

HA 3.2 The field \vec{E} of a full charged sphere. [20 points]

Consider a full sphere with radius R .

- 1) Calculate \vec{E} at any point in space in the case of a constant volume charge density

$$\rho = \rho_0 \text{ for } r \in [0, R] \quad . \quad (\text{HA3.1})$$

Use Gauss' theorem (no need to show again symmetry arguments). [5 points]

- 2) Calculate \vec{E} at any point in space in the case of a volume charge density

$$\begin{cases} \rho = \rho_0 \frac{r}{R_0} & \text{for } r \in [0, R_0], \quad R_0 < R \\ \rho = \rho_0 & \text{for } r \in [R_0, R]. \end{cases} \quad (\text{HA3.2a})$$

$$(\text{HA3.2b})$$

Also in this case use Gauss' theorem (no need to show again symmetry arguments). [15 points]

Show full calculations involving surface and volume integrals.