PHYS102 - Electric Fields
Dipole Moments
Field Lines

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January 22, 2007

Point Particles E-Field

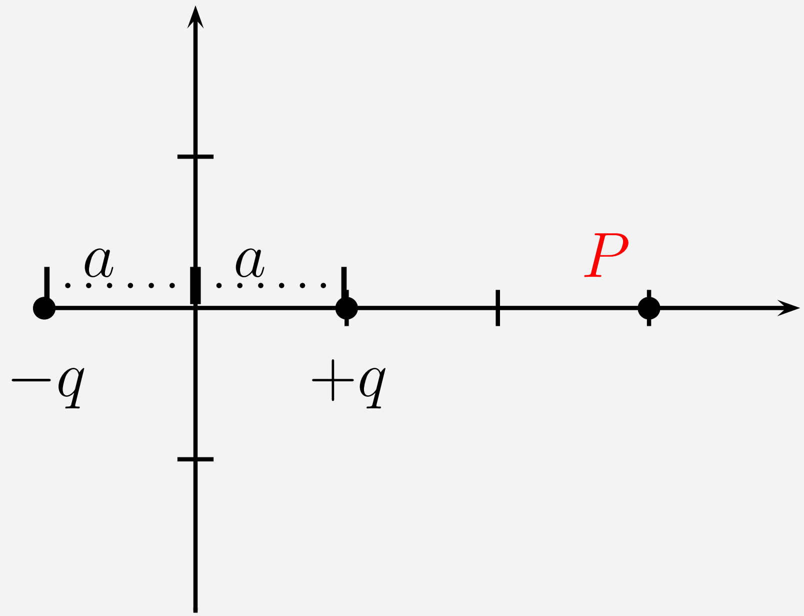
Superposition Principle

We have shown in the previous lecture that the electric field generated by a point particle of charge q at a position P in space.

$$\vec{\mathbf{E}}_{iP} = \frac{k\,q}{r_{iP}^2}\hat{r}_{iP}$$

Since the electric field is defined in terms of *force* and we know forces obey the superposition principle, electric fields also obey the superposition principle.

Example Problem #1



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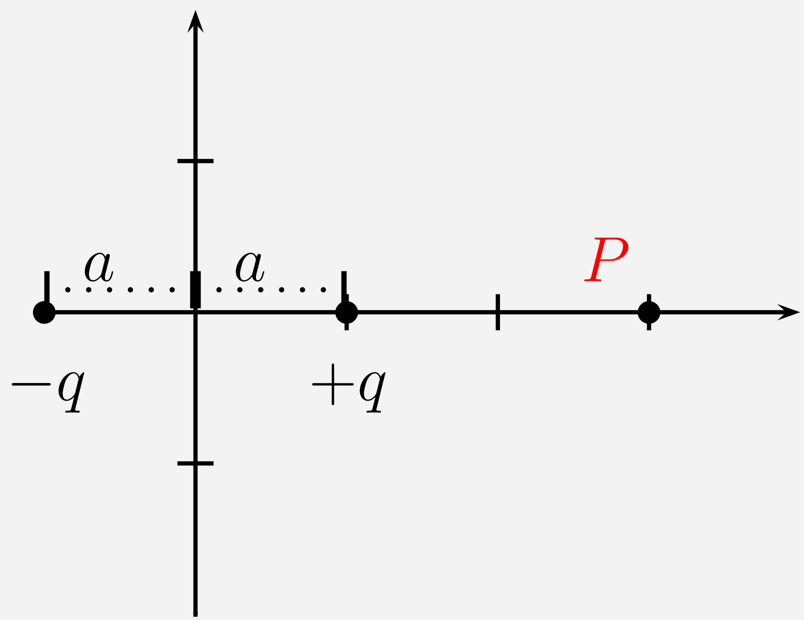

