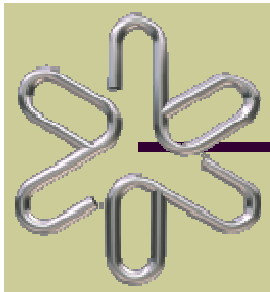

Universidade de São Paulo
Brasil

Física III para engenharia elétrica 2014 4320292

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Instituto de Física da USP. Prédio do Tokamak

Física III
Eletricidade e Magnetismo

Bibliografia:

- ✓ **Princípios de Física - Eletromagnetismo -Vol 3** Raymond A. Serway e John W. Jewett Jr. Pioneira Thomson Learning, Inc.,

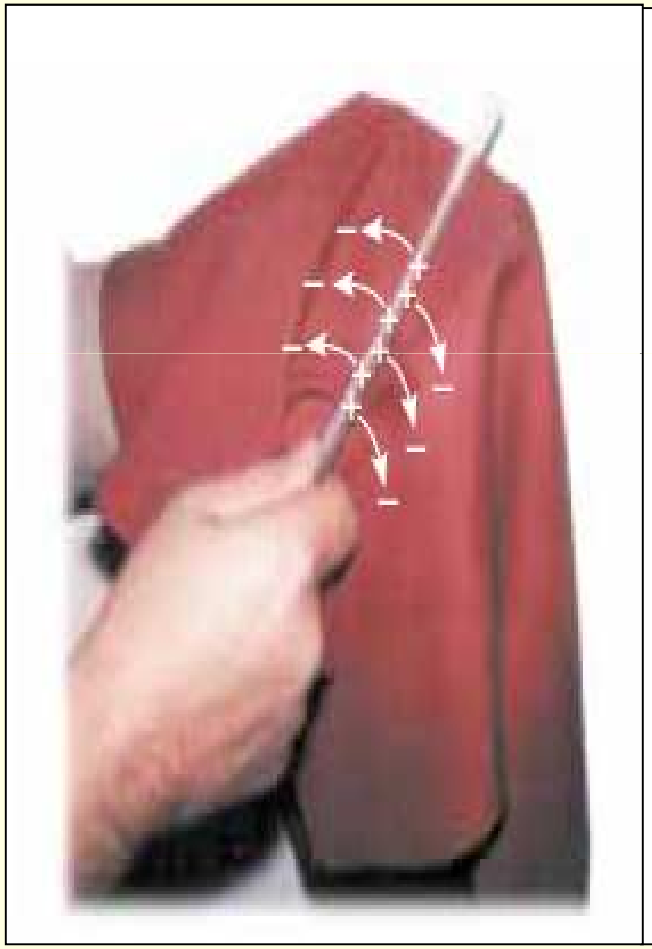
Texto usado para pautar o nível das aulas e provas.

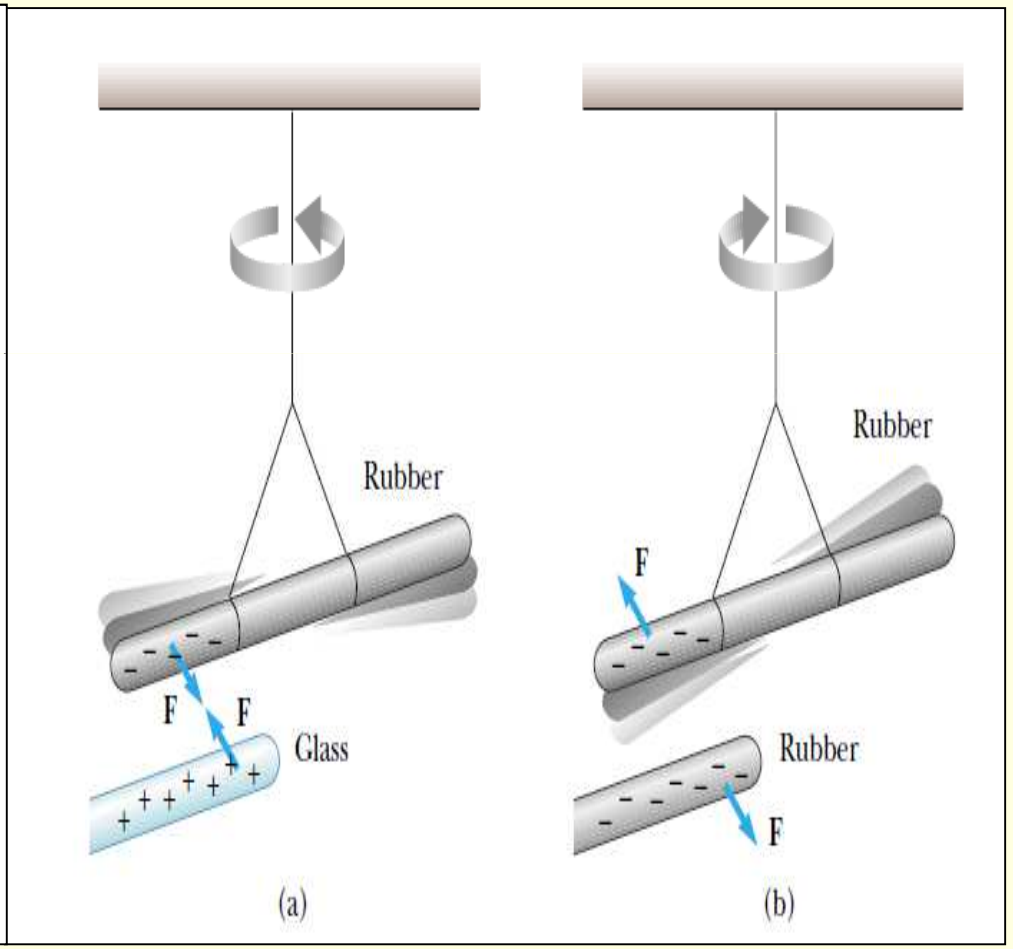
- ✓ **Física III – Eletromagnetismo**, Hugh D. Young e Roger A. Freedman 12a edição, Addison Wesley (Pearson)
- ✓ **Fundamentos de Física 3 – Eletromagnetismo** David Halliday e Robert Resnick Livros Técnicos e Científicos Editora
- ✓ **Lições de Física de Feynman, Volume 2**, Richard Feynman, Robert Leighton, Matthew Sand. Ed. Artmed, 1a Ed., 2008.
- ✓ **Notas de aula do prof. Marcos Lima no site da disciplina**.

Website da disciplina

- **http://disciplinas.stoa.usp.br/course/view.php?id=134**
- **Informações sobre a disciplina**
- Avisos, apresentação, critérios de avaliação, bibliografia, professores, calendário, horário (teoria), horário (laboratório), arquivos (listas de exercícios, gabaritos de prova, apostila), notas de provas e laboratórios, links interessantes etc.

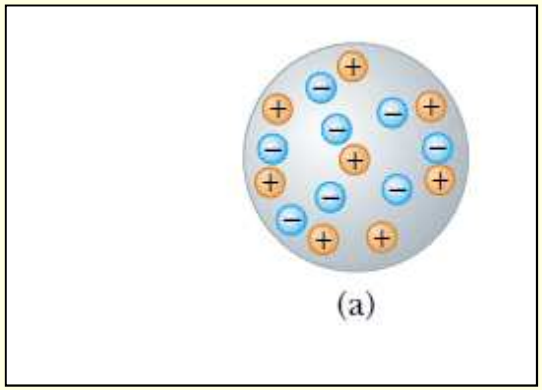
Eletrização por fricção

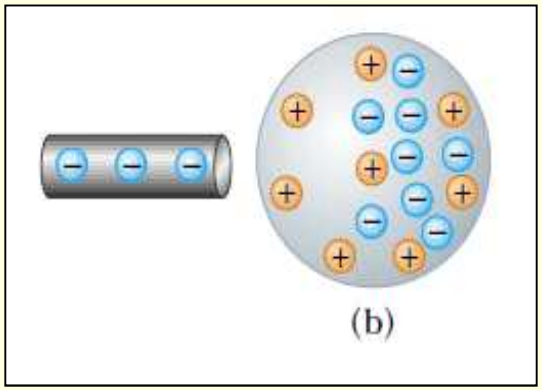


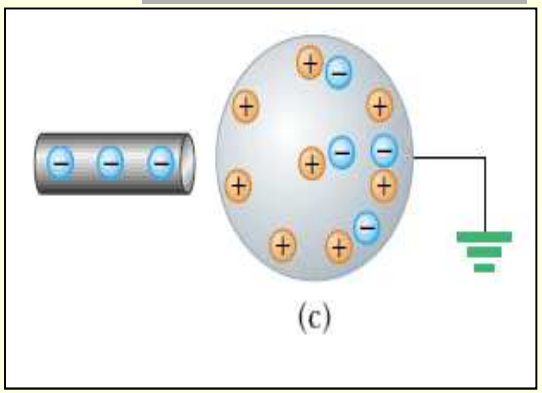


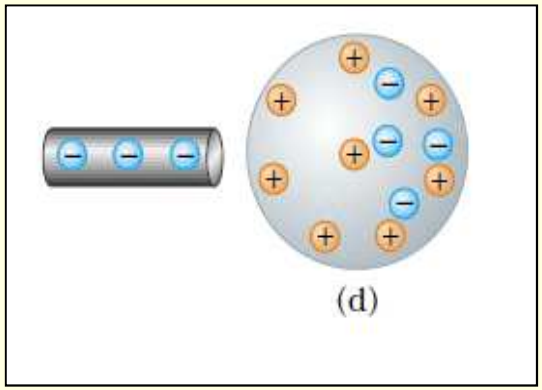
Eletrização por Fricção

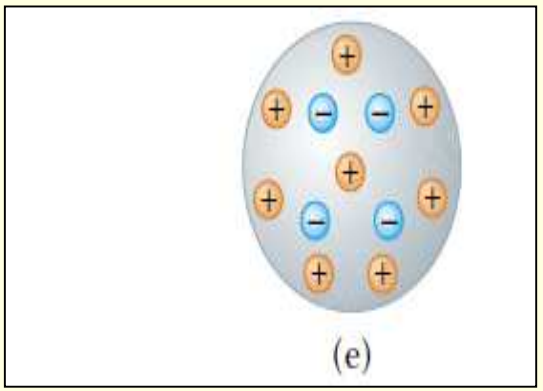
Eletrização por indução



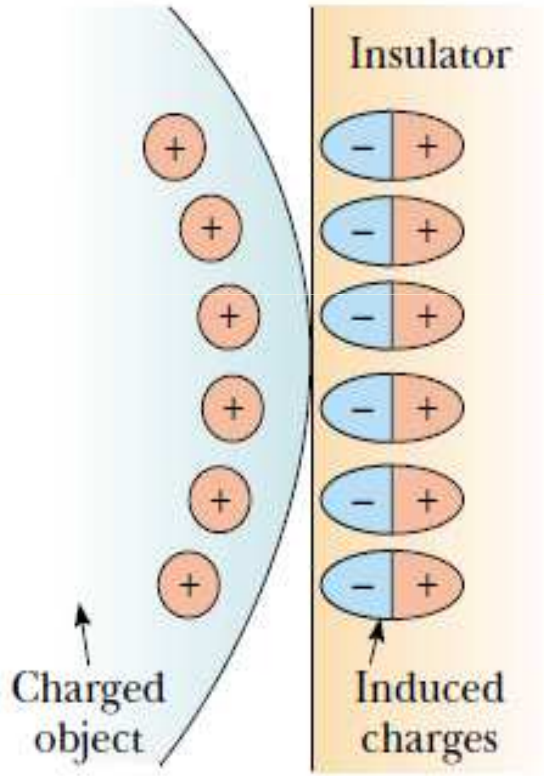








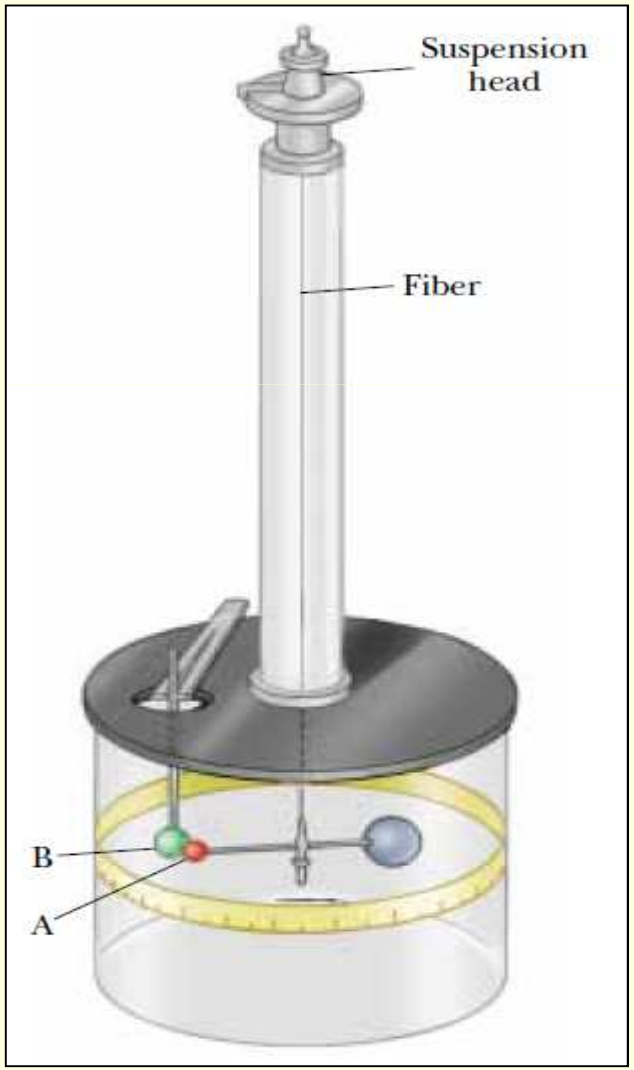
Polarização



(a)

(b)

Experiência de Coulomb e a lei de interação entre as cargas eletricas



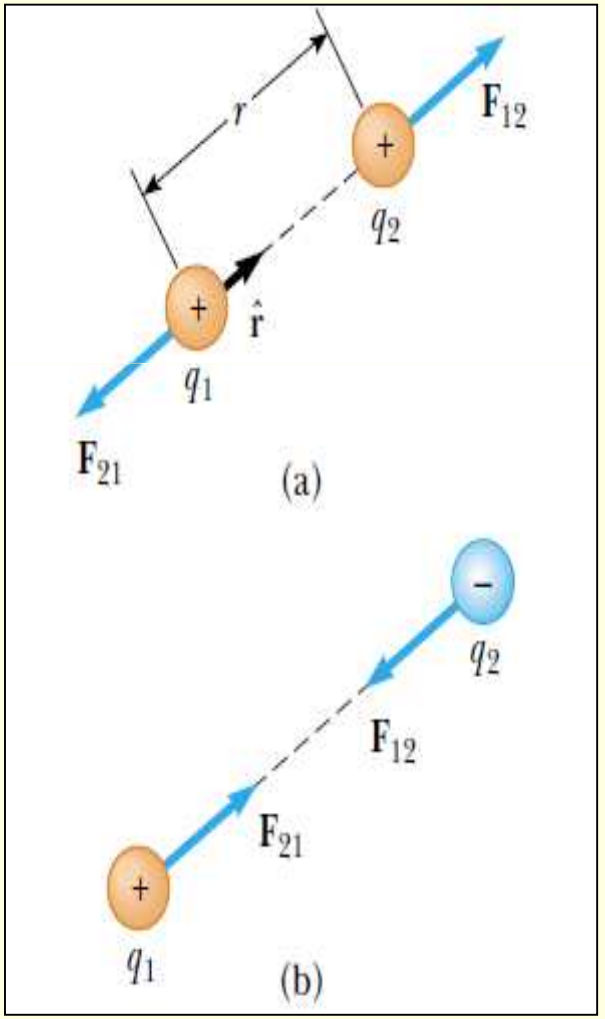
- **Força é proporcional ao inverso do quadrado das distâncias.**

