

$$P_s = |\langle \Psi_{N1}(Z) | \Psi_{N1}(Z-1) \rangle|^2 = 1 - \frac{33}{4Z^2} + \mathcal{O}\left[\frac{1}{Z}\right]^3,$$

$$P_e \approx 2(1 - P_s) \approx \frac{33}{2Z^2} \approx 3.6 \times 10^{-3}, \text{ for } Z = 68.$$