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Physics 3700
Problem Set 4
Due Monday, March 25, 2024

1) Taylor P3.26, page 84 (2nd edition: P3.22, page 83).

2) Taylor P3.28, page 84 (2nd edition: P3.24, page 83).

3) Taylor P3.32, page 86 (2nd edition: P3.28, page 85).

4) Taylor P3.52, page 92 (2nd edition: P3.46, page 90).

5) In the Bohr theory of the structure of the hydrogen atom the energies of the various quantum states are given by:

$$E_n = -\frac{me^4}{2N^2\hbar^2}$$

With: m the mass of the electron
e the electric charge of the electron
$\hbar$ is the Planck's constant divided by 2π

If: $\sigma_m/m = 0.1\%$ (i.e. the mass is known to 0.1%)
$\sigma_e/e = 0.2\%$ (i.e. the charge is known to 0.2%)
$\sigma_\hbar/\hbar = 0.1\%$

a) Calculate σ_E/E for arbitrary N.

b) If the precision of σ_E/E is to be improved which of the three quantities should be determined more precisely?