- **Força é proporcional ao produto das cargas elétricas de cada corpo.**

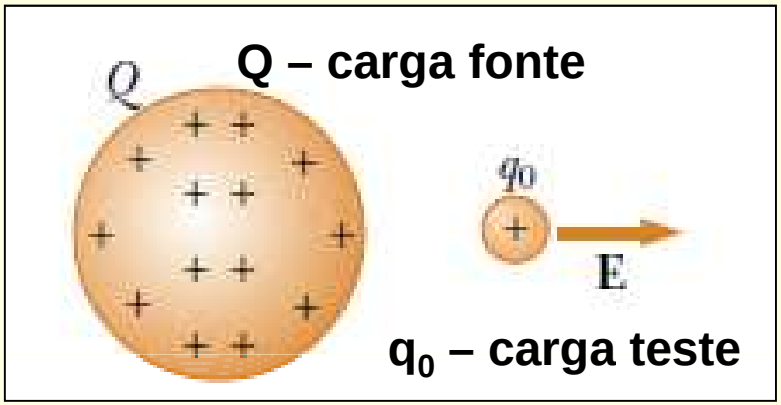
- **Cargas de mesmo sinal produzem força de repulsão e cargas de sinais contrários produzem atração.**

Lei de Coulomb para a interação entre cargas eletricas

$$\mathbf{F}_{12} = k_e \frac{q_1 q_2}{r^2} \hat{\mathbf{r}}$$



Campo Elétrico

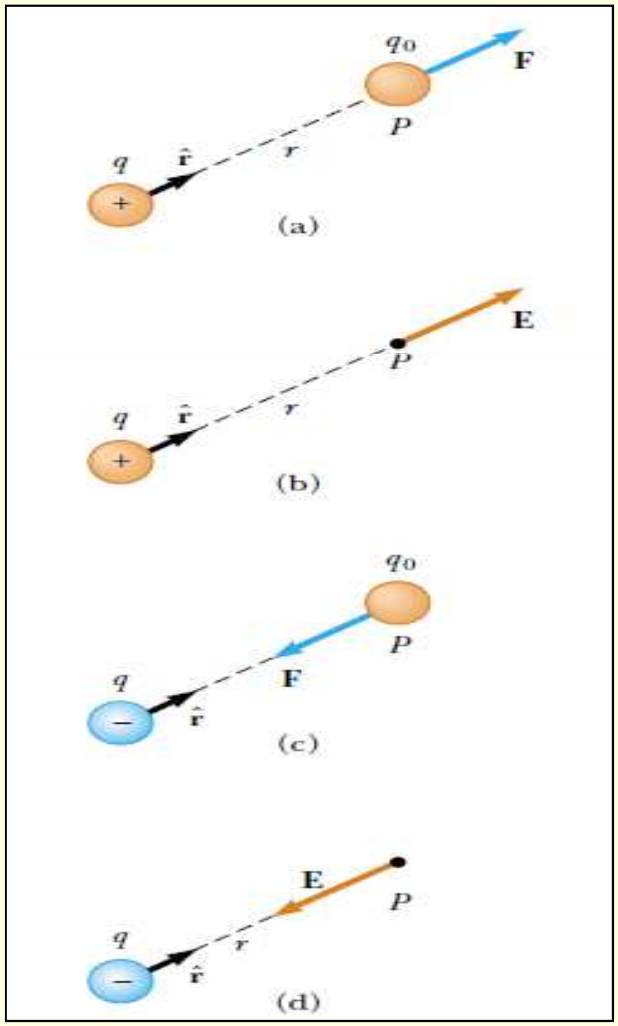


Q – carga fonte

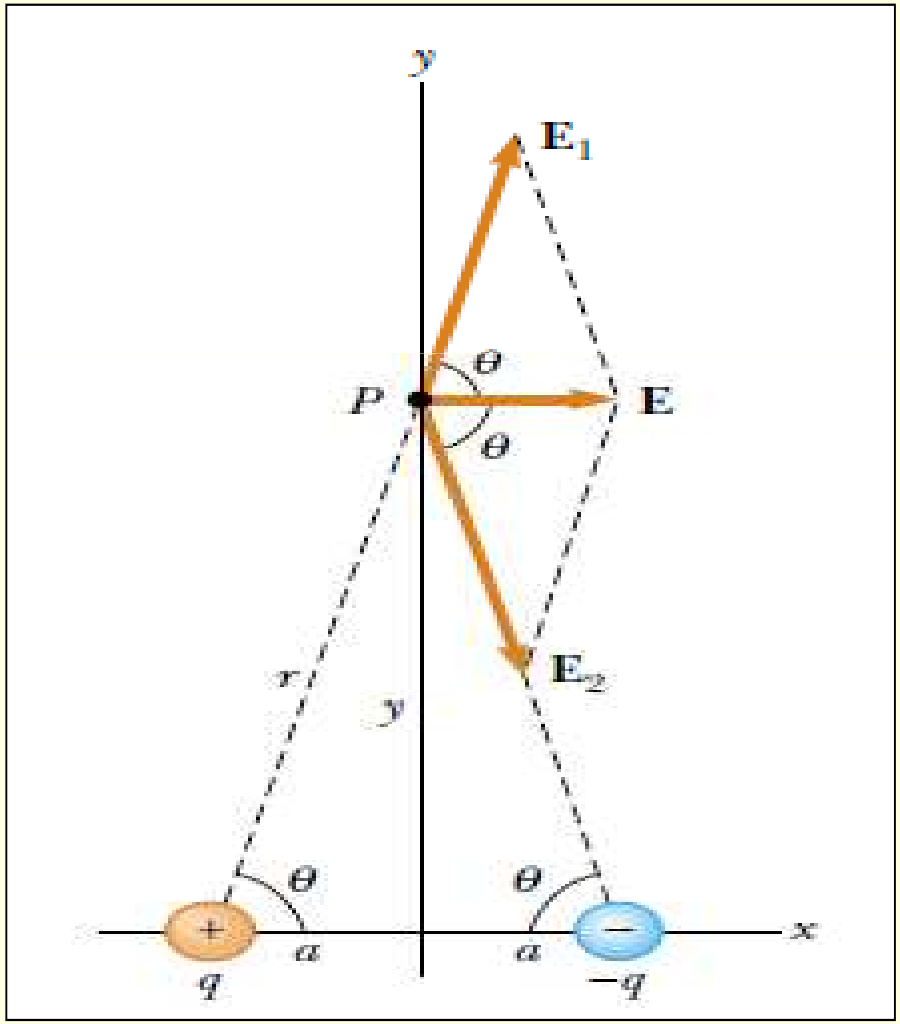
q_0 – carga teste

$$\mathbf{E} \equiv \frac{\mathbf{F}_e}{q_0}$$

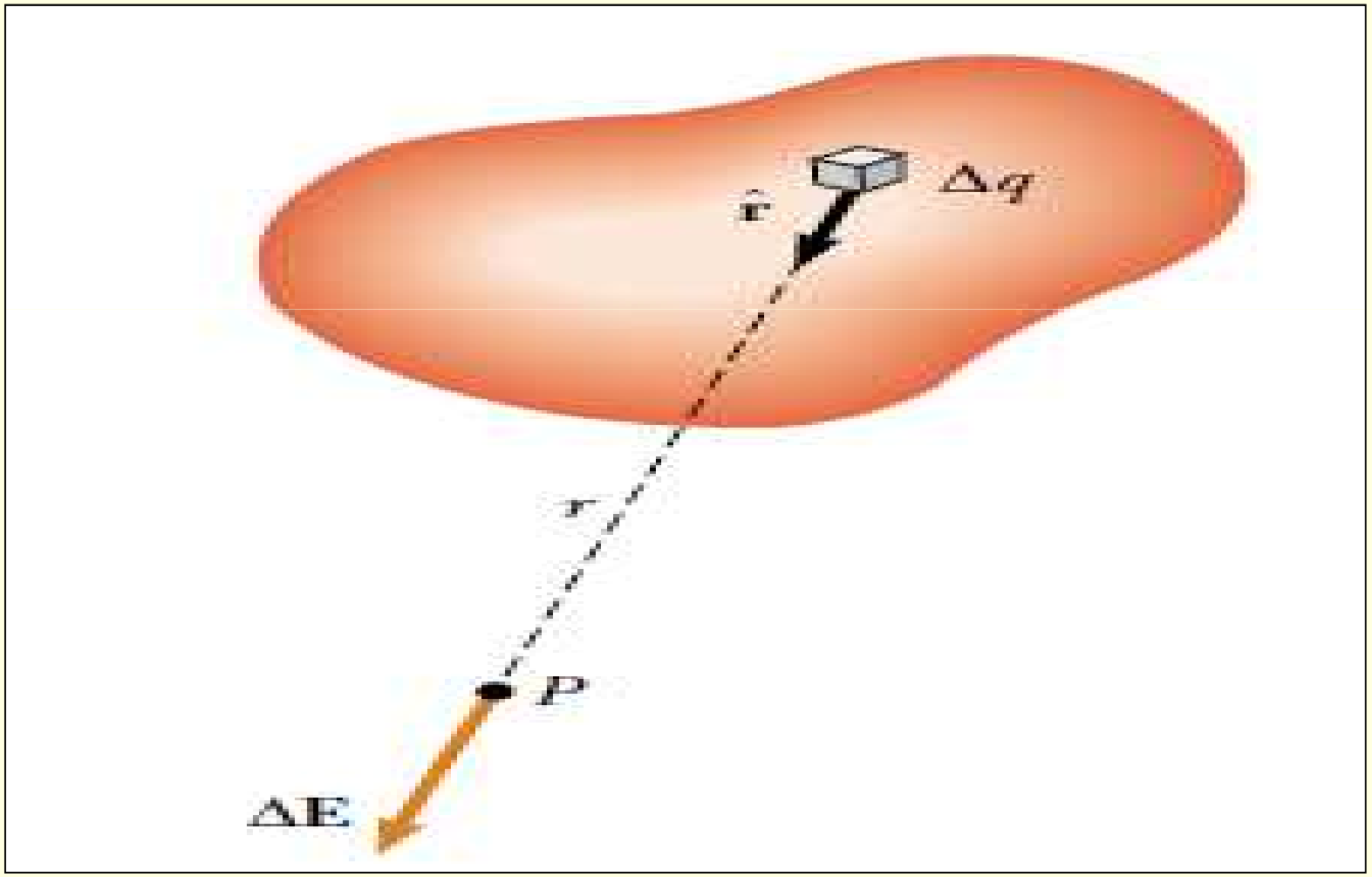
$$\mathbf{F}_e = q\mathbf{E}$$