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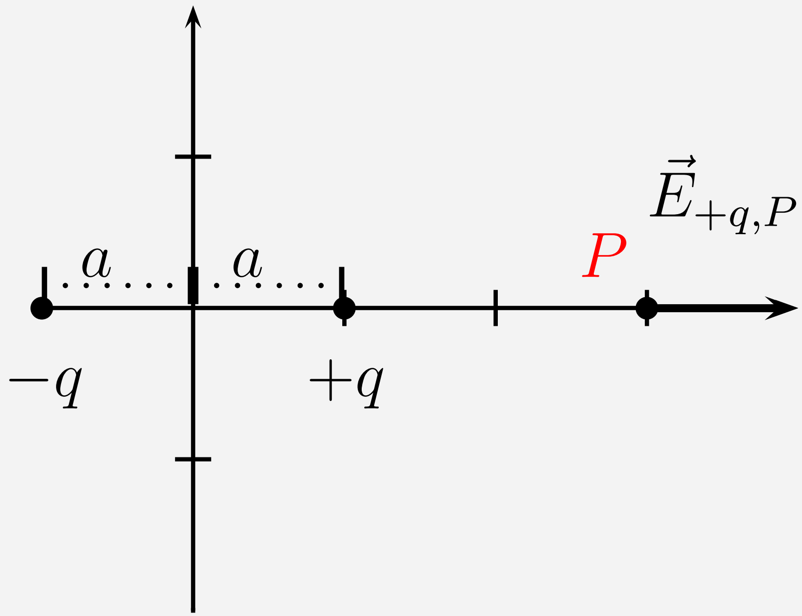

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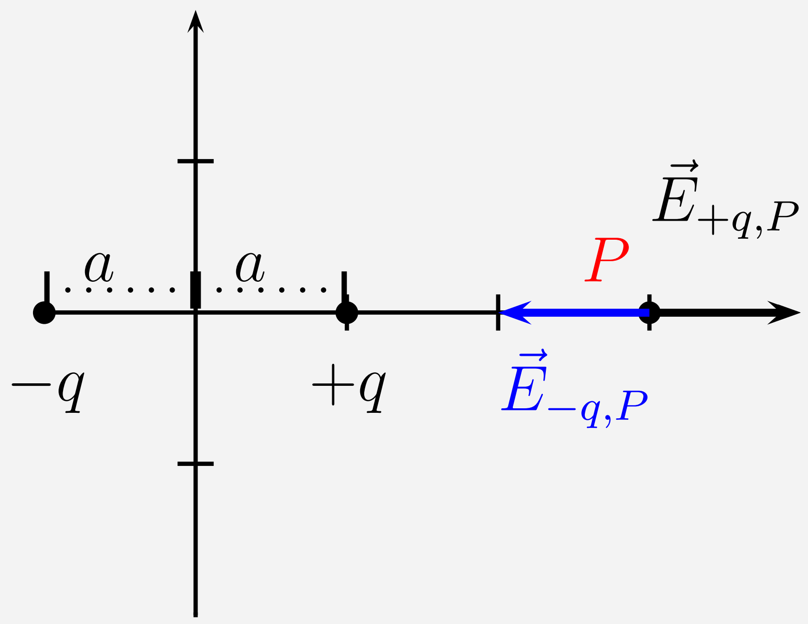

