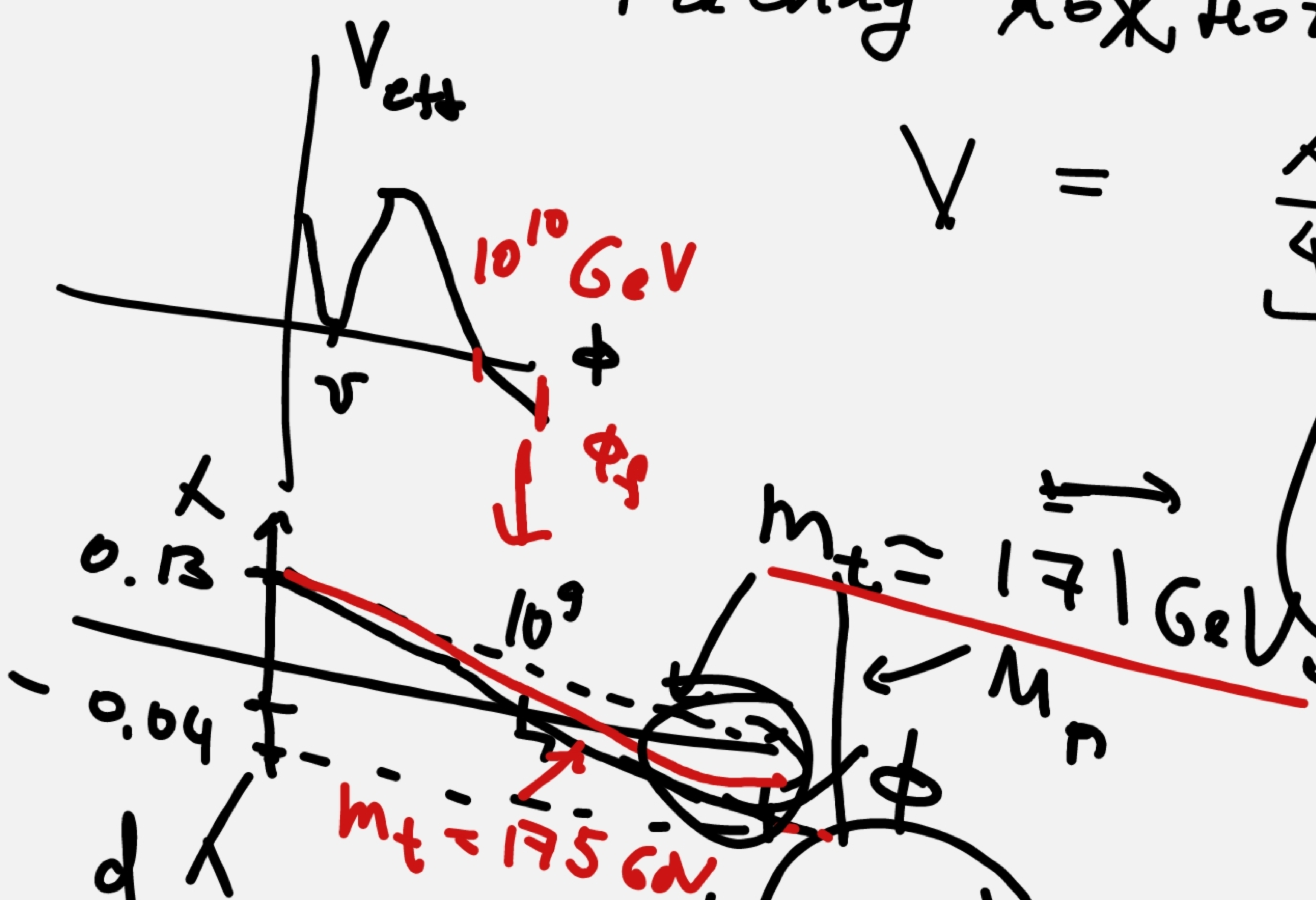
$m_t = 173\ \text{GeV}$

Лекция 5

Распад ложного вакуума II

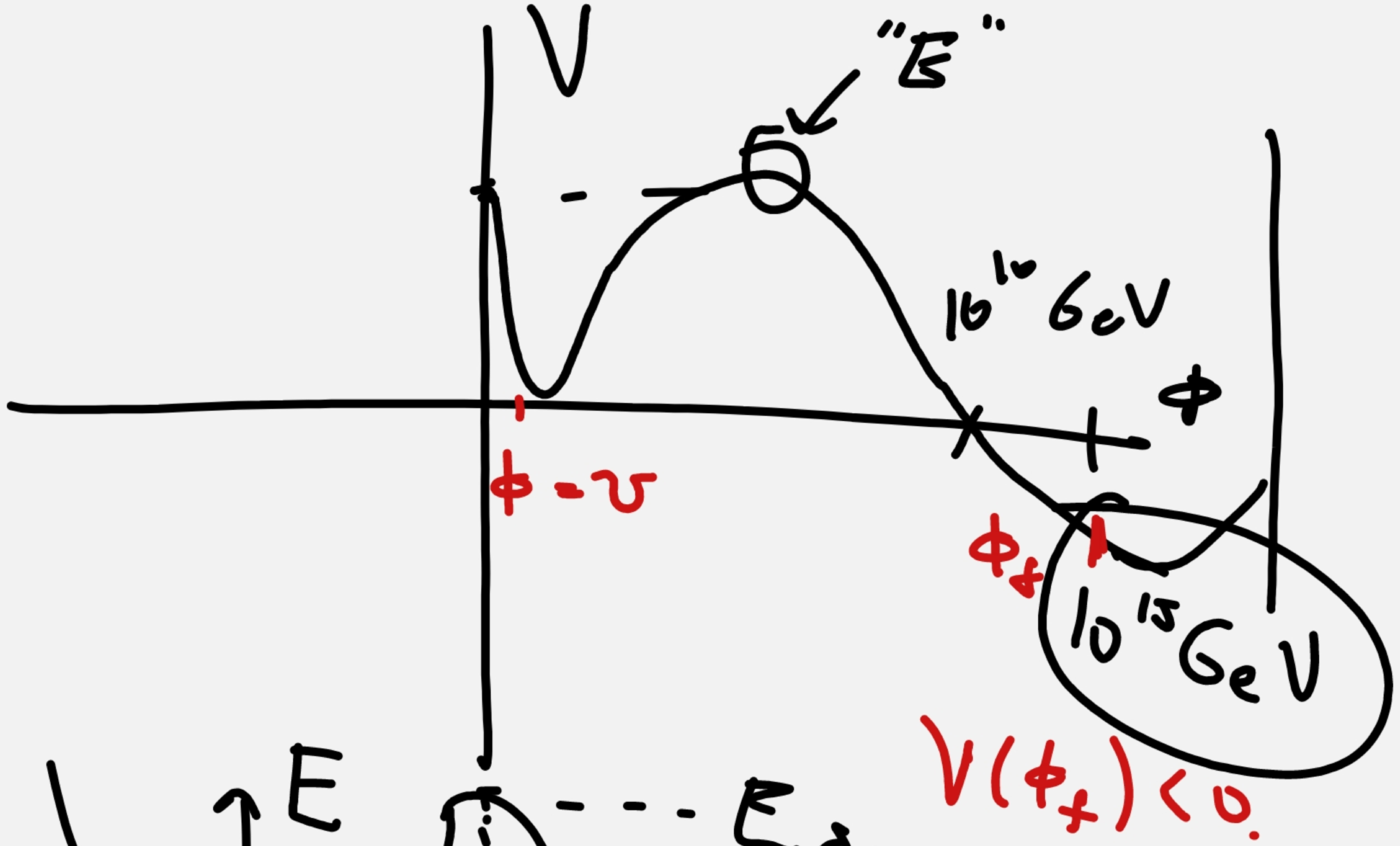
$$V = \underbrace{\frac{\lambda}{4}(\phi^2 - v^2)^2}\ \underbrace{- c\, y_t^4 \ln\left(\frac{\phi}{v}\right)\phi^4}$$

