Уравнение непрерывности

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Эл-ка

$\frac{\partial}{\partial t}\int \rho dV$ – изм-е заряда в объеме

$$\frac{\partial}{\partial t}\int_V \rho dV = -\oint \bar{j}\, d\bar{S}$$

$$= -\int \mathrm{div}\, \bar{j}\, dV$$

$$\frac{\partial}{\partial t}\int \rho dV = -\int \mathrm{div}\, \bar{j}\, dV$$

$$\int_V \left(\mathrm{div}\, \bar{j} + \frac{\partial \rho}{\partial t}\right) dV = 0$$

$$\mathrm{div}\, \bar{j} + \frac{\partial \rho}{\partial t} = 0$$

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e-точечное; если взять e как распределенное по ρdV и $\int \rho dV$

сумма всех зарядов в dV и V

$$\rho = \sum_\alpha e_\alpha \delta(\bar{r} - \bar{r}_\alpha)$$

$de = \rho dV \;\Big|\; dx^\mu$

$de\, dx^\mu = \rho dV dx^\mu = \rho dV dt \frac{dx^\mu}{dt} =$

$= dV dt\, \rho \frac{dx^\mu}{dt} =$

$= dV dt\, j^\mu =$

$= dV dt\, \rho(c, \bar{v}_x, \bar{v}_y, \bar{v}_z) =$

$= dV dt\, (\rho c, \bar{j}_x, \bar{j}_y, \bar{j}_z)$

$= dV dt\, (c\rho, \bar{j})$

$\bar{j} \Rightarrow \rho = e\delta(\bar{r} - \bar{r}_0)$

$= e\bar{v}\delta(\bar{r} - \bar{r}_0)$

$\frac{\partial \rho}{\partial t} = \frac{\partial \rho}{\partial \bar{r}_0}\frac{\partial \bar{r}_0}{\partial t} =$

$= -\frac{\partial \rho}{\partial \bar{r}}\bar{v} = -\mathrm{div}(\rho \bar{v})$

$\frac{\partial \rho}{\partial t} + \mathrm{div}\, \rho \bar{v} = 0 \;\Big|\; \frac{\partial x^\mu}{\partial}$

$= 0$