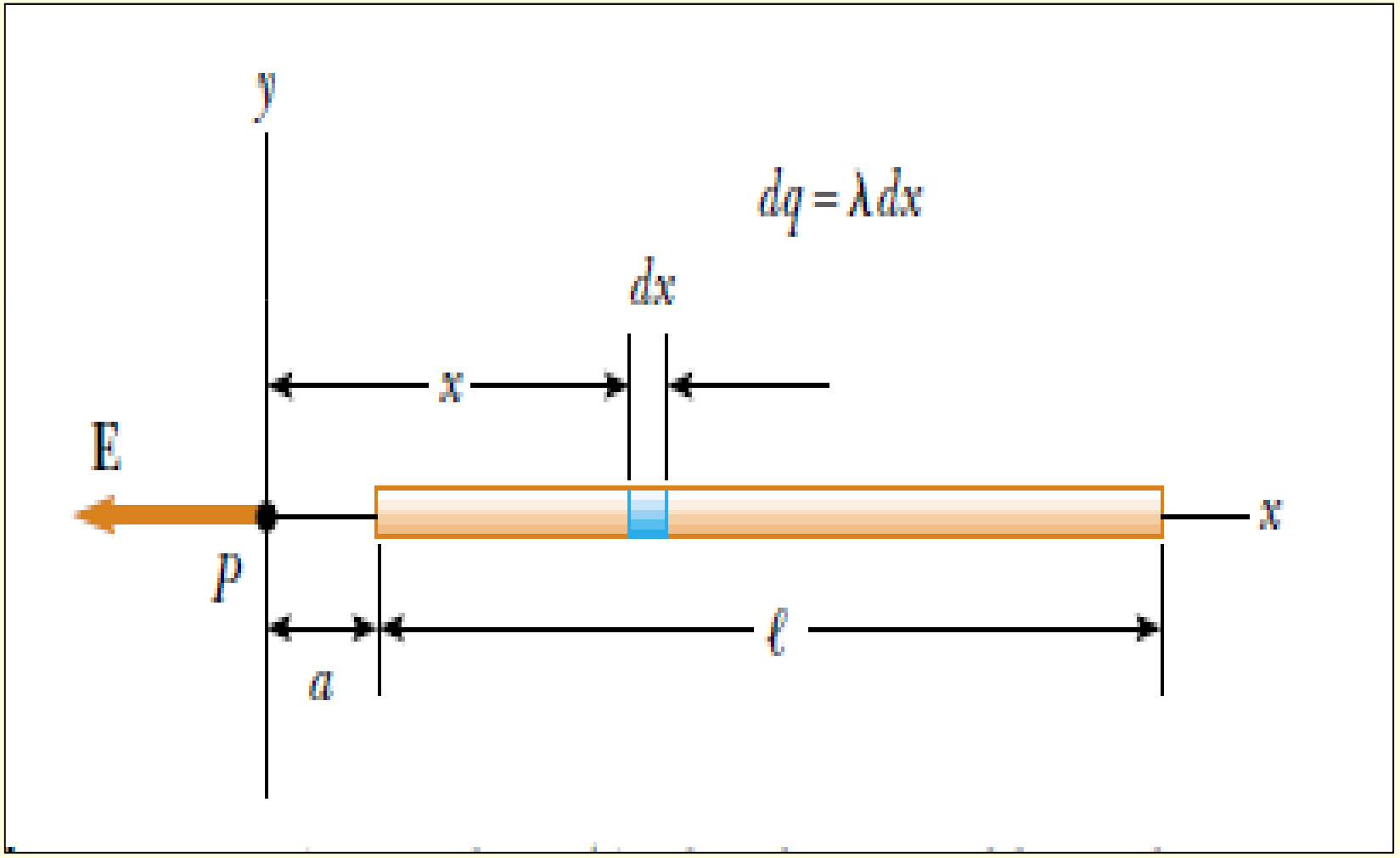
Campo elétrico em um dipolo



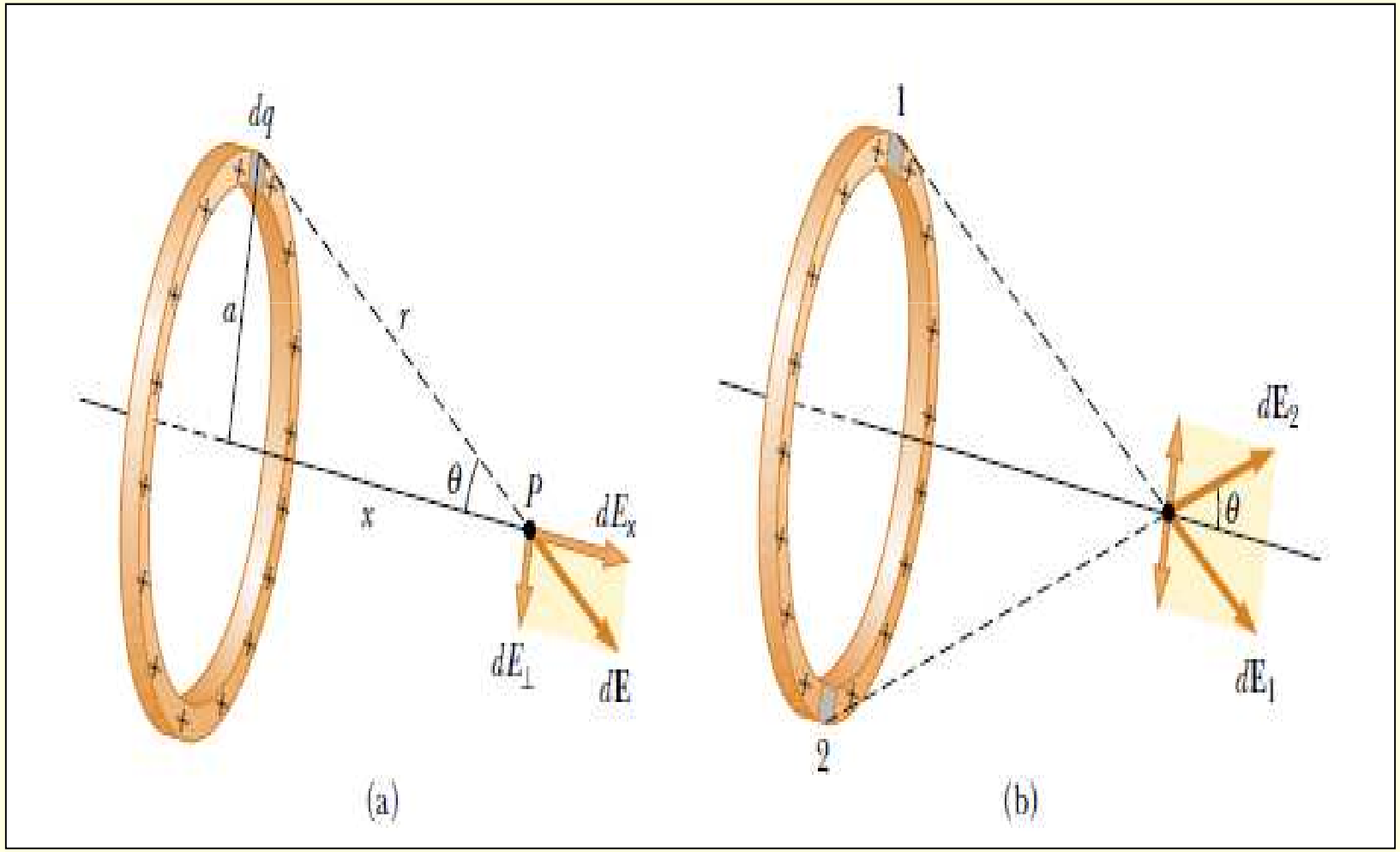
Distribuição de cargas



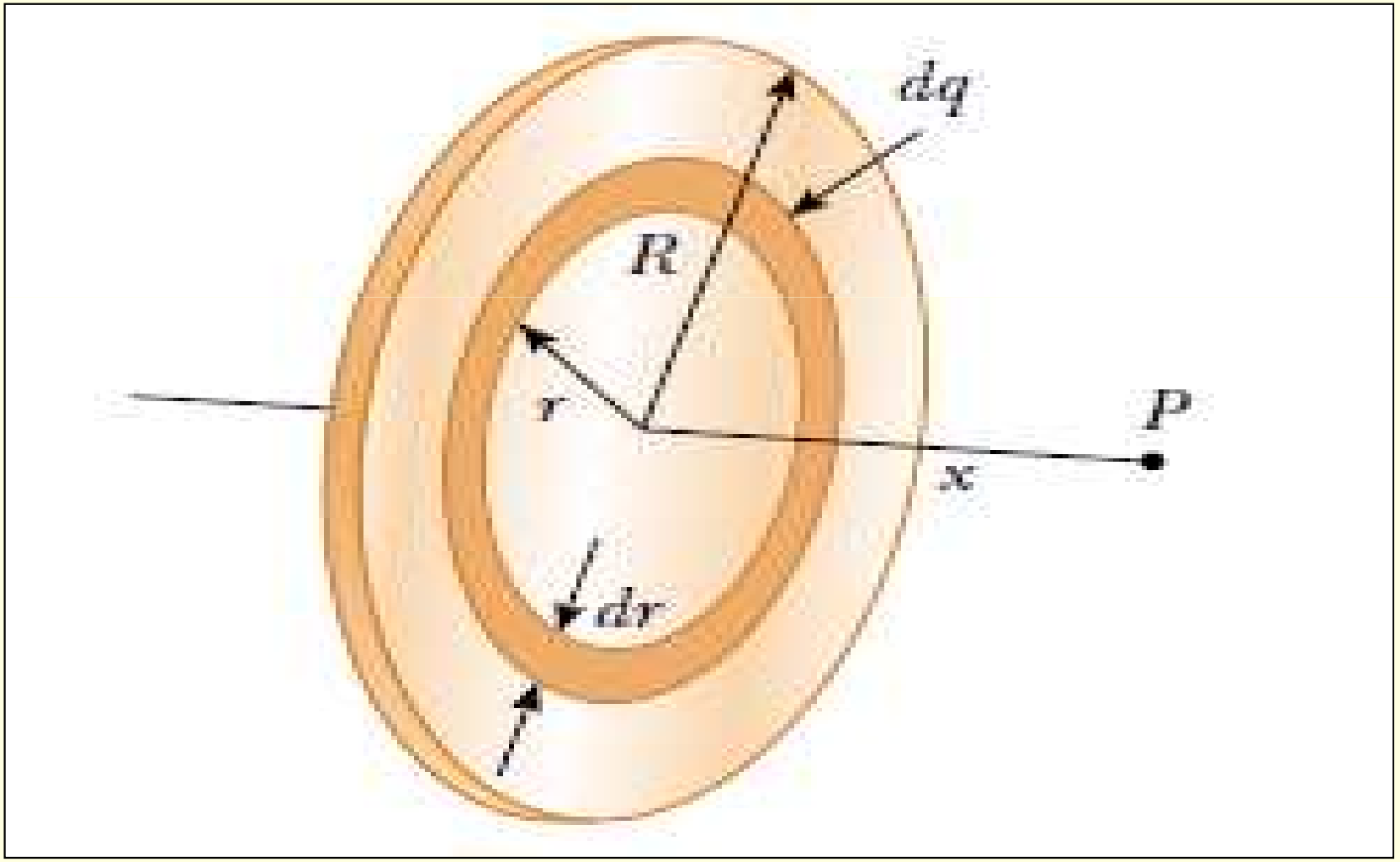
Campo elétrico em um fio uniformemente carregado



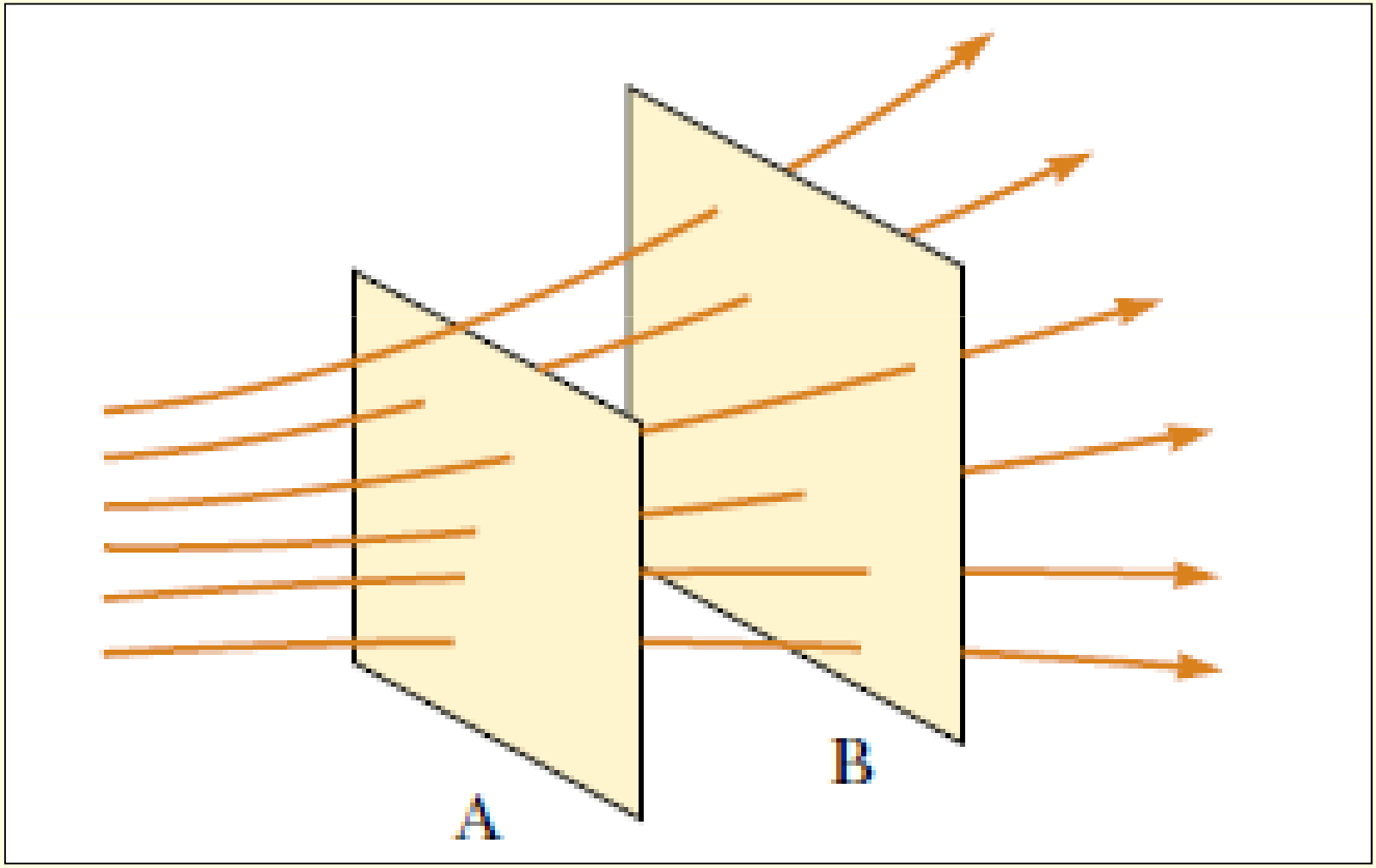
Campo elétrico em um anel uniformemente carregado



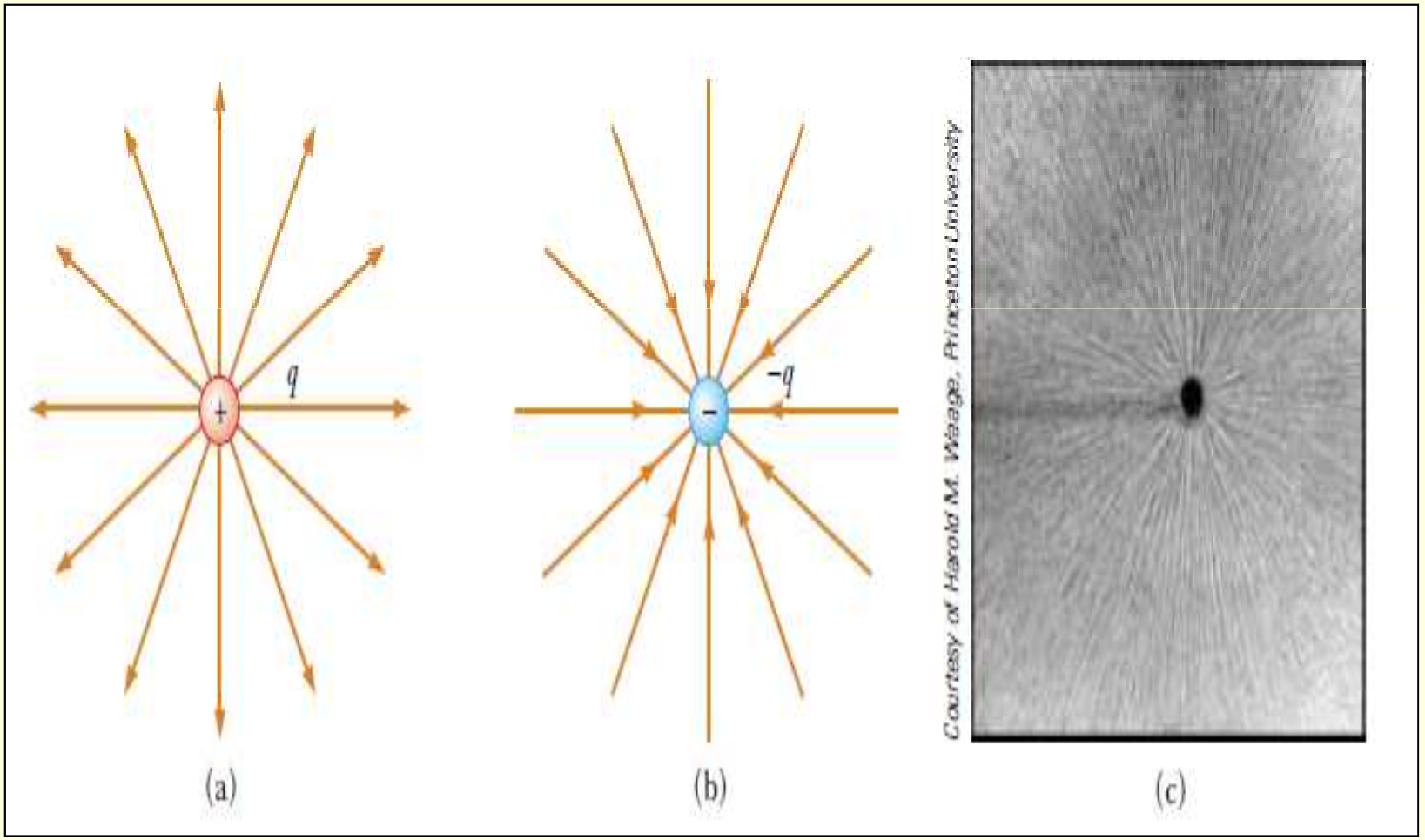
Campo elétrico em um disco uniformemente carregado



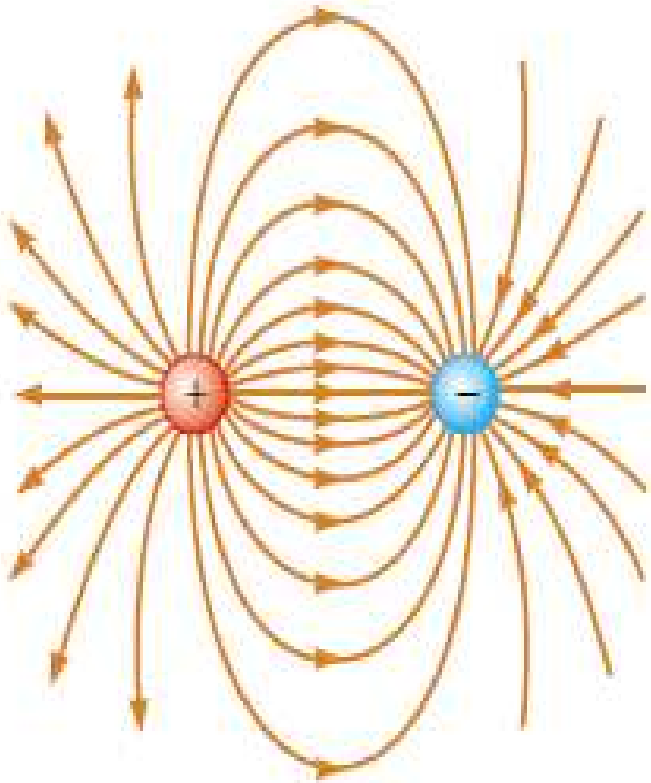
Linhas de campo elétrico



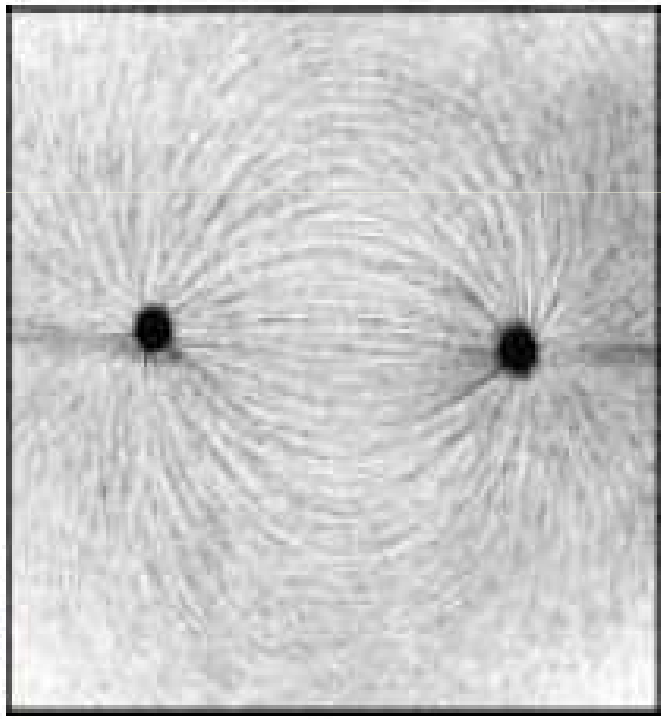
Linhas de campos produzidas por cargas induviduais