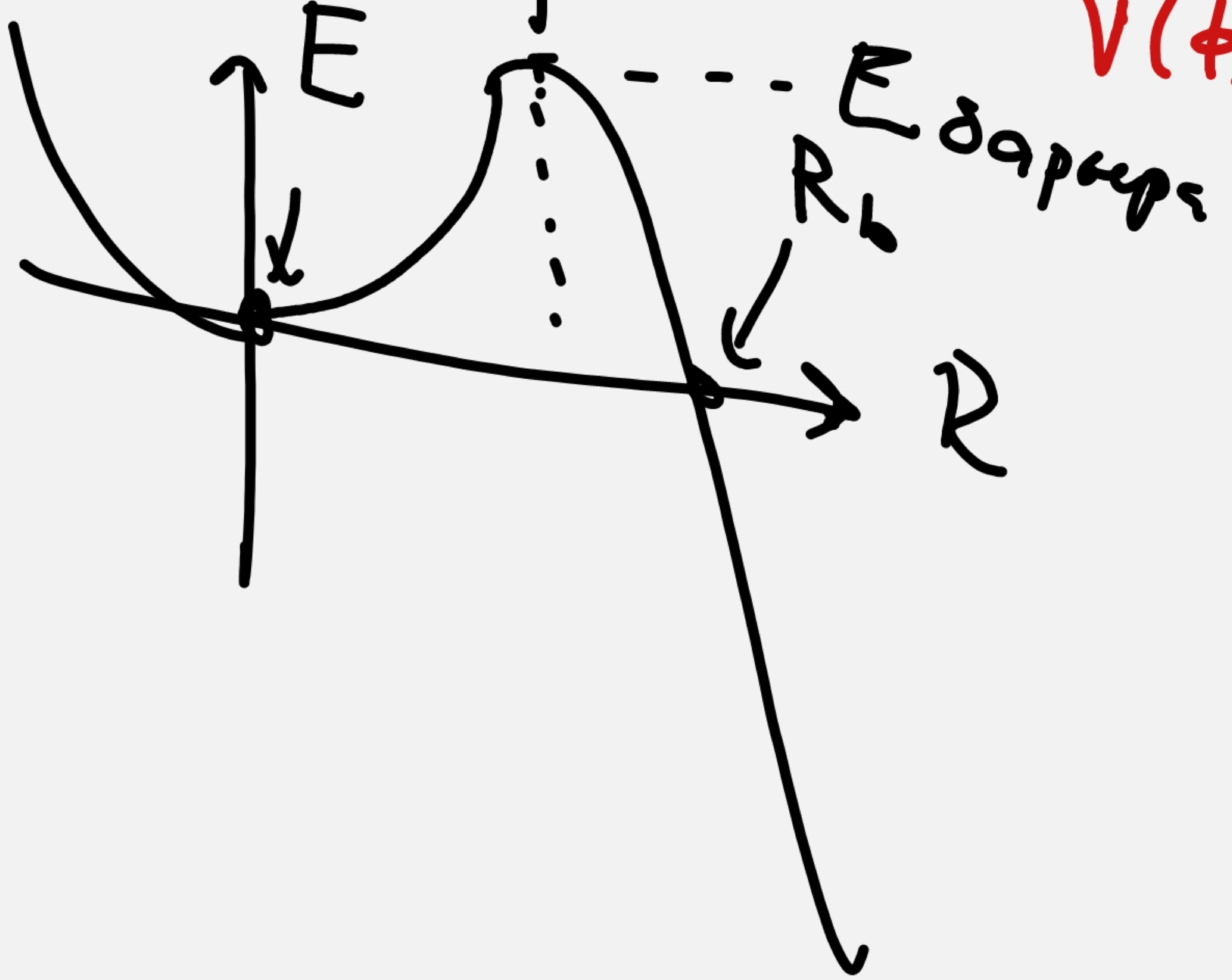


$$\longleftrightarrow \underbrace{\left(\frac{\lambda}{4} - c\, y_t^4 \ln\left(\frac{\phi}{v}\right)\right)}_{\lambda(\ln(\phi))}\phi^4 \simeq \lambda(\ln\phi)\,\phi^4$$

$$\frac{d\lambda}{d\ln\phi} = \frac{1}{16\pi^2}\left(-6y_t^4 + 12\lambda y_t^2 + \frac{3}{4}g^2 g'^2 + \dots\right) + \dots + 3\ \text{петли}$$