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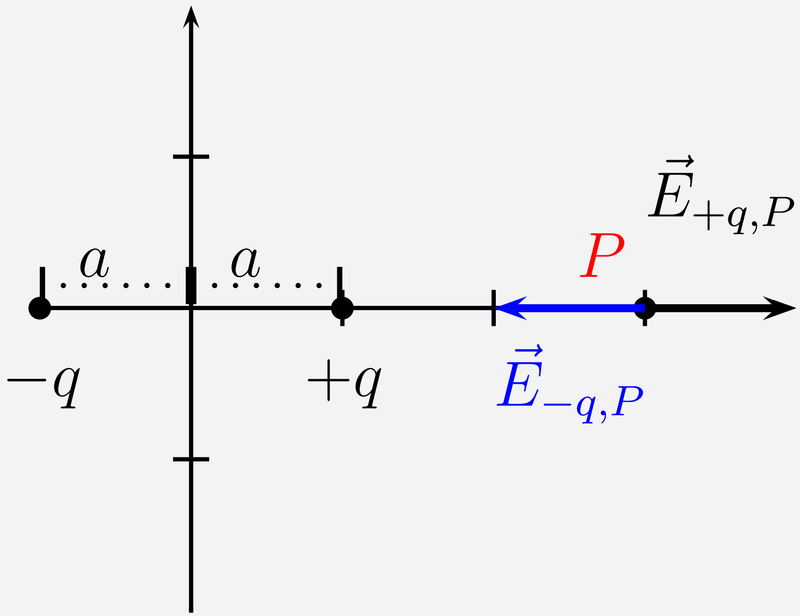

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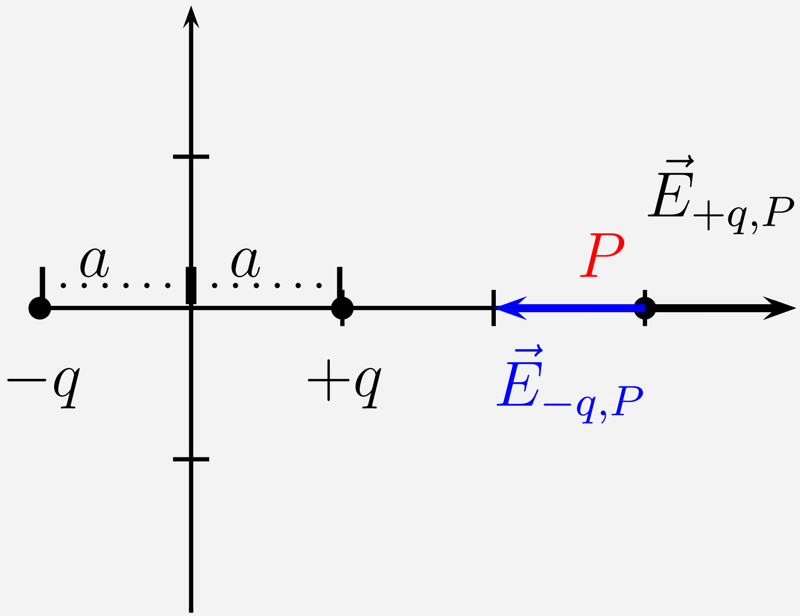

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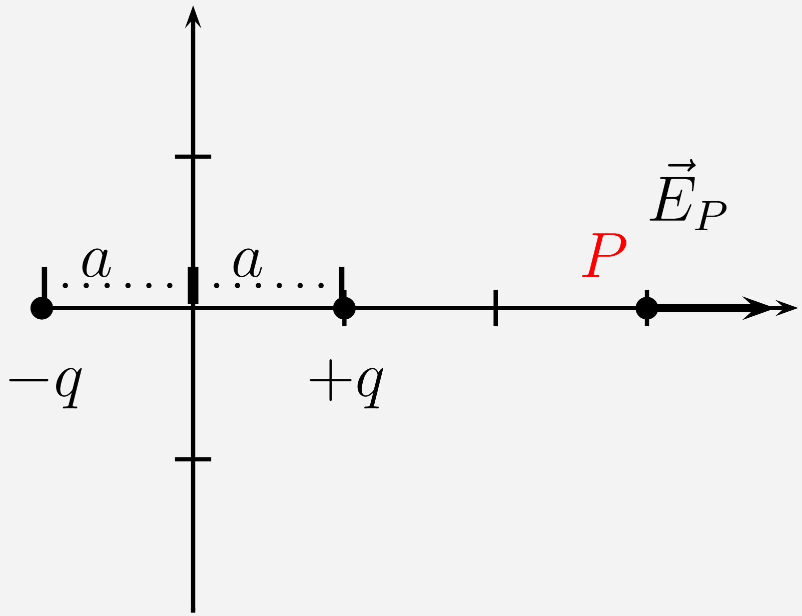