Linhas de campos produzidas por um dipolo



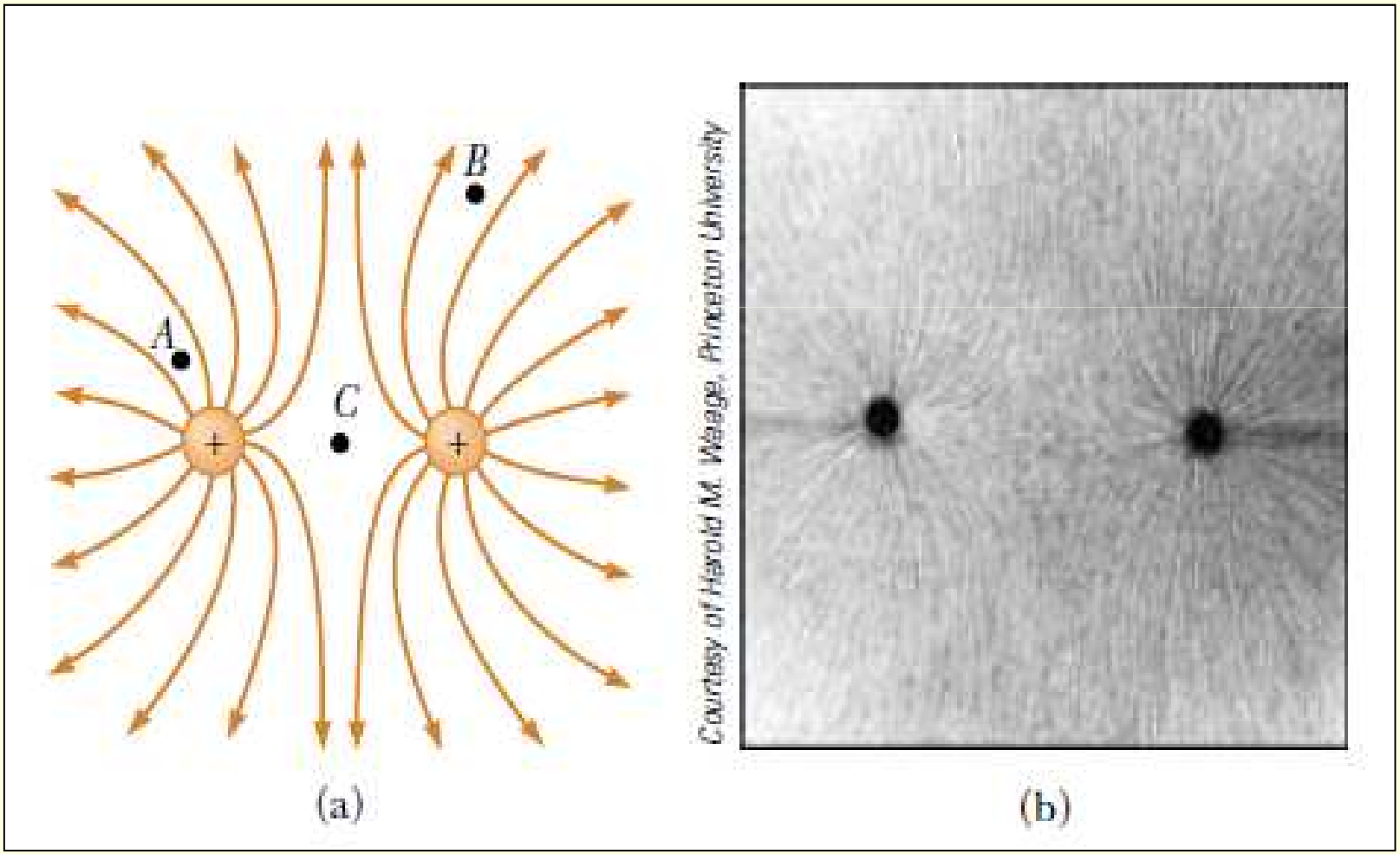
(a)



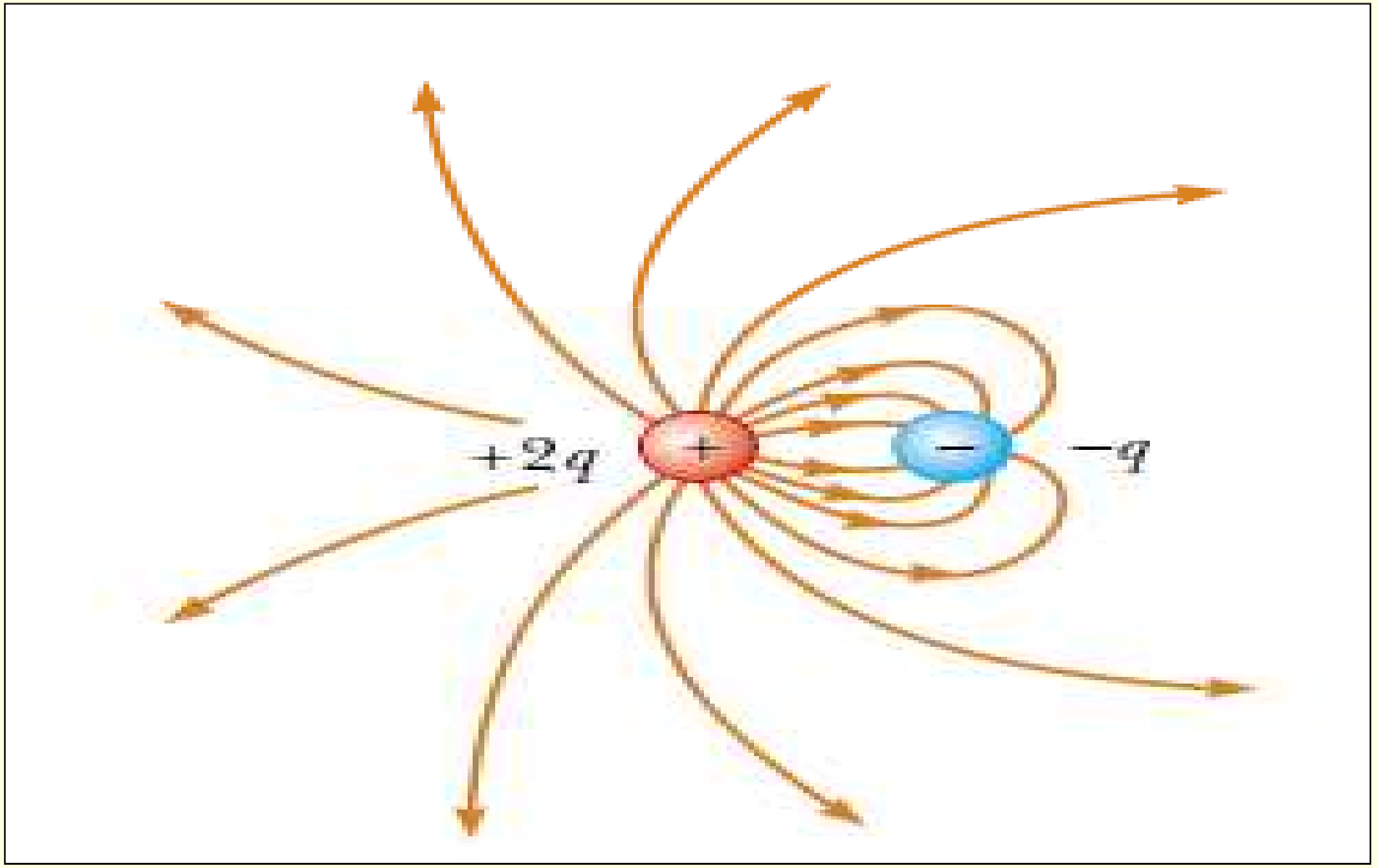
Courtesy of Harold M. Waage, Princeton University

(b)

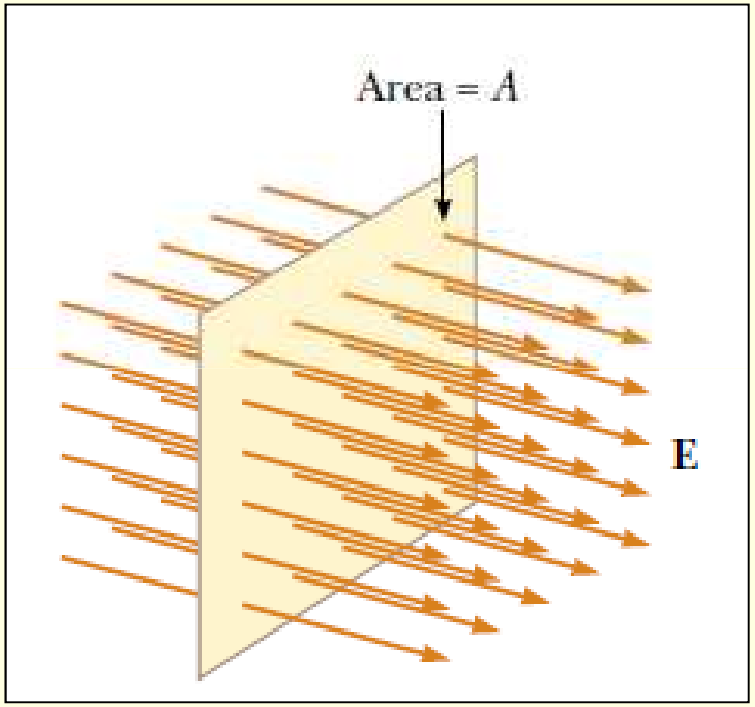
Linhas de campos produzidas por cargas de mesmo módulo e sinal

