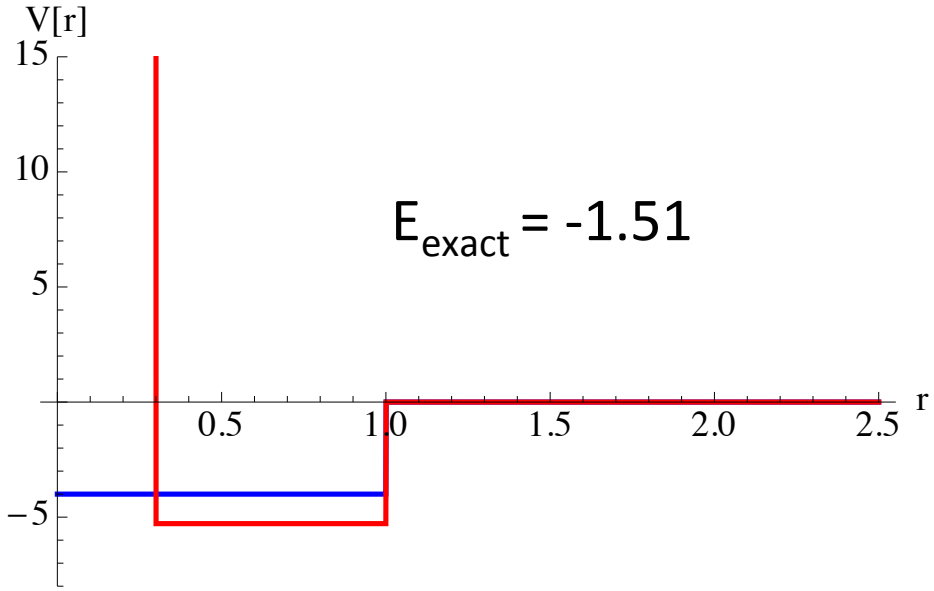
$N_{\max} = 2$, $E_2 = -0.87$

Expanding wave functions in an HO basis

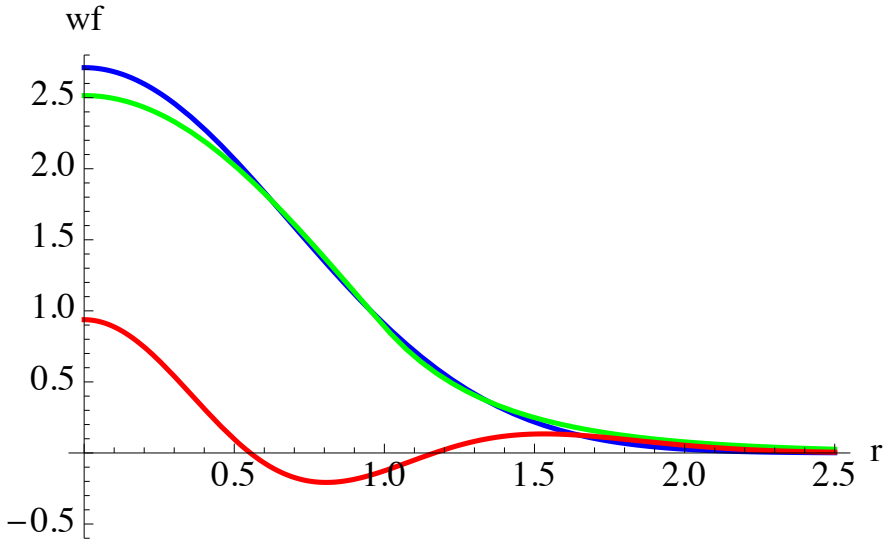
- Single-particle radial wf $\psi(r)$
- Expand in harmonic oscillator wfs:

