

Flux of the Electric Field Electric flux is the rate of flow of the electric field through a given area (Fig. . 1

1). Electric flux is proportional to the number of electric field lines going through a virtual surface. Figure 1: Electric Flux: Electric flux visualized. The ring shows the surface boundaries. The red arrows for the

electric field lines. Flat Surface, Uniform Field: We begin with a flat surface (Fig. 2) with area A in a uniform electric field \vec{E} . The total flux Φ is then: $\Phi = \int \vec{E} \cdot d\vec{A}$. $\vec{E} \cdot d\vec{A} = E dA \cos(\theta)$ $\Phi = \int (E \cos(\theta)) dA$ $\Phi = E \cos(\theta) \int dA$ $\Phi = E A \cos(\theta)$ When the electric field is uniform and the surface is flat: $\Phi = (E \cos(\theta))A$ (uniform field, flat surface)

Figure 2: An electric field vector pierces a small square patch on a flat s