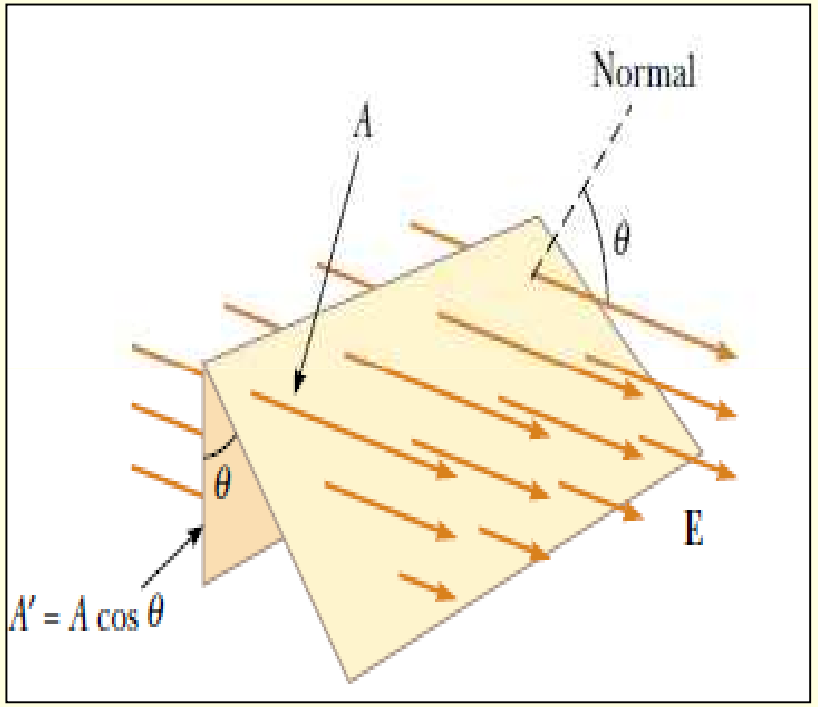


Linhas de campos produzidas por cargas de módulo e sinal diferente



Fluxo do campo elétrico





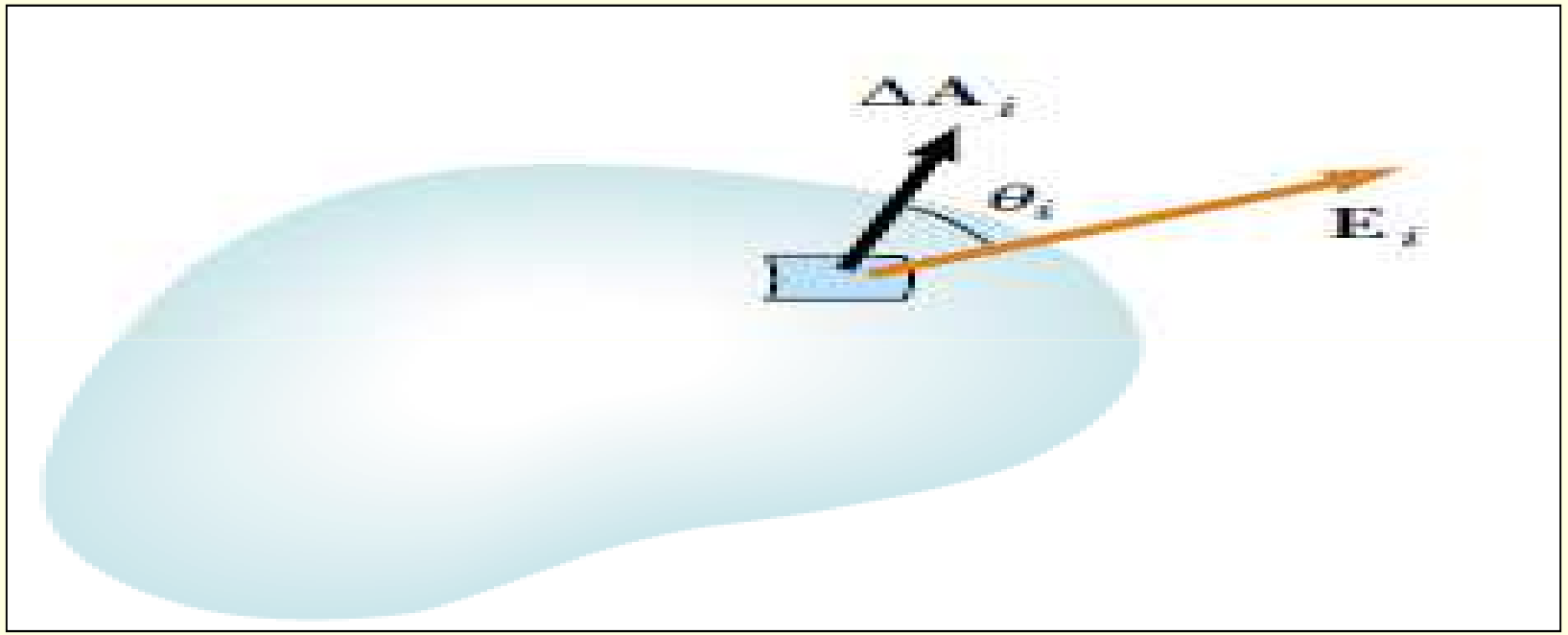
E ⊥ A

$$\Phi_E = EA$$

E Λ A

$$\Phi_E = EA' = EA\cos\theta$$

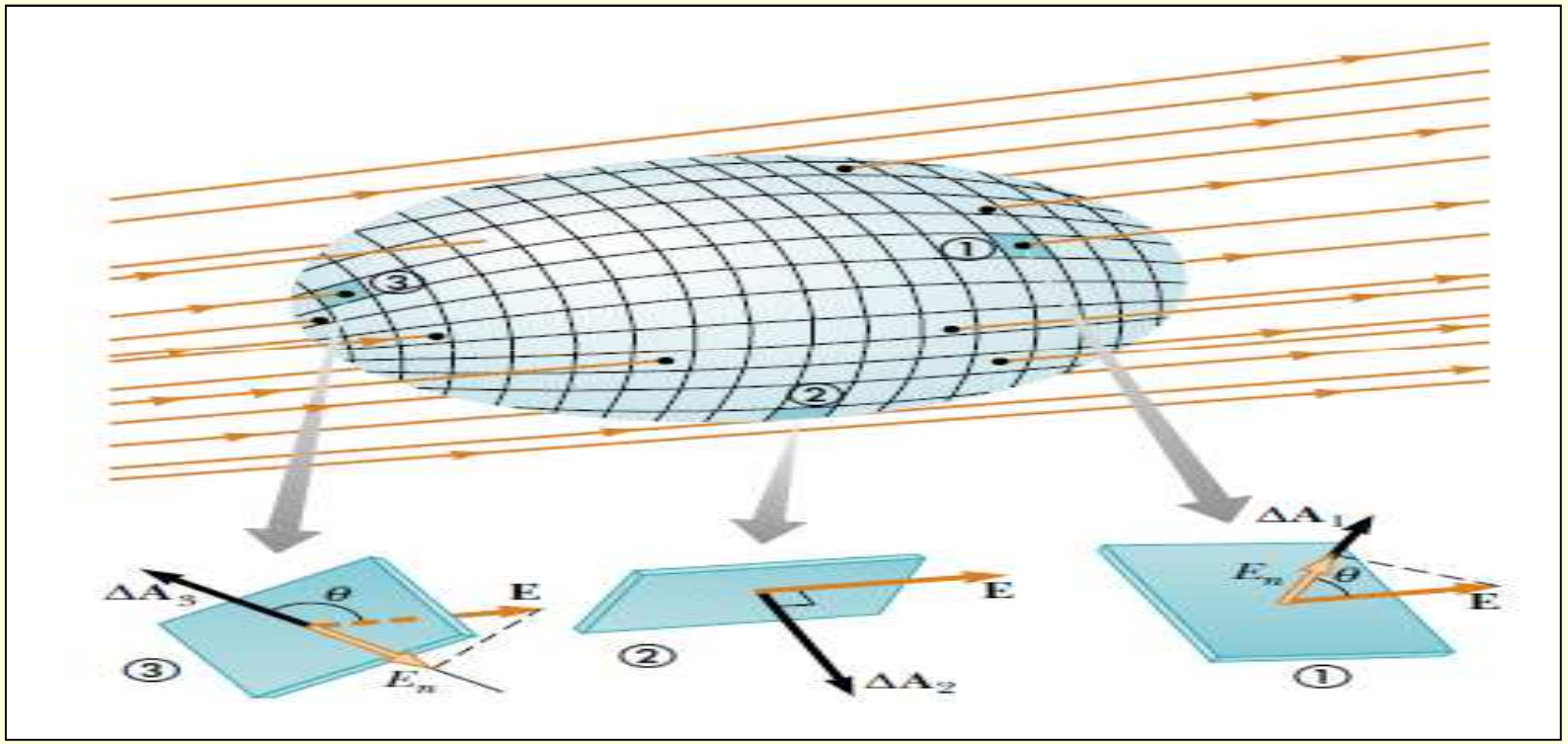
Definição matemática de fluxo elétrico



$$\Delta\Phi_E = E_i \, \Delta A_i \cos\theta_i = \mathbf{E}_i \cdot \Delta \mathbf{A}_i$$

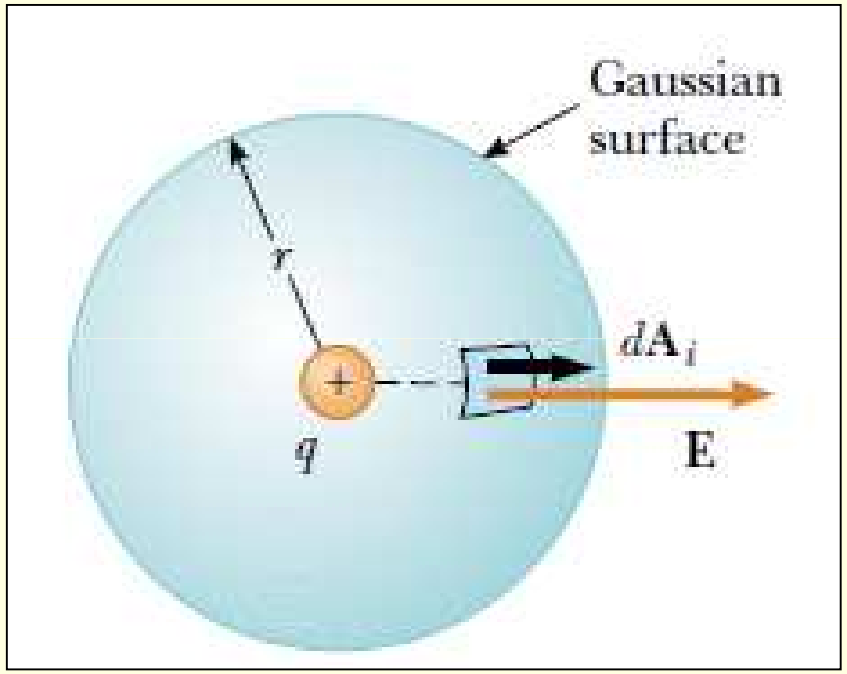
$$\Phi_E = \lim_{\Delta A_i \to 0} \sum \mathbf{E}_i \cdot \Delta \mathbf{A}_i = \int_{\text{surface}} \mathbf{E} \cdot d\mathbf{A}$$

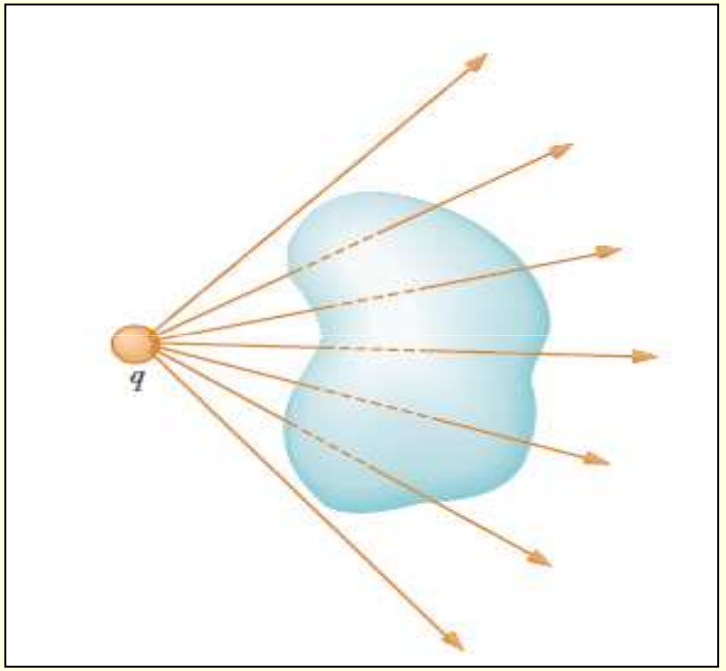
Fluxo elétrico através de uma superfície fechada



$$\Phi_E = \oint \mathbf{E} \cdot d\mathbf{A} = \oint E_n \, dA$$

Lei de Ostrogradsky Gauss

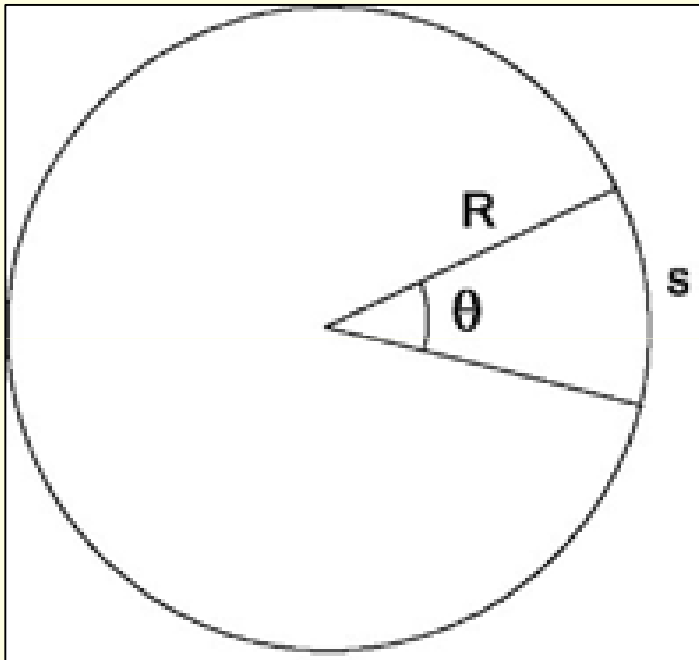




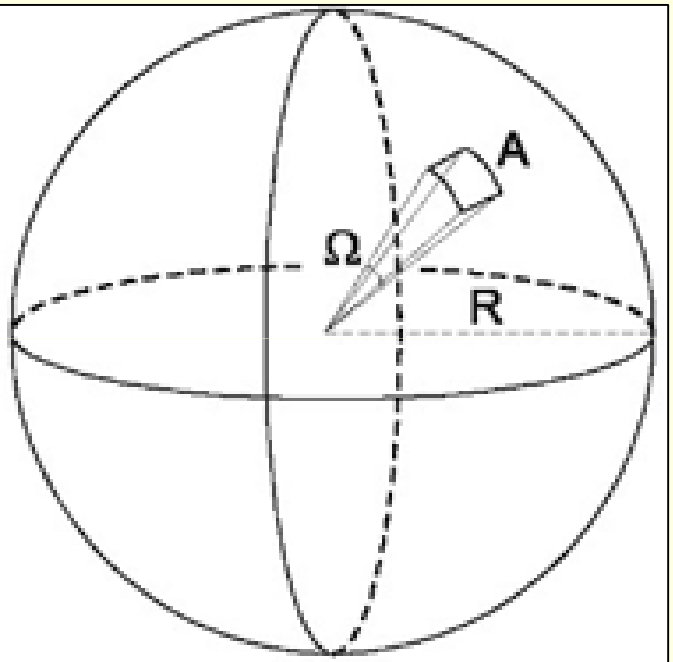
$$\Phi_E = \oint \mathbf{E} \cdot d\mathbf{A} = \frac{q_{in}}{\epsilon_0}$$

$\Phi_E = 0$

Definição de radiano e steradiano

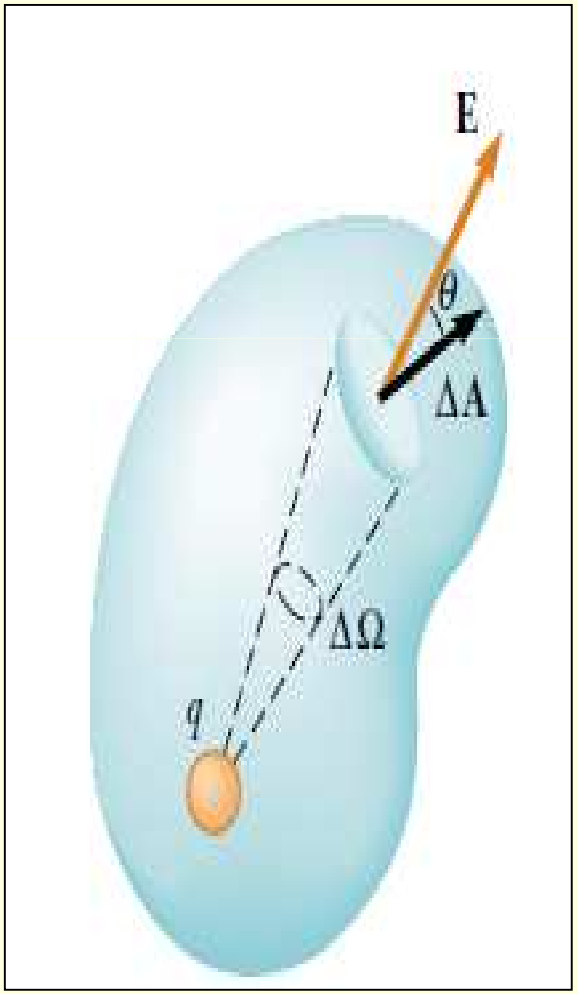


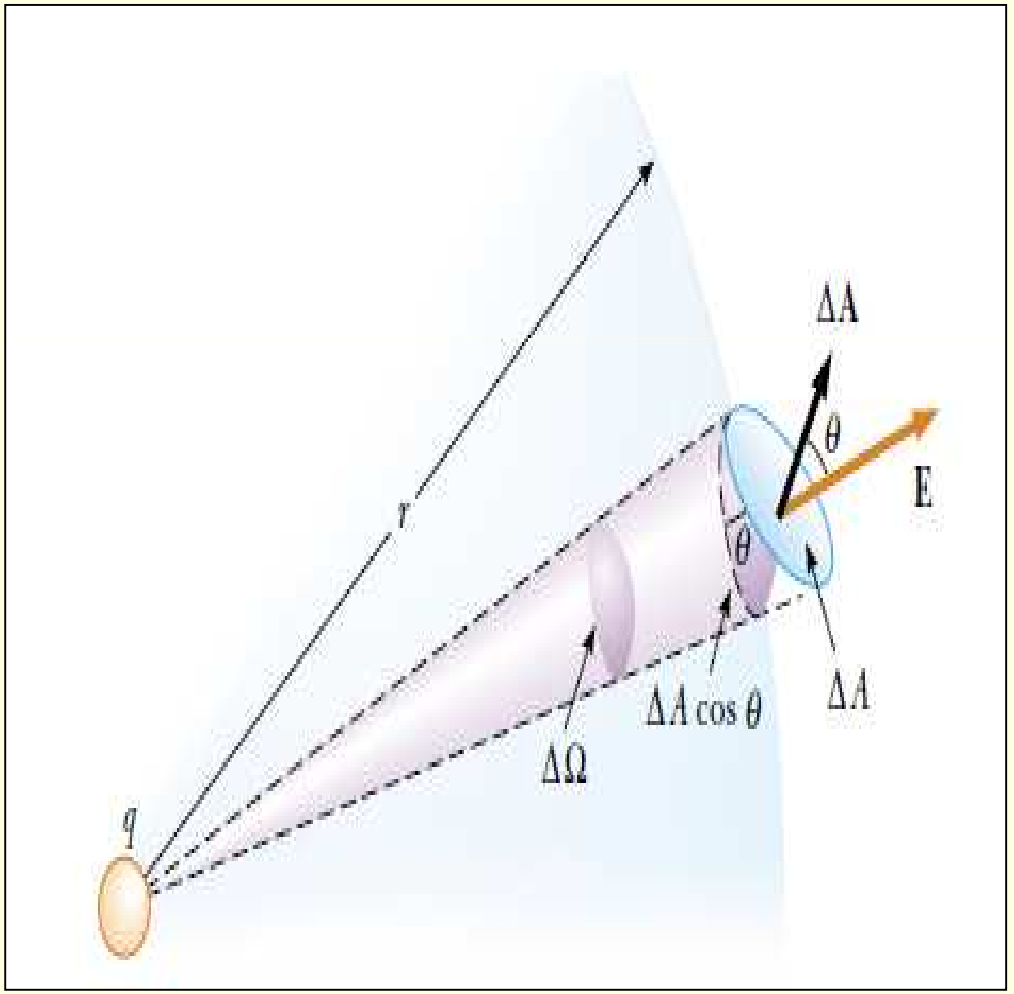
$$\theta = \frac{s}{R} \quad \text{radians}$$