$$\psi_{N_{\max}}(r) = \sum_{\alpha=0}^{N_{\max}} c_\alpha \phi_\alpha(r)$$

- Find c_αs by diagonalizing $\hat{H}\Psi = E\Psi$

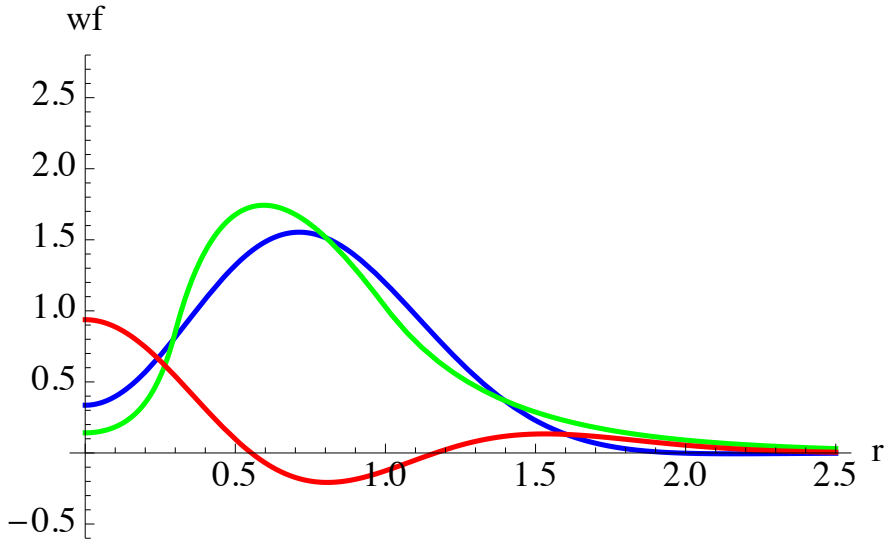


$\psi_{\text{exact}}(r)$, $\psi_4(r)$, $0.5 * \phi_4$



$N_{\max} = 4$, $E_4 = -1.46$

$\psi_{\text{exact}}(r)$, $\psi_4(r)$, $0.5 * \phi_4$



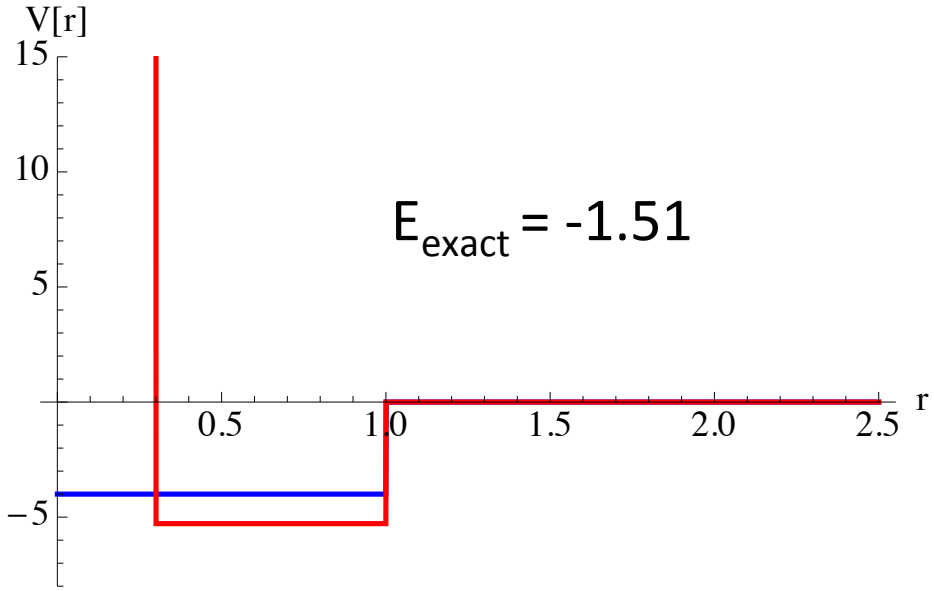
$N_{\max} = 4$, $E_4 = -1.04$

Expanding wave functions in an HO basis

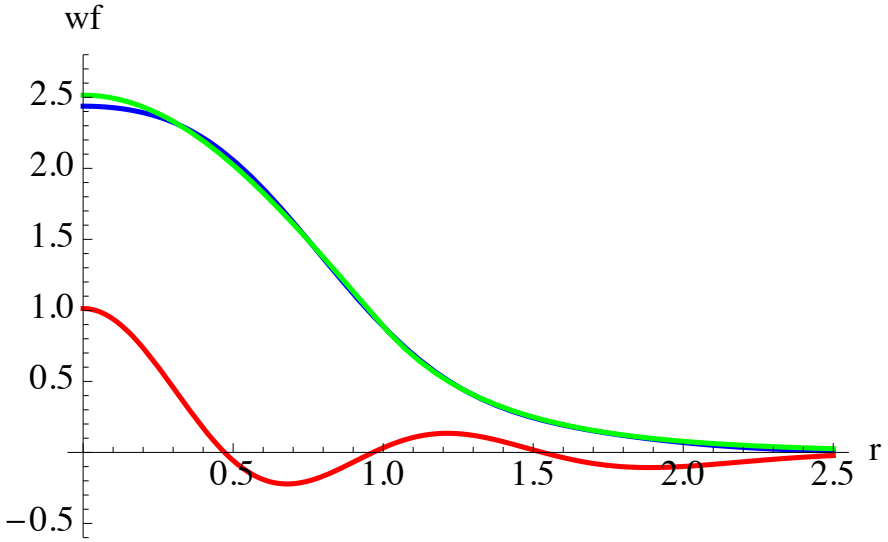
- Single-particle radial wf $\psi(r)$
- Expand in harmonic oscillator wfs:

