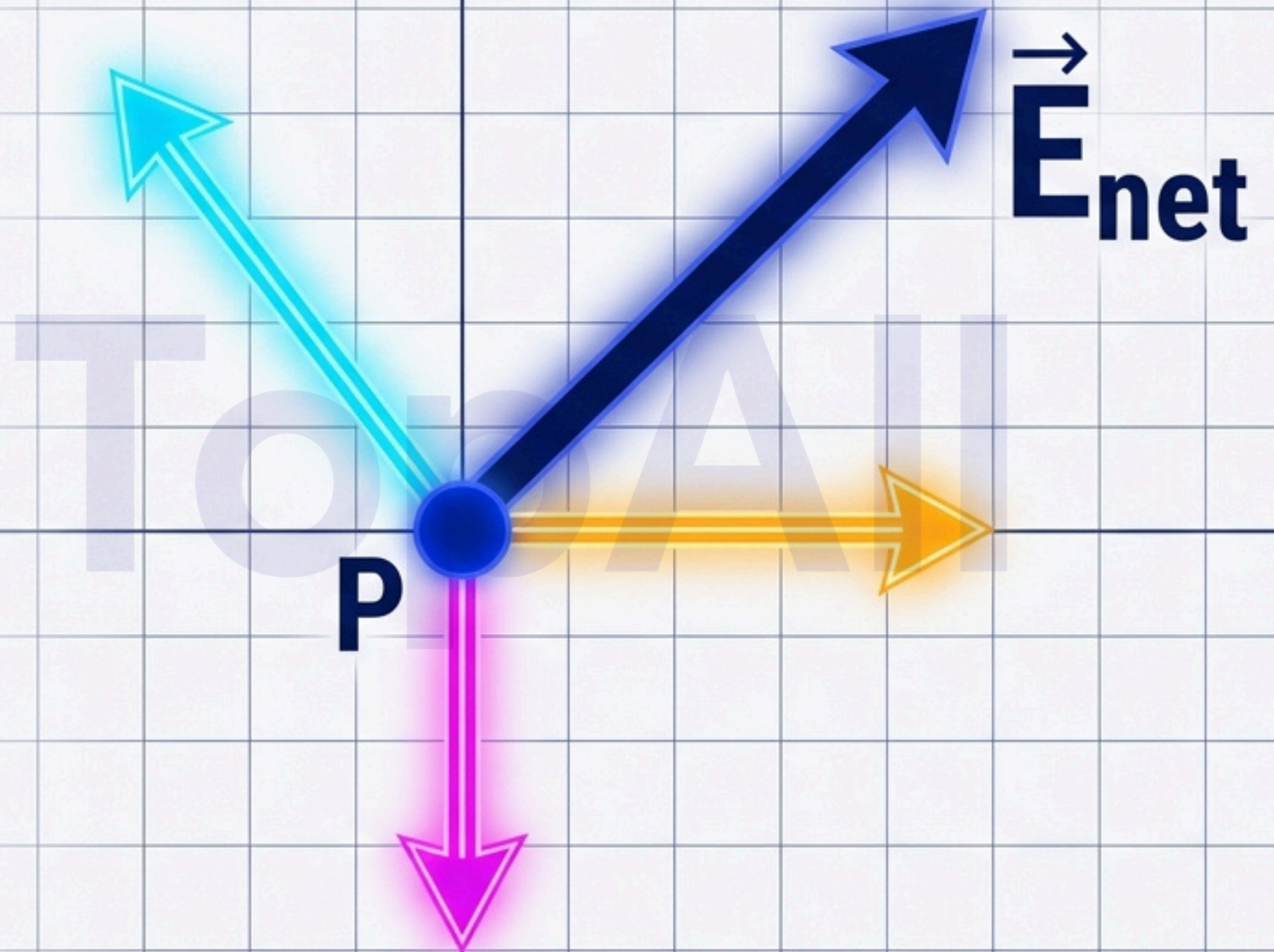


## Module 1.7.1

# Electric Field Due to a System of Charges

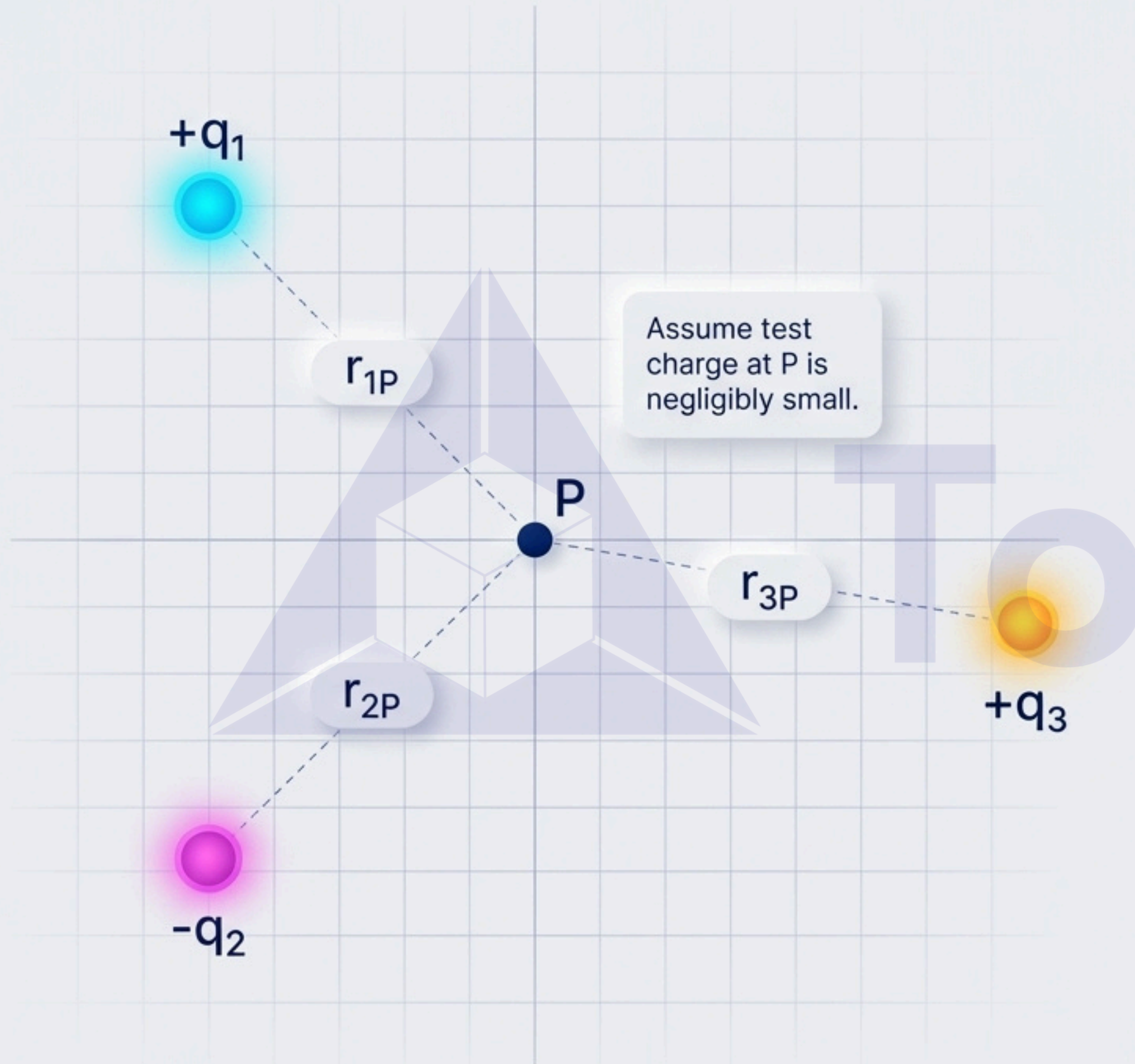
How multiple individual fields combine to define a single point in space.



## One Point, Many Sources

Point P does not exist in isolation. Its electrical environment is the simultaneous result of all surrounding source charges in the system.