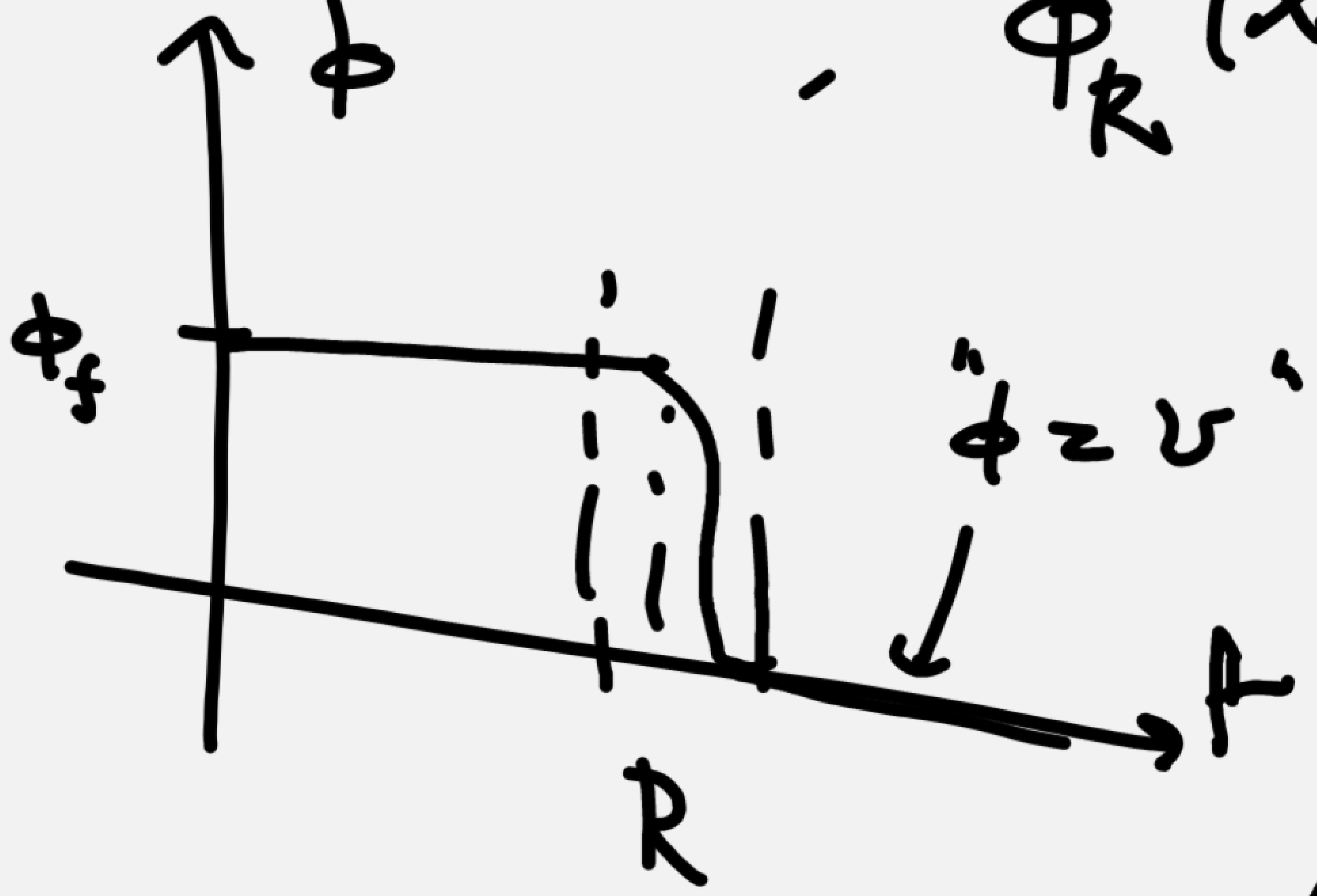
$m_t \propto v \cdot y_t$





$$V = \lambda(\phi) \cdot \phi^4.$$

$$\phi_R(\vec{x}).$$



вклад стенки

$$E = -|V(\phi_f)| R^3 \frac{4\pi}{3} + 4\pi R^2 \cdot \sigma$$

$$4\pi R^2 \sigma = \int_{R-\Delta}^{R+\Delta} d^3x \left(\frac{(\partial_i \phi)^2}{2} + V(\phi) \right).$$

$$L = \frac{\dot{R}^2}{2} - V(R)$$

$$\langle R = R_b | e^{-H\tau_{fi}} | R = 0 \rangle \sim \frac{1}{\ } \exp\left(-T_{fi} \, K'^{-1/2} \, e^{-S[R_{cl}]}\right)$$