$$\psi_{N_{\max}}(r) = \sum_{\alpha=0}^{N_{\max}} c_\alpha \phi_\alpha(r)$$

- Find c_αs by diagonalizing $\hat{H}\Psi = E\Psi$

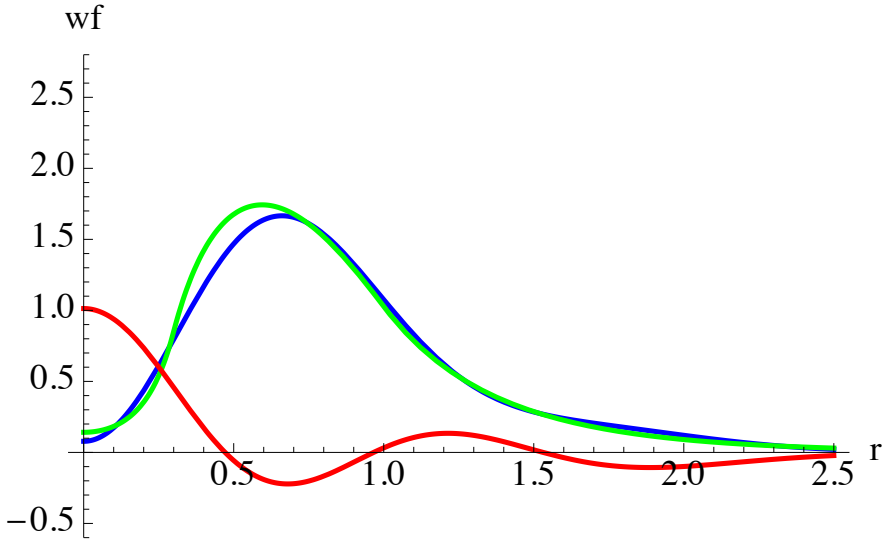


$\psi_{\text{exact}}(r)$, $\psi_6(r)$, $0.5 * \phi_6$



$N_{\max} = 6$, $E_6 = -1.50$

$\psi_{\text{exact}}(r)$, $\psi_6(r)$, $0.5 * \phi_6$



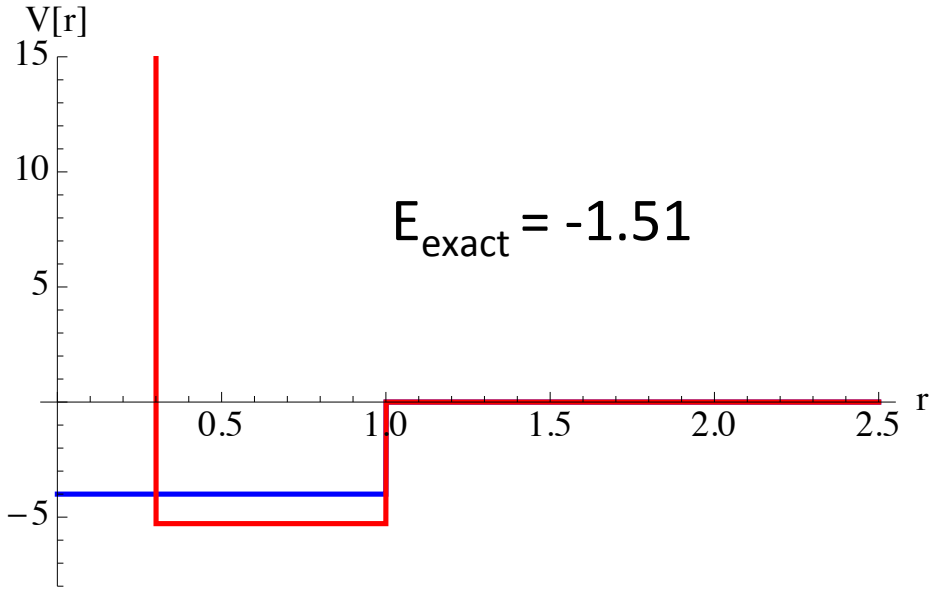
$N_{\max} = 6$, $E_6 = -1.40$

Expanding wave functions in an HO basis

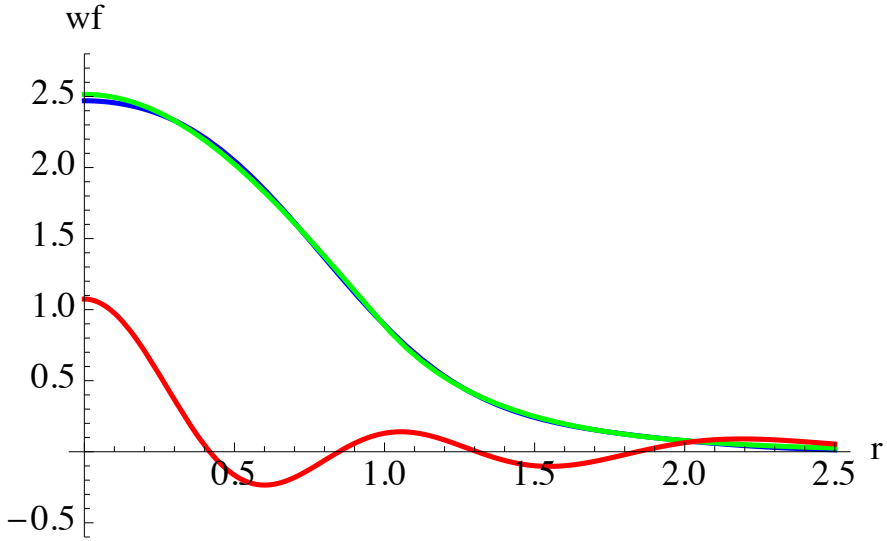