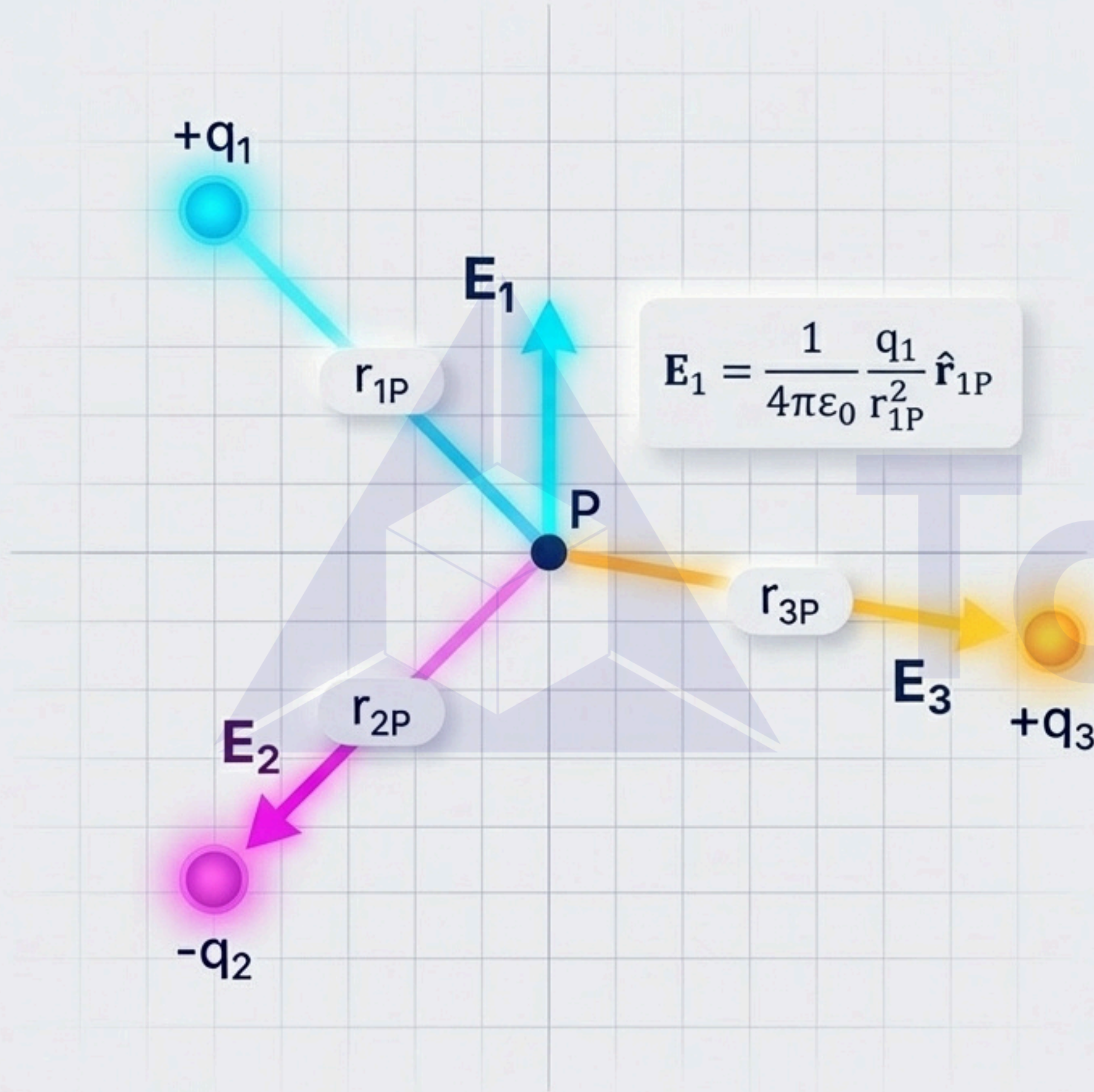
To find the total electric field at P, we must first look at the field created by each charge individually.



## Individual Field Vectors

According to the Principle of Superposition, each charge creates its own independent electric field at point P.

**CAUTION:** The presence of  $q_2$  does NOT weaken, bend, or block the field created by  $q_1$ . Each field acts as if the other charges don't exist.





