

Geschwindigkeit und Elementarladung

$$E_E = \frac{1}{4\pi\epsilon_0} \frac{q^2}{l_E}$$

$$E_{Ph} = \hbar\omega$$

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$$\frac{1}{4\pi\epsilon_0} \cdot \frac{q^2}{l_E} = \hbar\omega$$

$$v = l_E \cdot \omega = \frac{q^2}{4\pi\epsilon_0\hbar}$$

$$\frac{v}{c} = \frac{q^2}{4\pi\epsilon_0\hbar c} = \frac{q^2}{q_{\text{Planck}}^2}$$