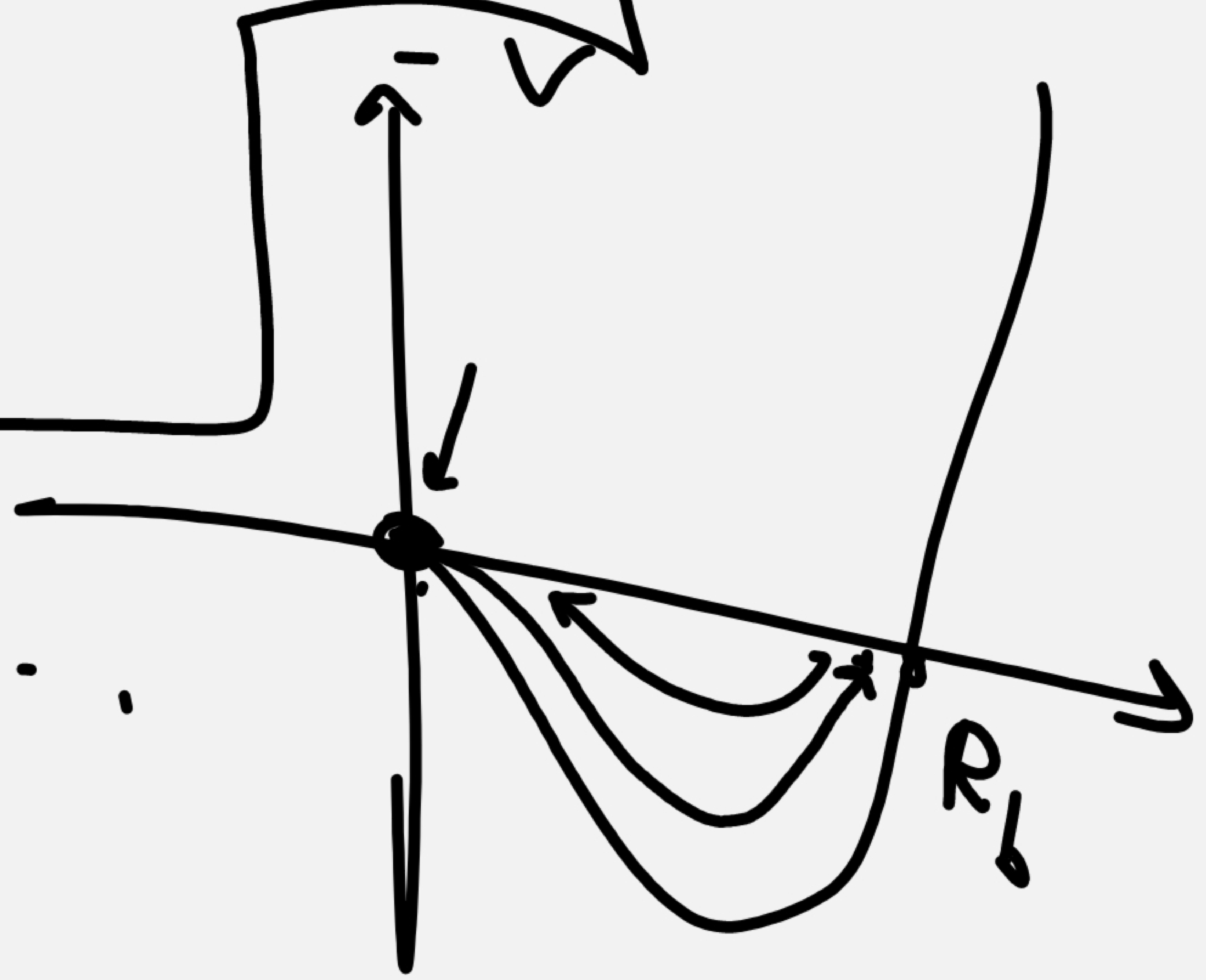
$$S[R_{cl}] = -\int_{-\infty}^{0} d\tau \, L[R_{cl}]$$