# You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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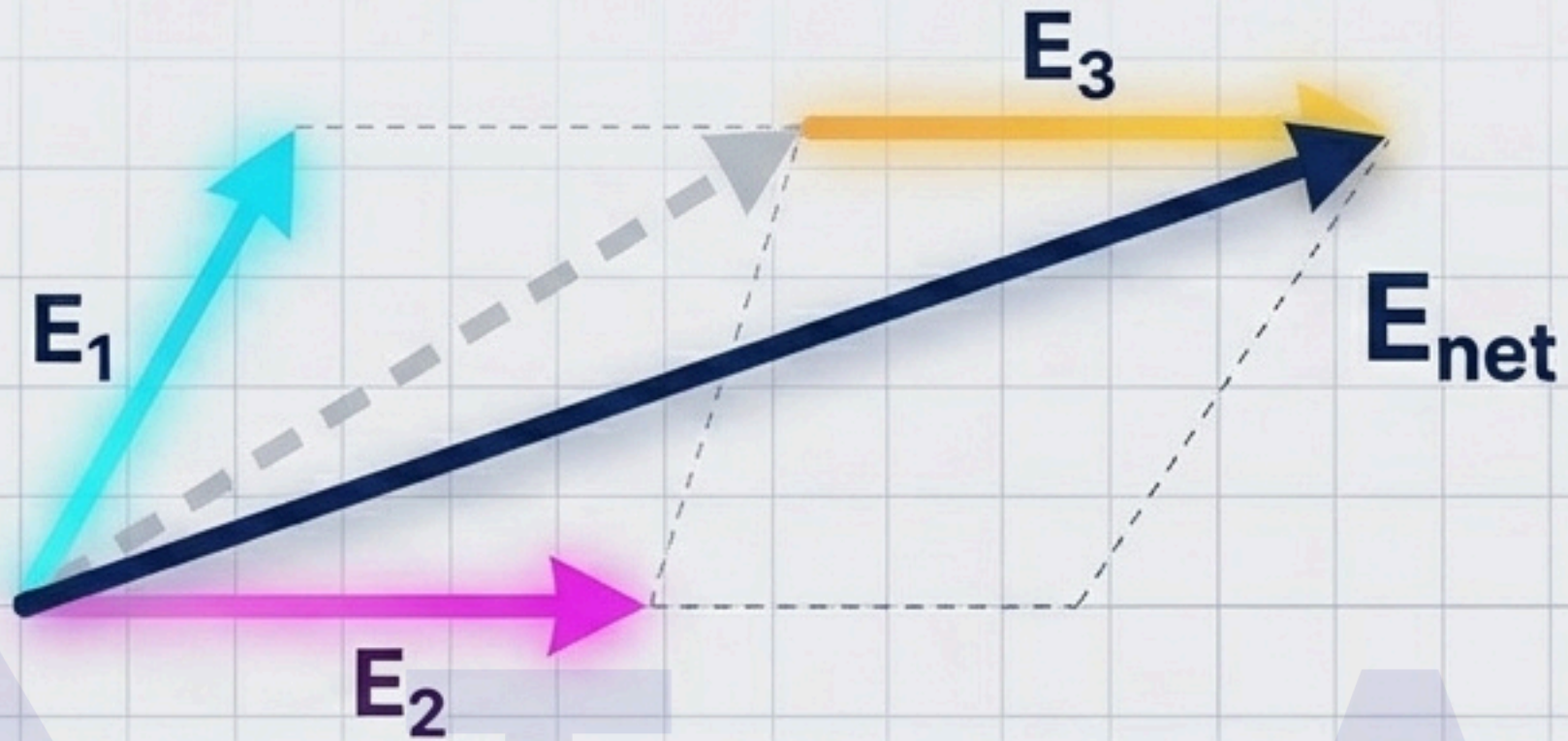
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# Vector Sum



$$\mathbf{E} = \mathbf{E}_1 + \mathbf{E}_2 + \dots + \mathbf{E}_n$$

$$\mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \sum \frac{q_i}{r_{iP}^2} \hat{\mathbf{r}}_{iP}$$