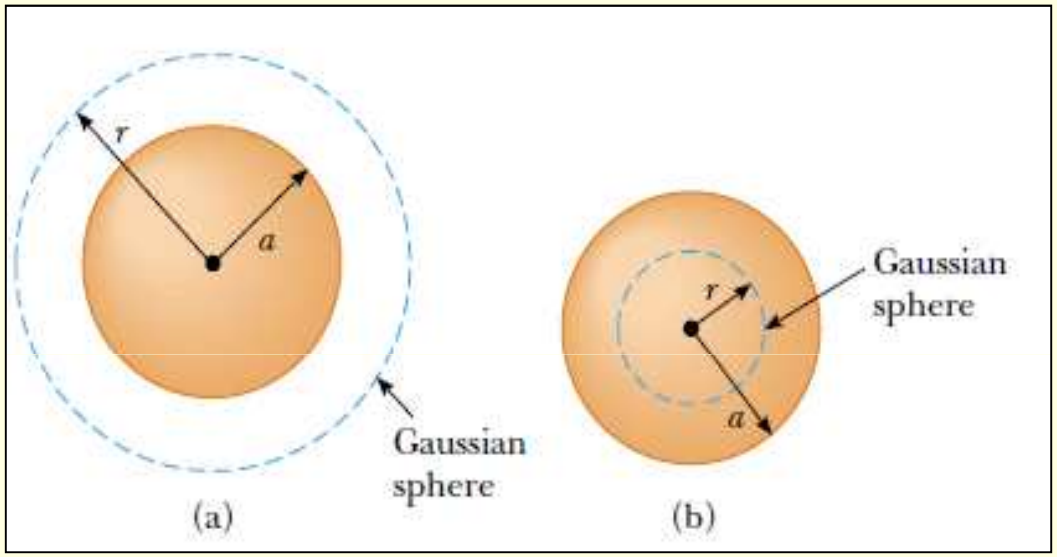
$$\Omega = \frac{A}{R^2} \quad \text{steradians (sr)}$$

