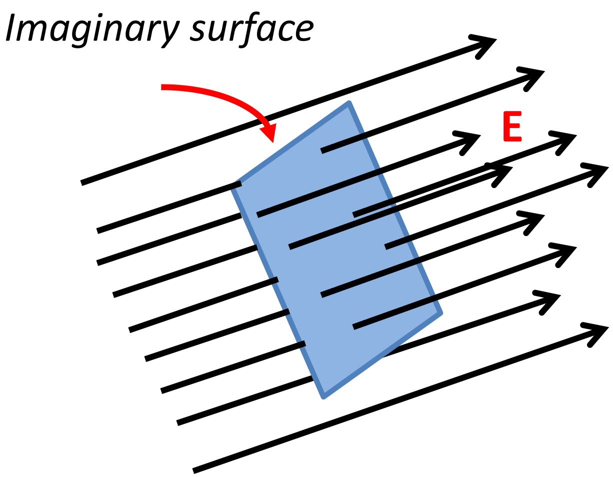
Electric Flux



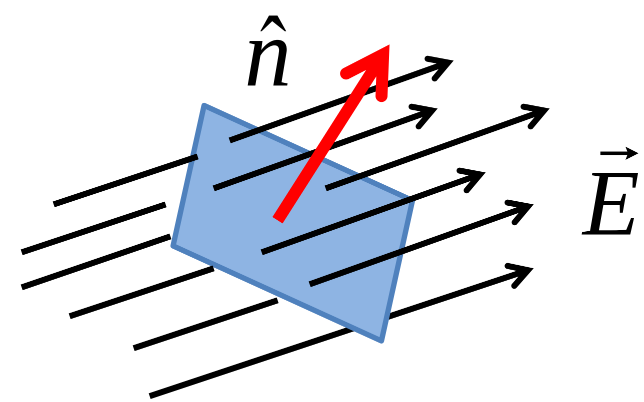
Electric Flux = Electric Field * Area

$$\Phi = E \cdot A$$

This definition only works when **E** is ***constant*** everywhere on the surface , and is ***perpendicular*** to it.
Flux is **0** when field **E** is ***parallel*** to the surface.

In a more general case, flux through surface element **dA** is multiplied by cos α , where α is the angle between the field and the unit vector **n** perpendicular to the surface **(called normal vector)**

$$d\Phi = E\cos(\alpha)\, dA$$



Gauss Theorem

Gauss Theorem:

Total Electric Flux though any closed surface is equal to the ***Total Electric Charge*** inside that surface, times $4\pi k_e$

$$\Phi_{\text{closed surface}} = 4\pi k_e q_{inside}$$

Here the flux is a surface integral, i.e. sum of fluxes over all surface elements:

$$\Phi_{\text{closed surface}} = \oiint E\cos(\alpha)\, dA$$

In practice, we do not need to compute this complicated integral. We need to find a good surface, such that electric field is either parallel to it, or perpendicular and constant.

Homework

ProblemA fountain is placed in the center of circular pool. It consumes a fixed volume of water per second (let us call it **I**).

a) Find the average speed of the water current in the pool, at distance **r** from the center, if the pool depth is **h**.

b) Propose electrostatic problem in which electric field has the same dependence on the distance, as velocity of water in (a) .