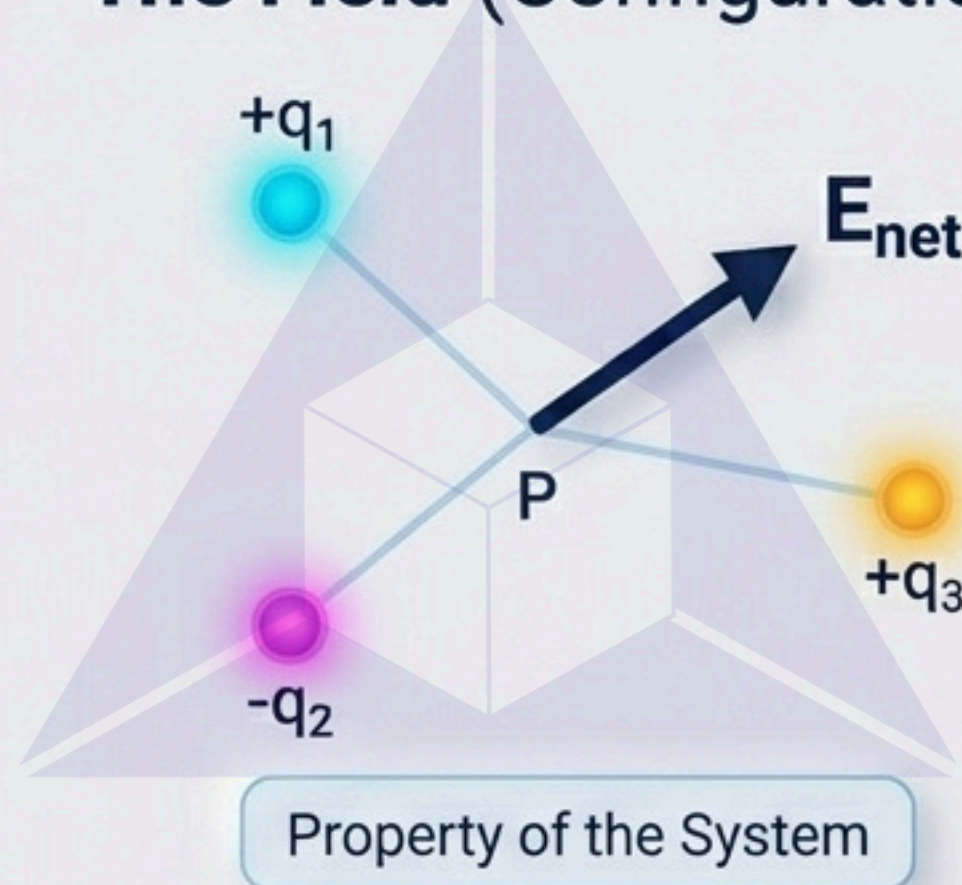
Vector sum of all 'n' fields

Source charge magnitude & sign

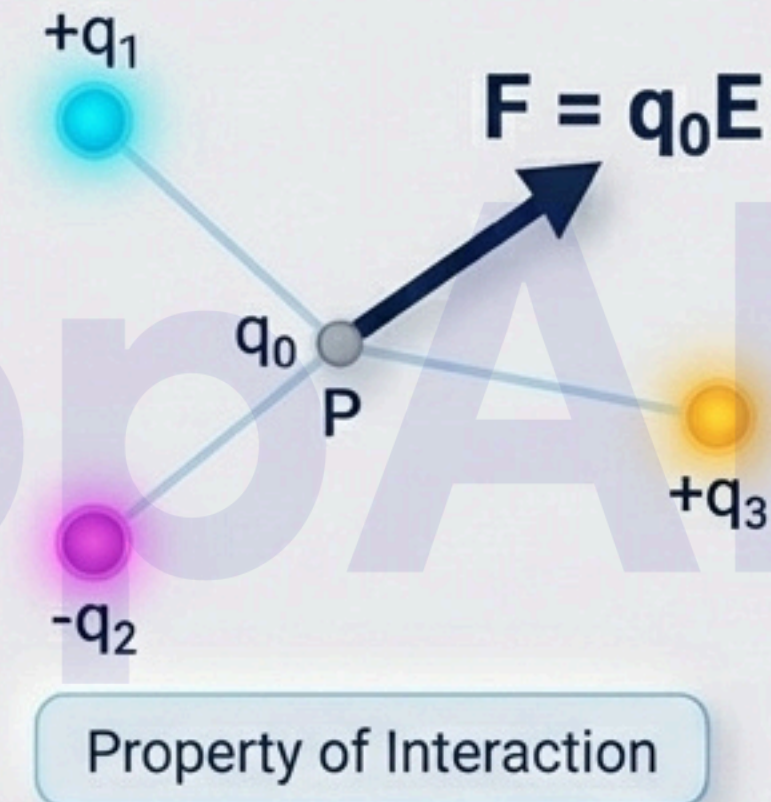
Direction from source to point P

# Why This Matters

## The Field (Configuration)



## The Force (Interaction)



The electric field characterizes the electrical environment. It is entirely independent of the test charge  $q_0$  used to measure it. The field exists even if  $P$  is empty.

# Summary + Practice

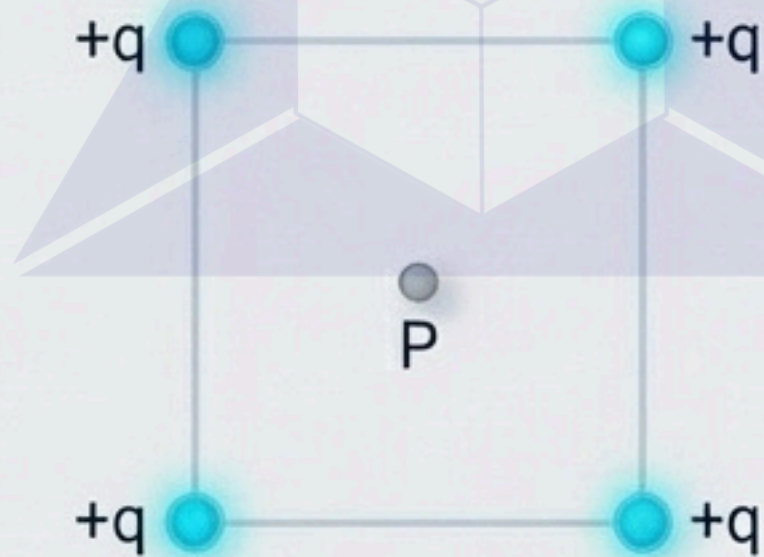