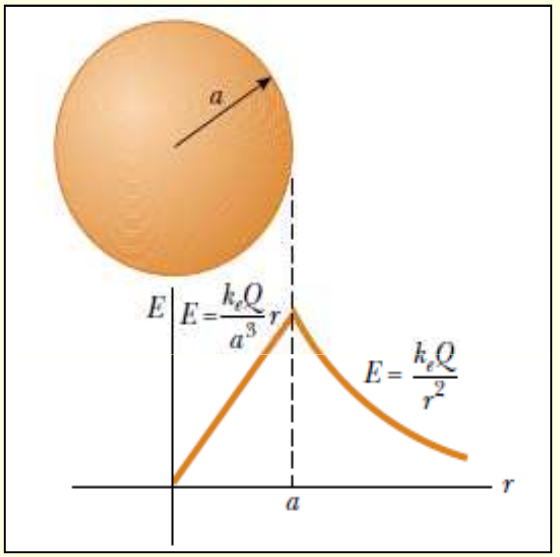
Dedução matemática da lei de Gauss



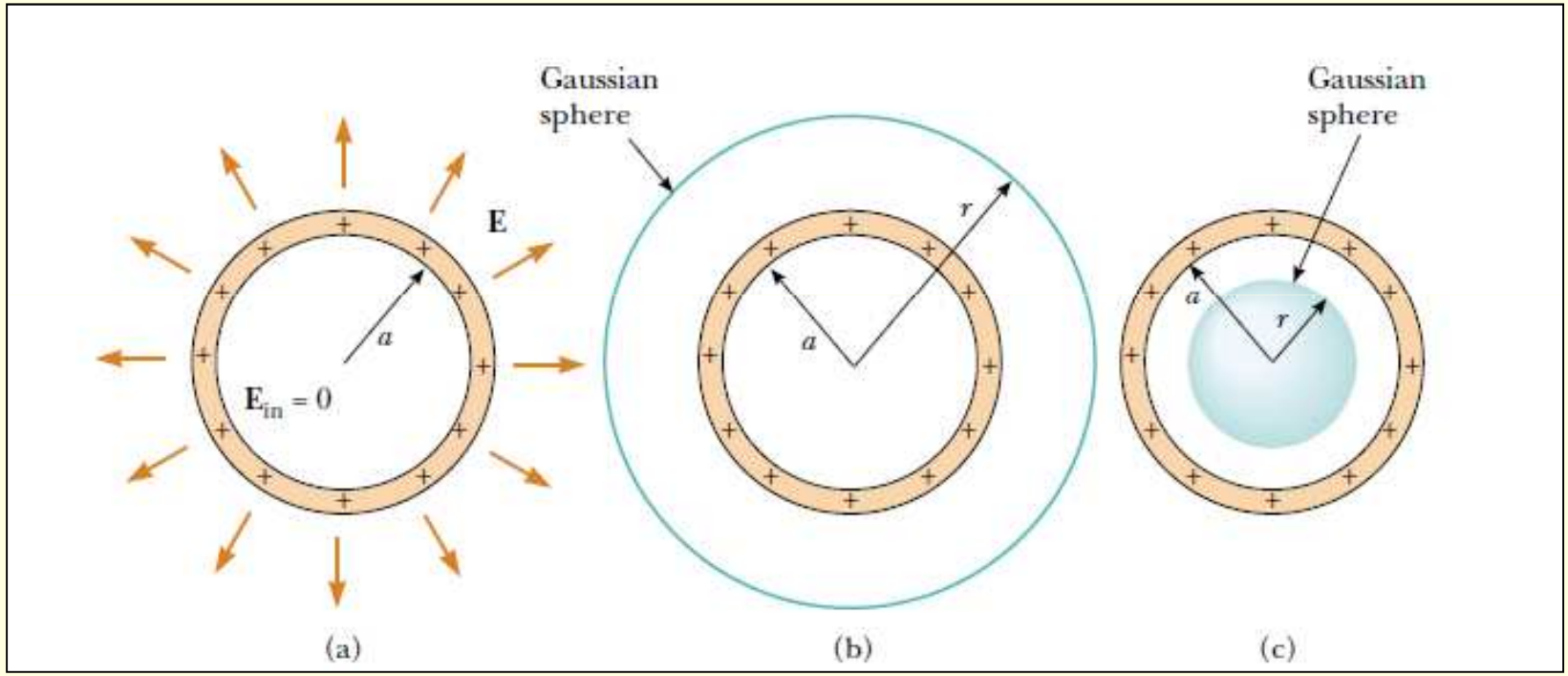


Exemplo de simetria esférica

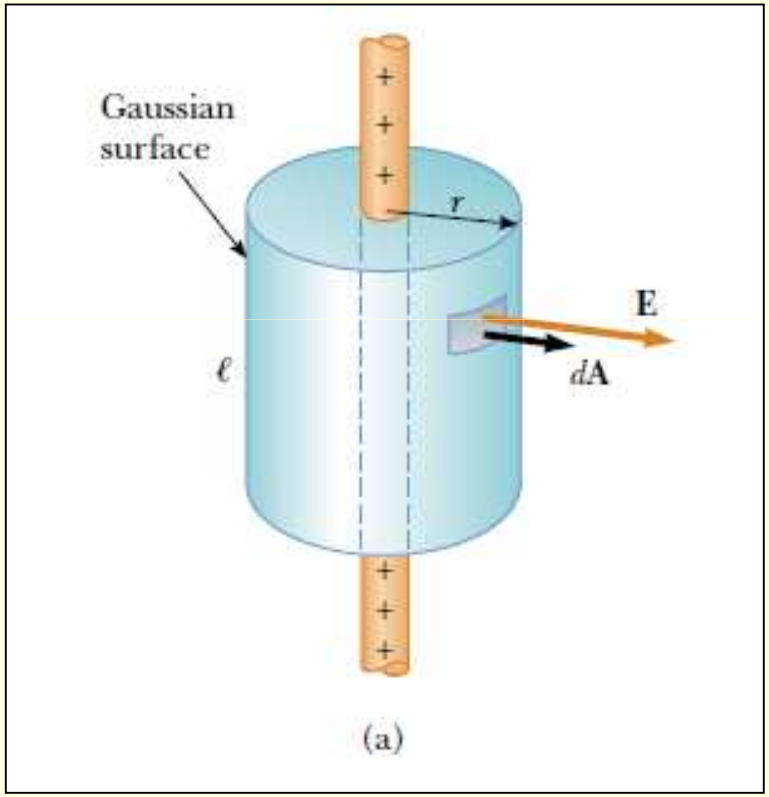


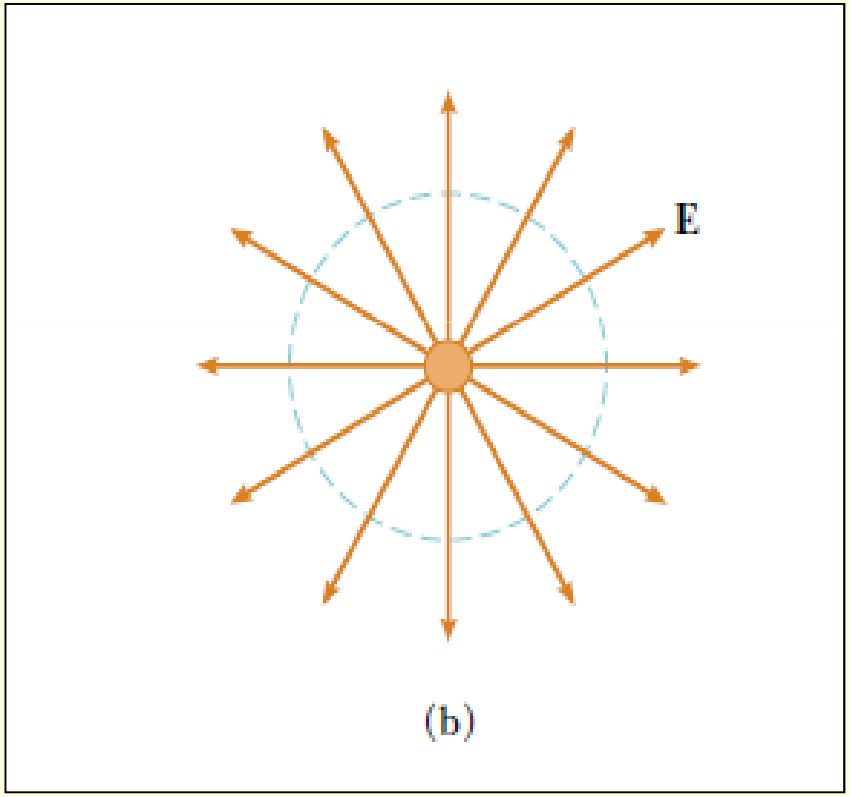


Exemplo de simetria esférica

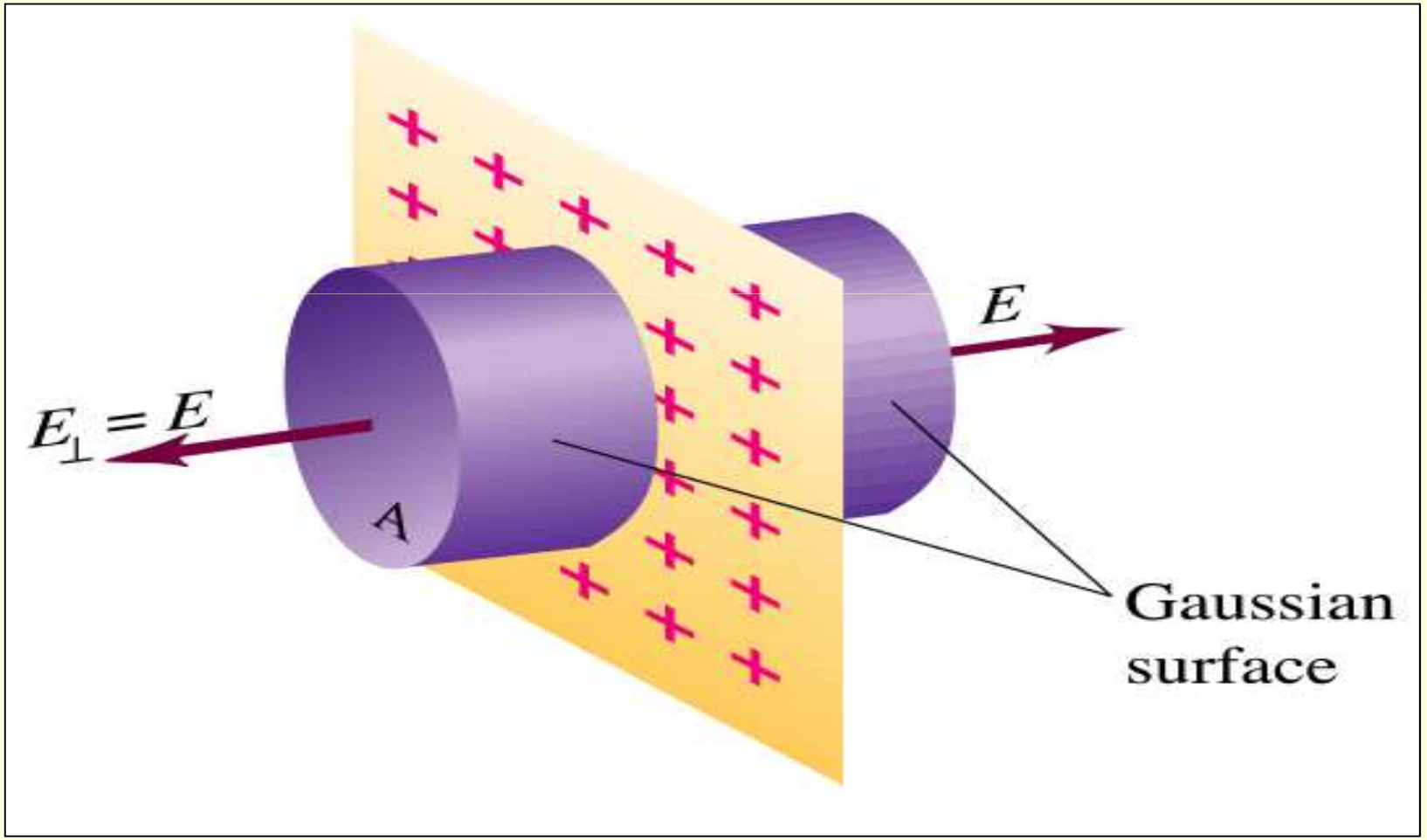


Exemplo de simetria cilíndrica

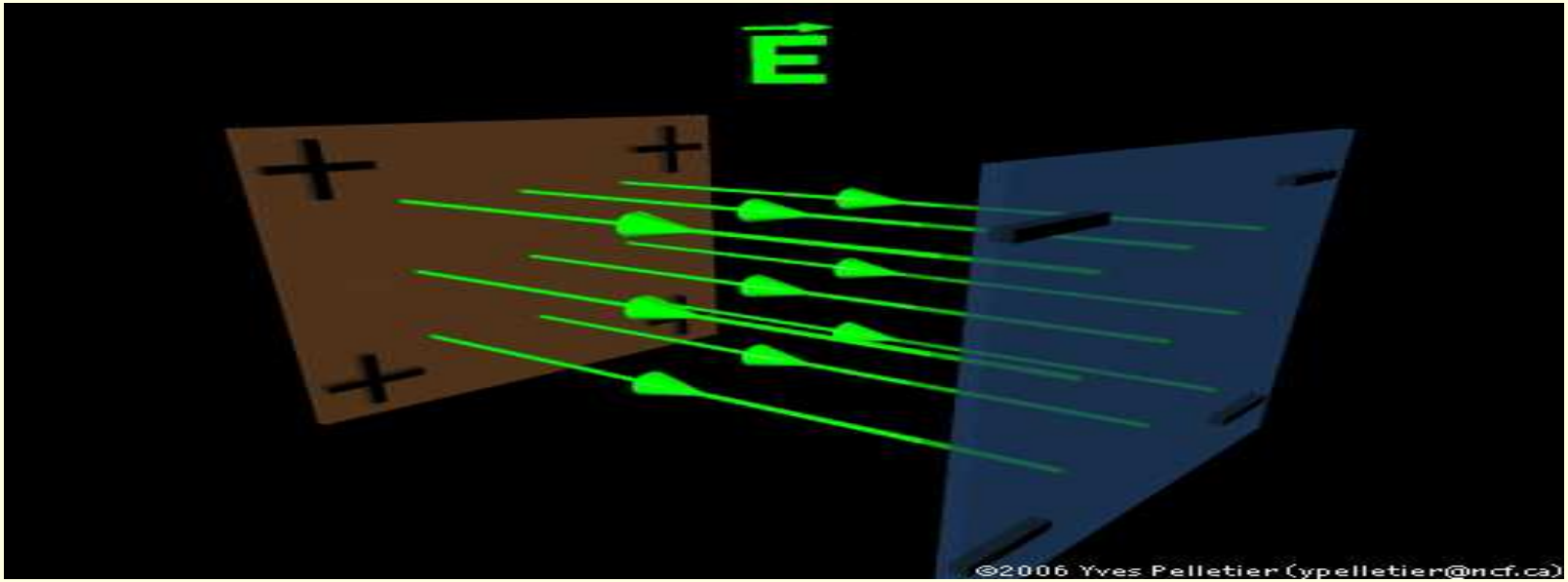


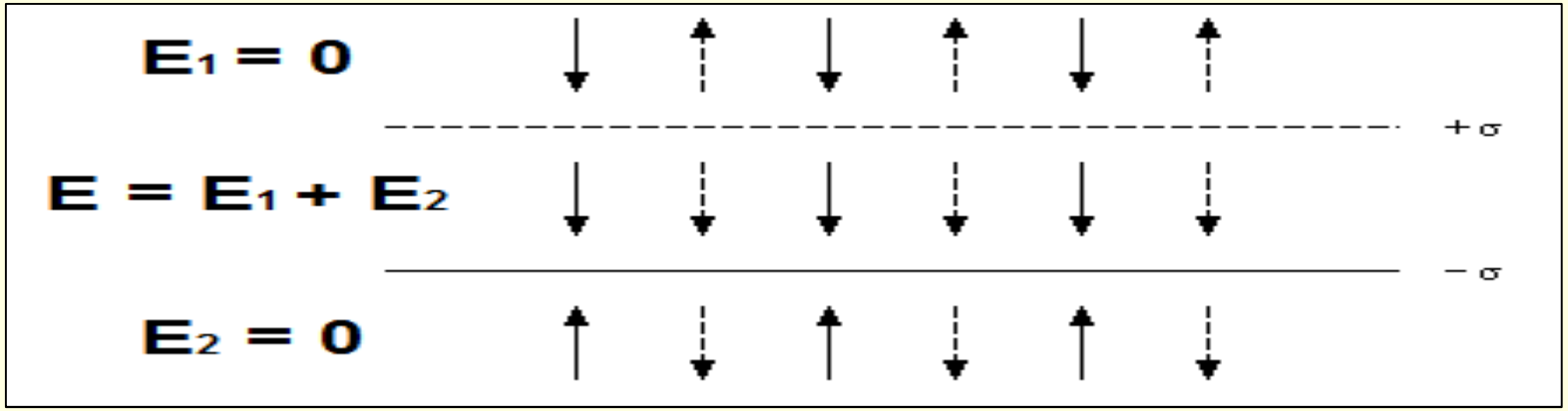


Exemplo de simetria plana

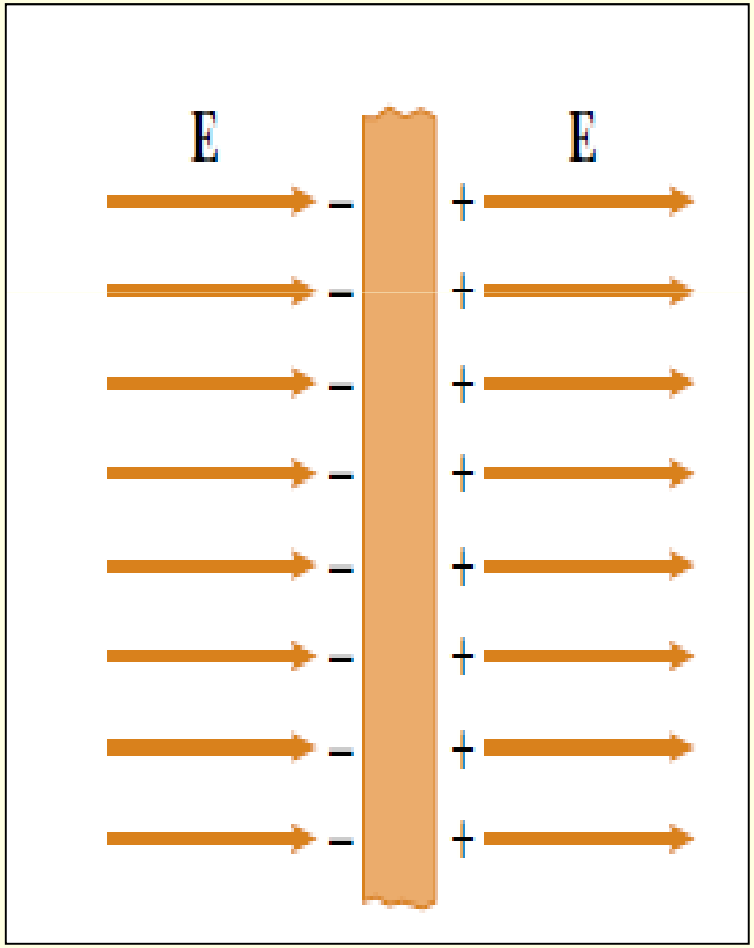


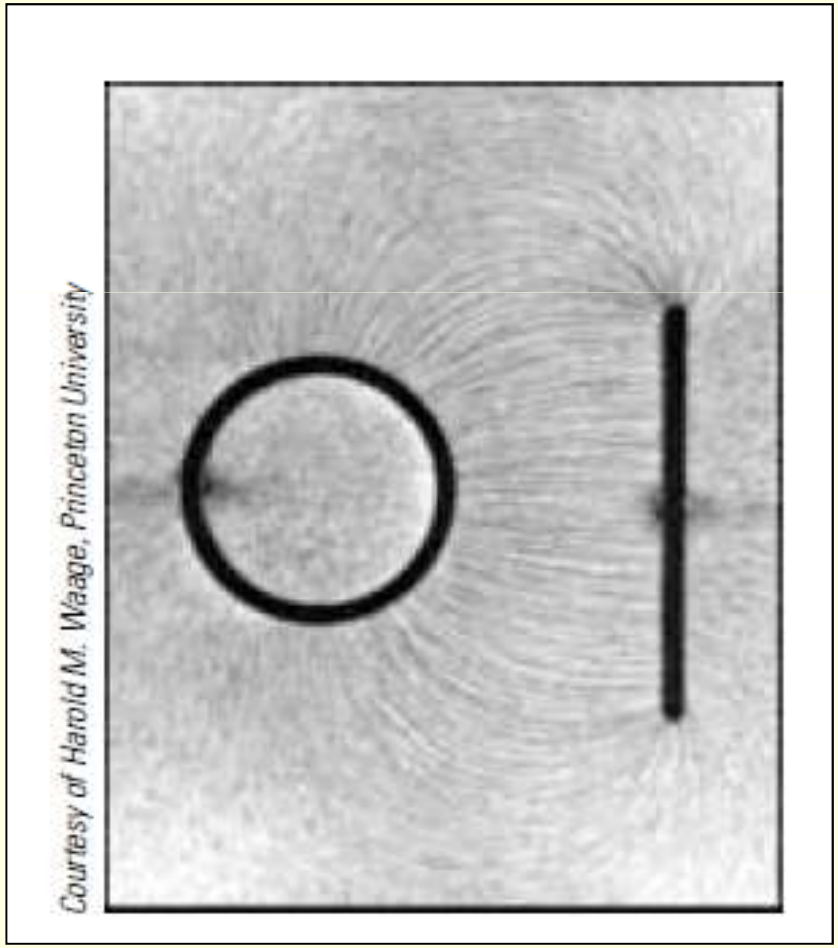
Exemplo de simetria plana (placas paralelas)



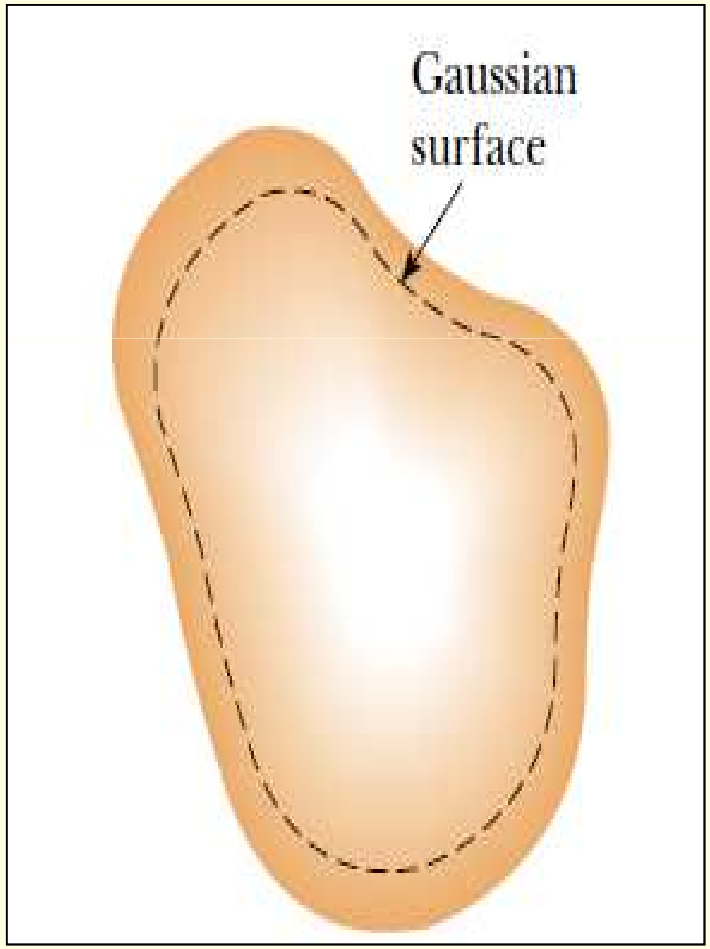


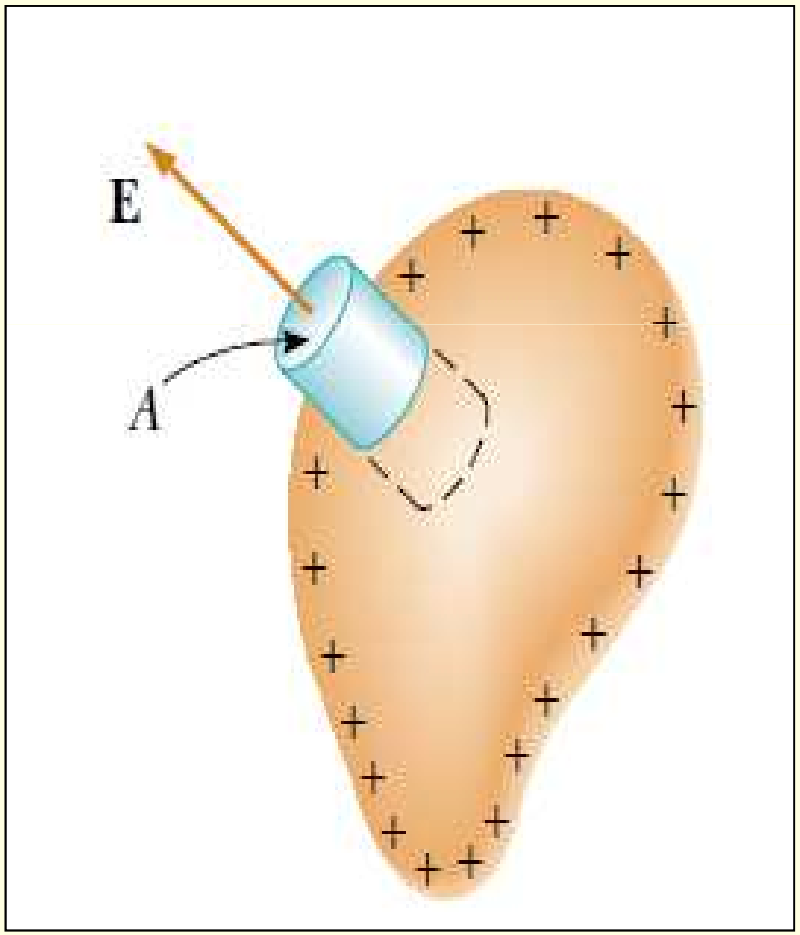
Campo elétrico no interior de um condutor