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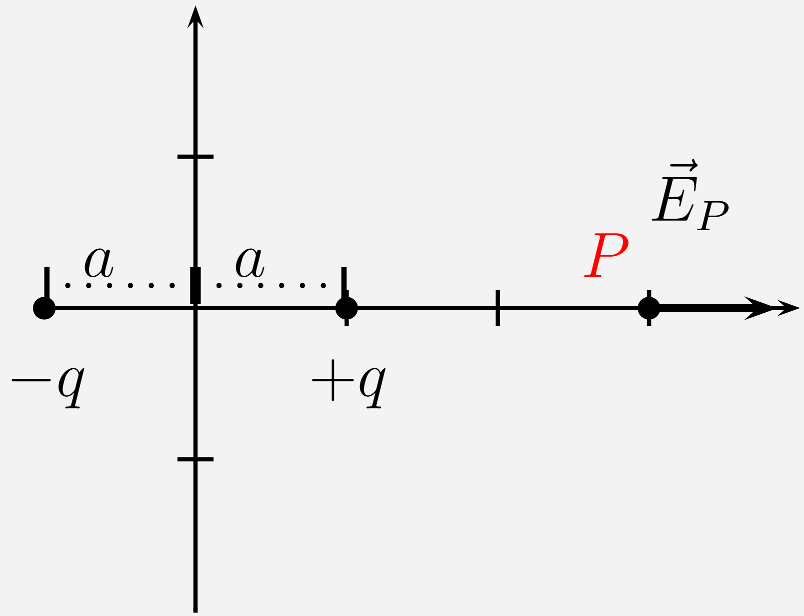

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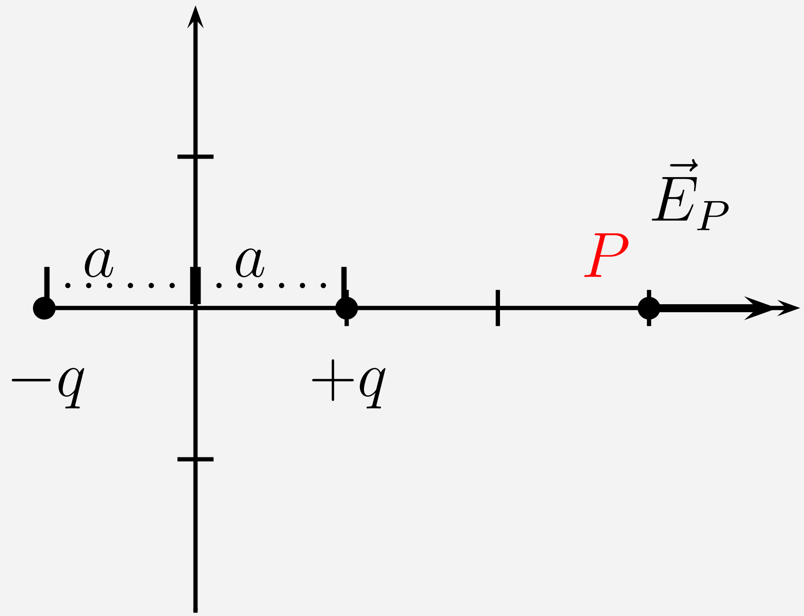

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$$E_{x,P} \approx \frac{4\,k\,q\,a}{x^3}$$

Dipoles

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    where $\vec{L}$ is the separation vector pointing from the negative charge to the positive charge.

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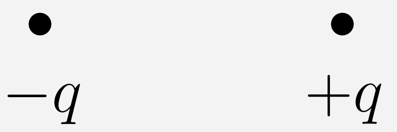

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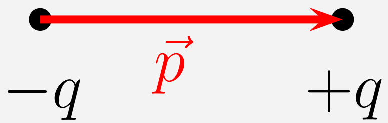

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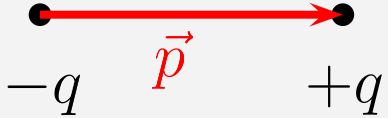

This would be the dipole moment (for the example covered in lecture).

