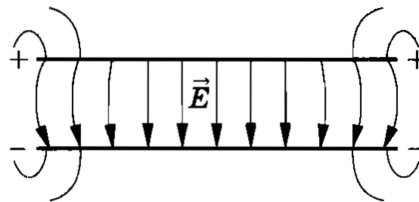
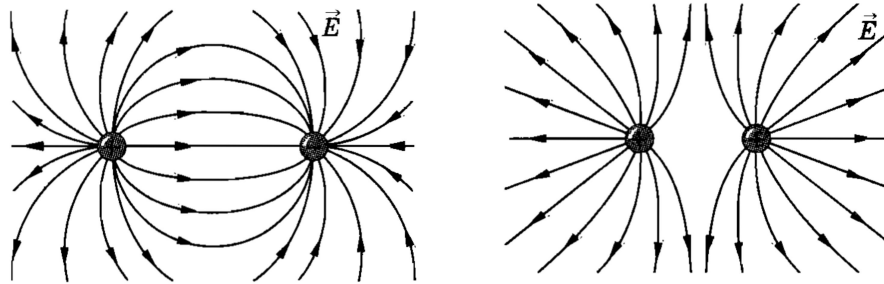
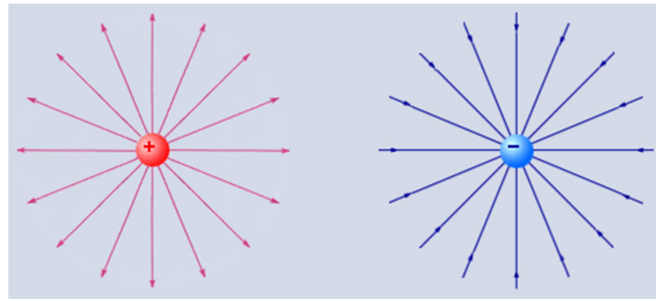
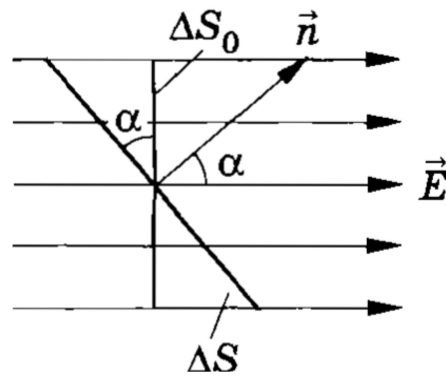
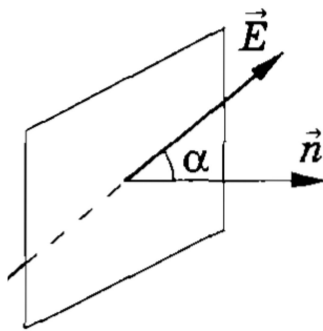


*Electric field.*



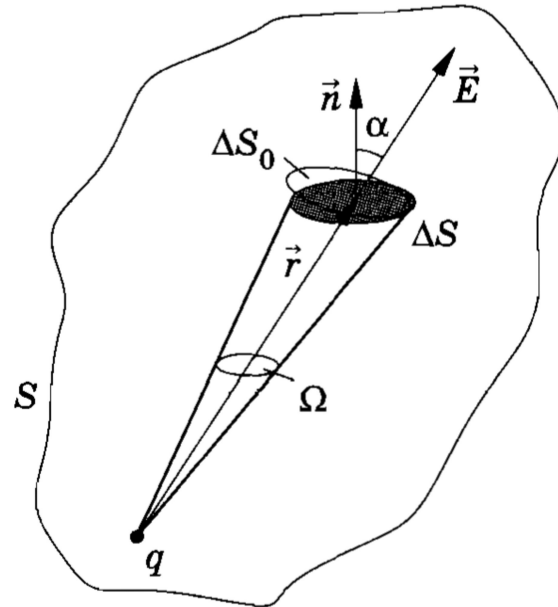
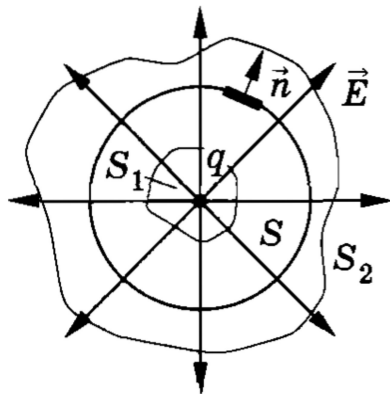
*The Flux of the Vector.*



$$\Delta S_0 = \Delta S \cos \alpha.$$

$$\Delta N = E \cos \alpha \cdot \Delta S = E \Delta S_0,$$

**Theorem.** The flux of the electric field through the closed surface is proportional to the charge enclosed inside this surface.



$$E_n = k \frac{q}{\epsilon r^2}.$$

$$\begin{aligned} N &= \sum_i E_{n_i} \Delta S_i = E_n \sum_i \Delta S_i = \\ &= E_n \cdot 4\pi r^2 = k \frac{4\pi q}{\epsilon}. \end{aligned}$$



**Homework problem 1.** Use Gauss' law to find the electric field of a thin infinite straight wire with a linear density of charge  $\rho$ .

*Note: One can of course compute the same result differently: imagine that wire is made of tiny pieces, so small that each produces field of a single particle. Then one can add-up fields of all these pieces. This harder exercise requires knowledge of integrals but gives the same answer!*



**Homework problem 2.** Positive charge  $q$  is uniformly spread along the length on the thin wire ring with radius  $R$  (so it is spread along the perimeter of a circle). Find the field along the axes of the symmetry of the ring as a function of  $h$ , the height from the plane of the ring. (Hint: see Note above).