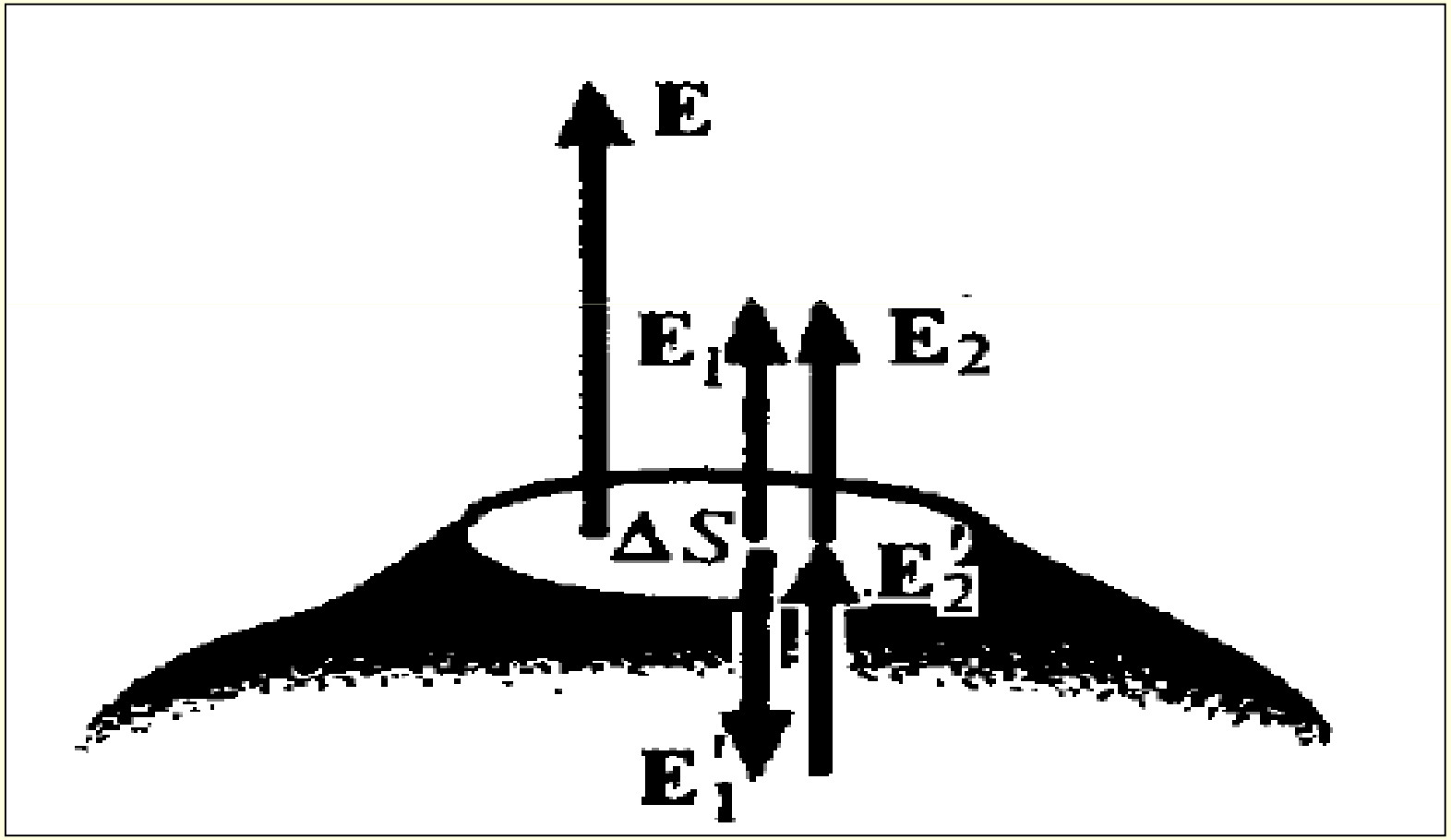


Distribuição das cargas na supefície dos condutores e direção do campo E

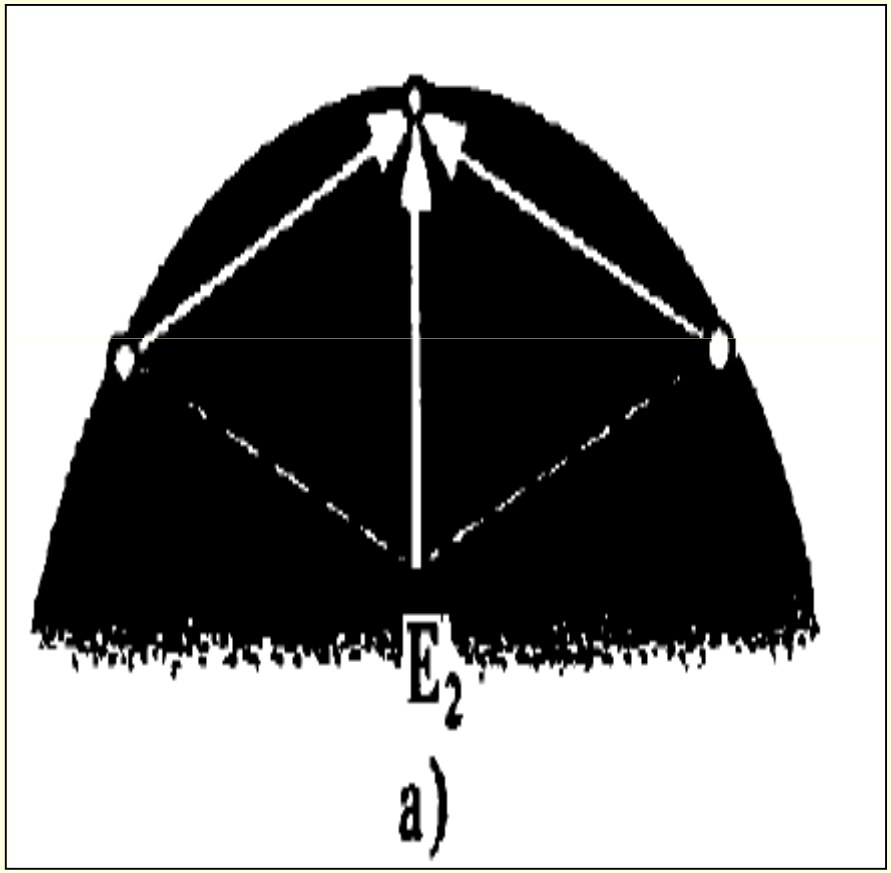


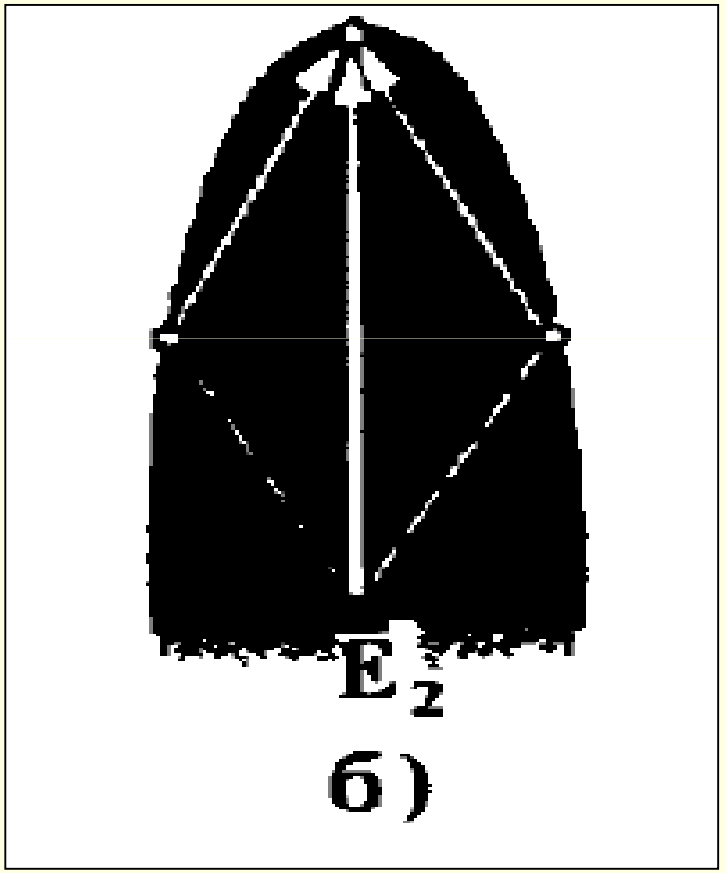


Formação do campo elétrico na superfície de um condutor

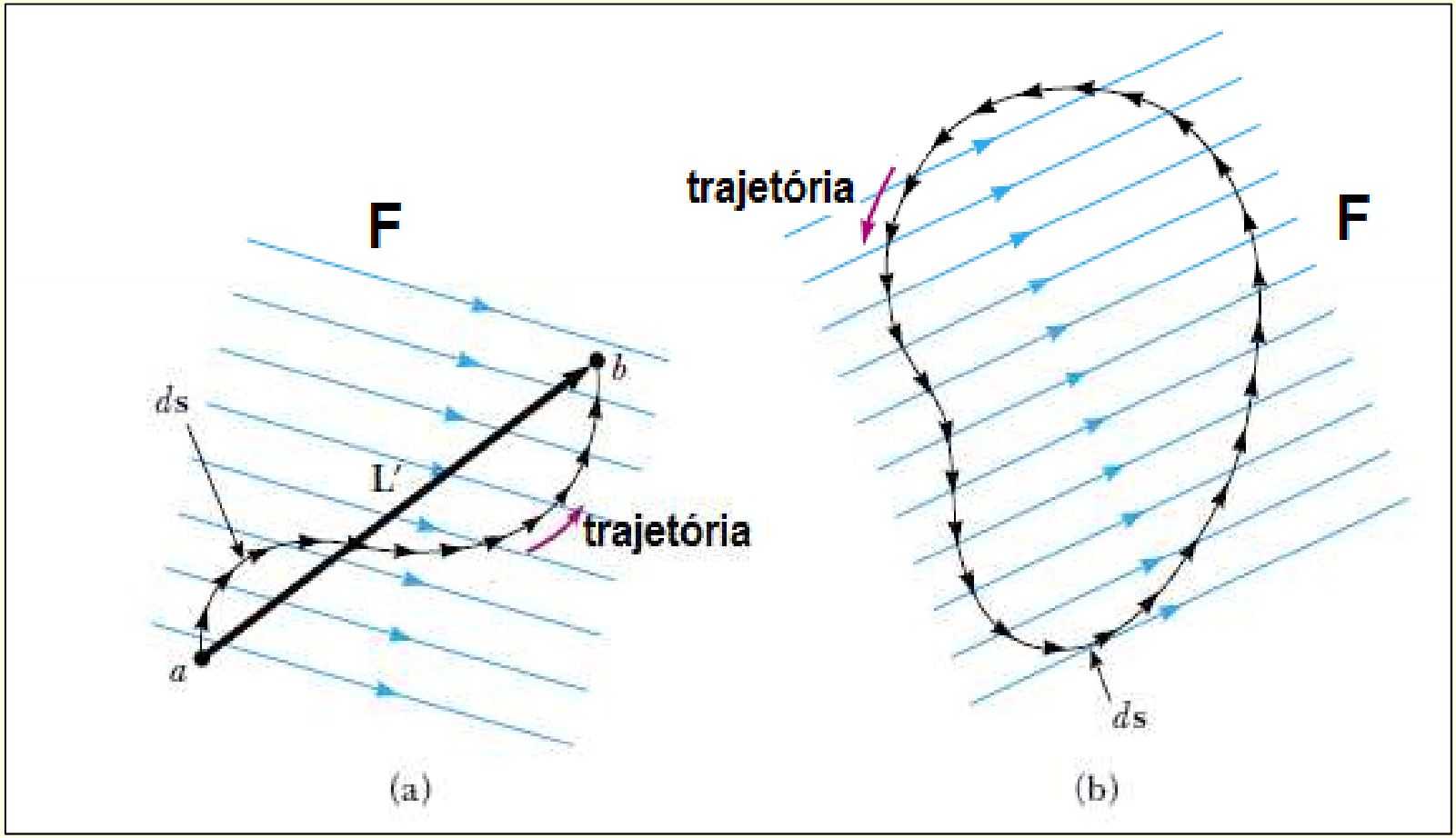


Efeito das pontas

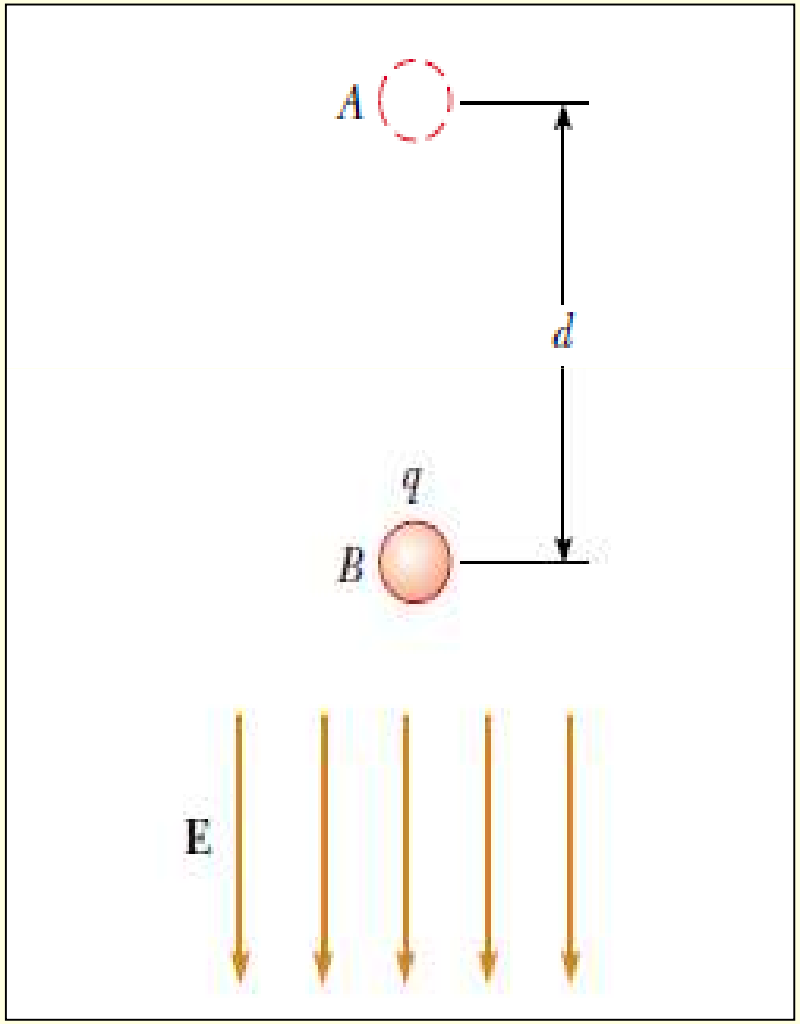


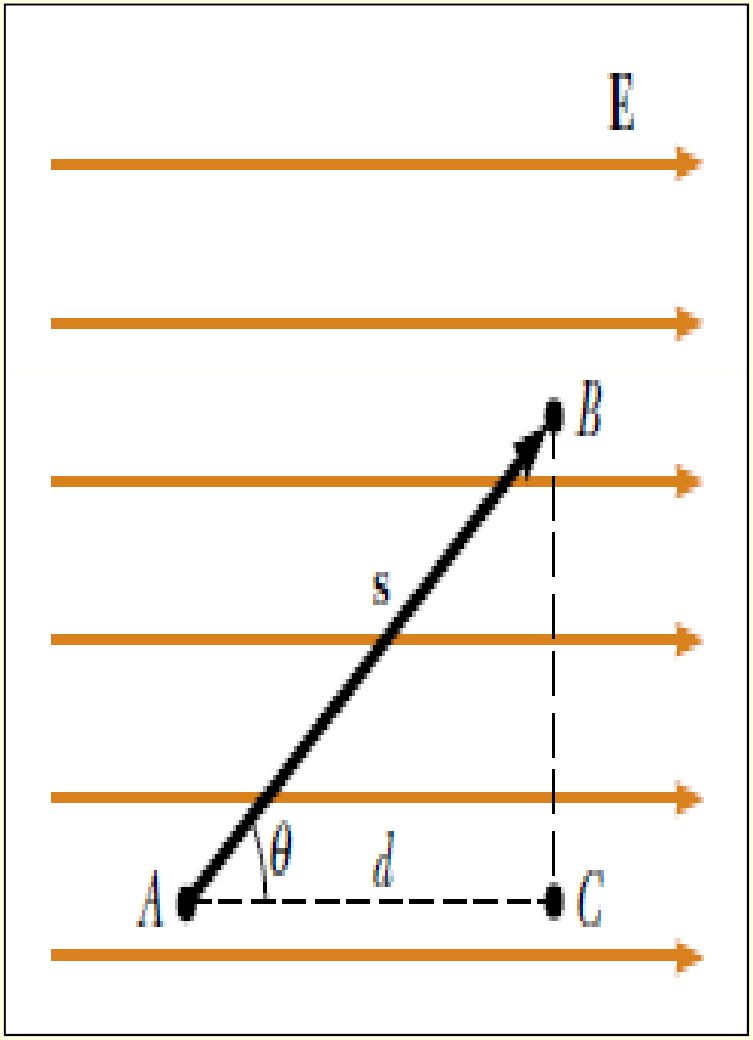


Integral de linha



Diferença de potencial em um campo elétrico uniforme





Potencial elétrico de cargas pontuais