- Single-particle radial wf $\psi(r)$
- Expand in harmonic oscillator wfs:

$$\psi_{N_{\max}}(r) = \sum_{\alpha=0}^{N_{\max}} c_\alpha \phi_\alpha(r)$$

- Find c_αs by diagonalizing $\hat{H}\Psi = E\Psi$
- Extend to many-body system

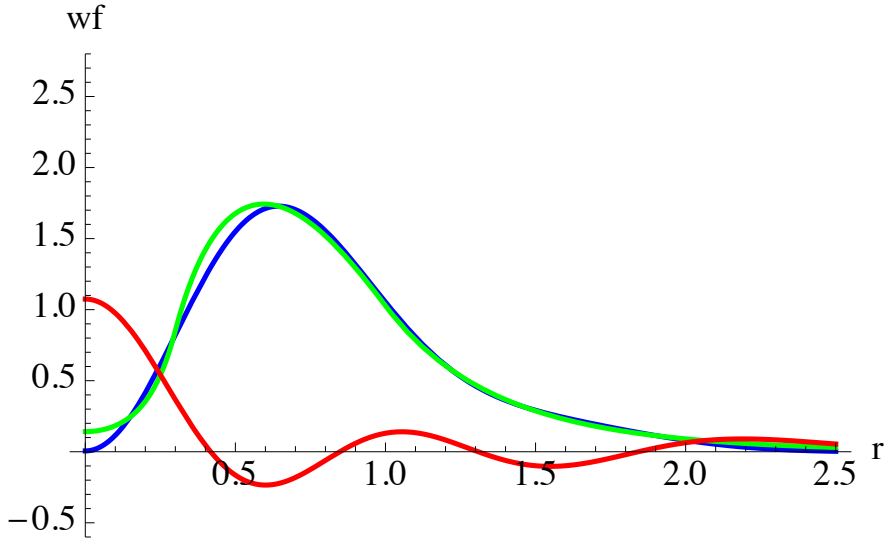


$\psi_{\text{exact}}(r)$, $\psi_8(r)$, $0.5 * \phi_8$



$N_{\max} = 8$, $E_8 = -1.50$

$\psi_{\text{exact}}(r)$, $\psi_8(r)$, $0.5 * \phi_8$



$N_{\max} = 8$, $E_8 = -1.43$