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  - You may be able to simplify your life:
    - Treat collection of charged particles as a "spread" of continuous charge.

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Board Time

Let's move to the board for an example.

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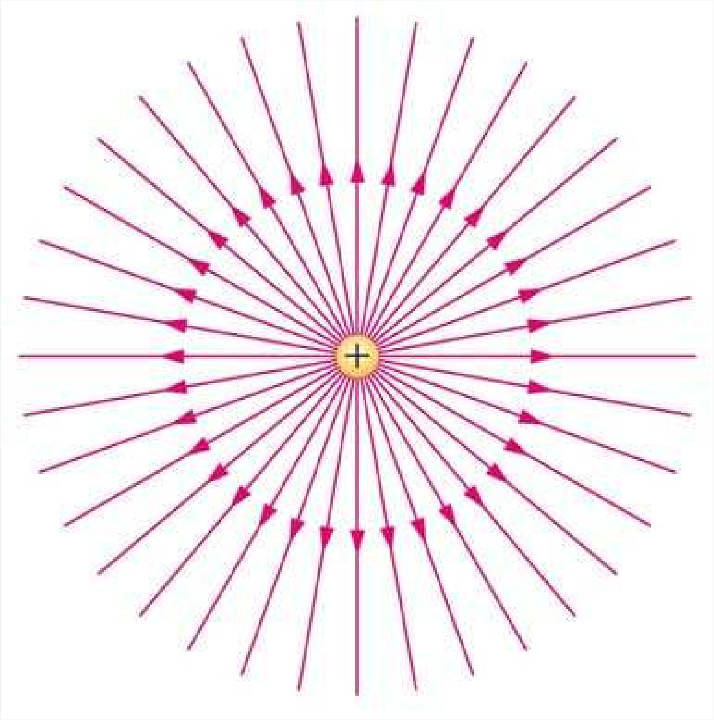
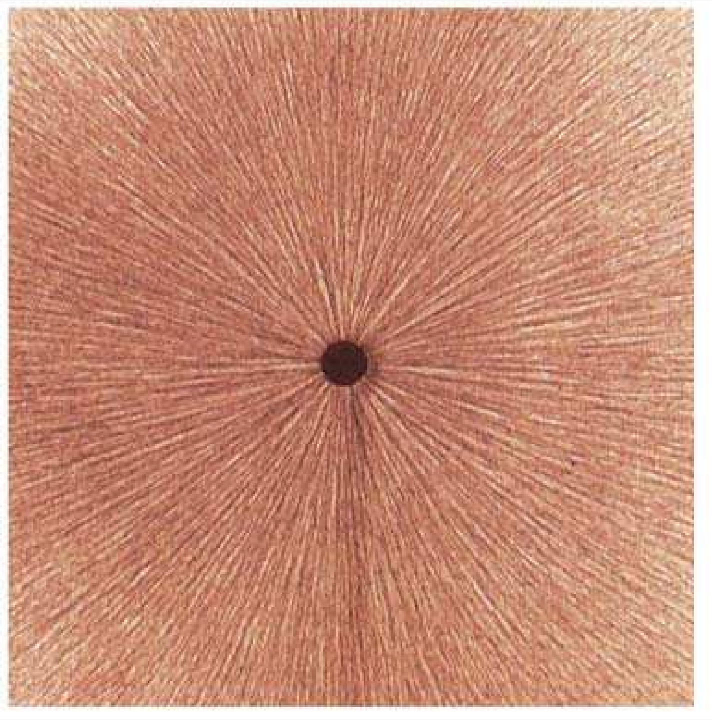
- Electric field lines do not cross.

Field Line Example +

Field line representation of a positive charge.





Field Line Example -/+

Field line representation of a negative and positive charge.