1. **Superposition:** Charges act independently.

2. **Vector Addition:** Use parallelogram law for  $\mathbf{E}_{\text{net}}$ .

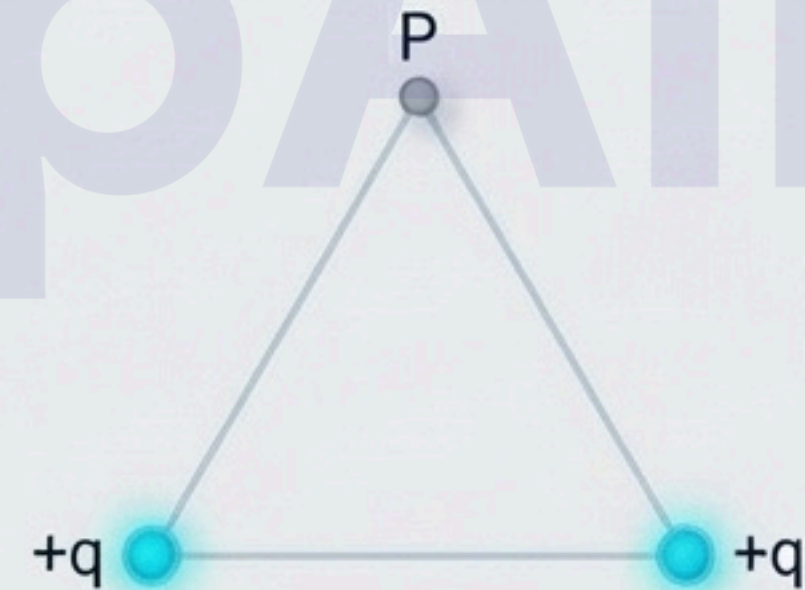
3. **Independence:** Field ignores the test charge.

**Point in the direction of the net field at P:**

**Square,** equal positive charges.



**Base of triangle,** equal positive charges.



Next: Physical Significance of Electric Field →



# You've Learned the Theory.

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