$R(\tau) \mapsto 0$ при $\tau \mapsto -\infty$

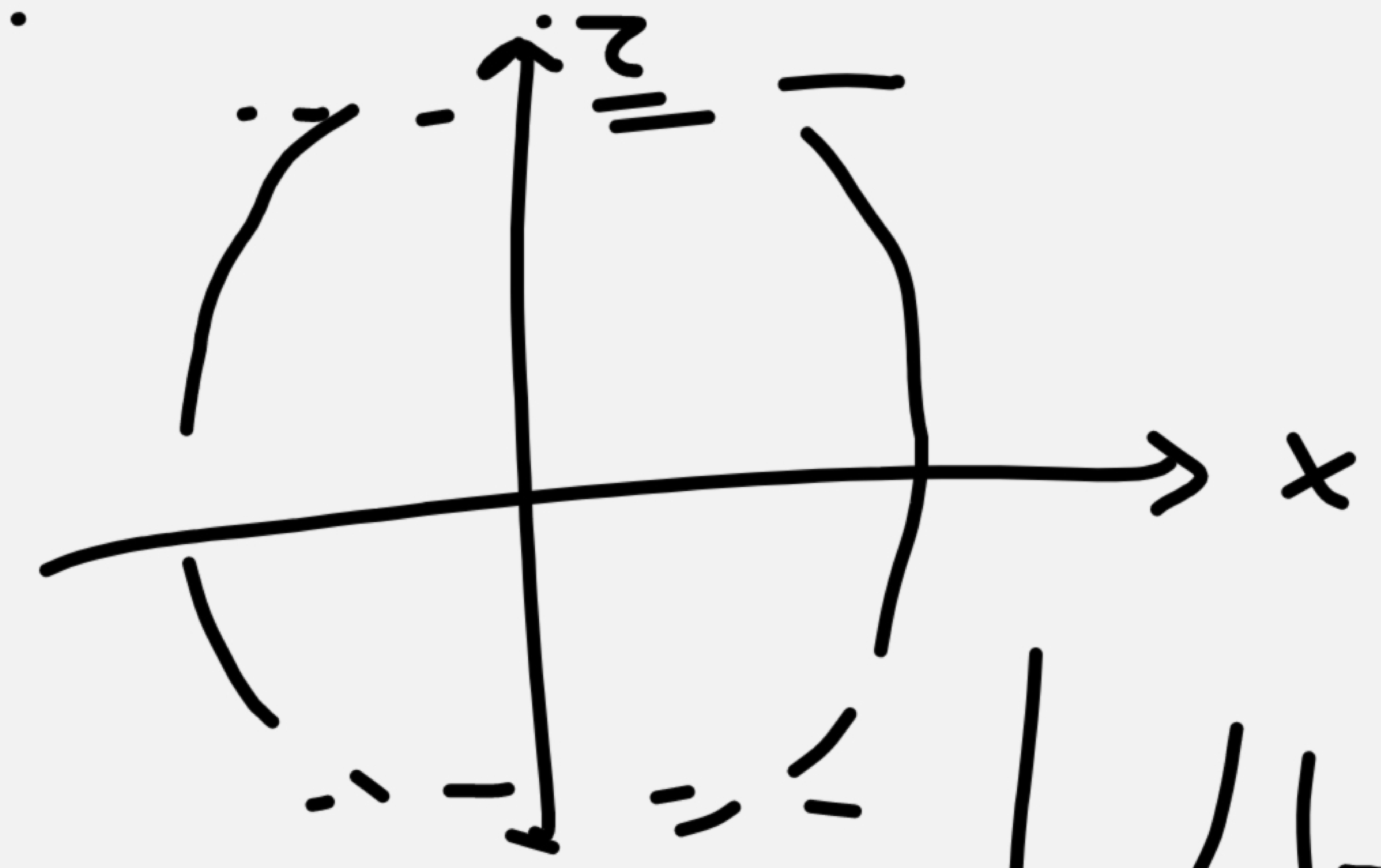
$\tau_{fi} \mapsto \infty$

$$\ddot{R} = -V'(R)$$

$R_{cl}(\tau)$ - OTCKOK - $\frac{d^2R}{d\tau^2} = -V'(R)$



$$P \propto e^{-\int_{-\infty}^{+\infty} L(R_{cl}) d\tau} \sim e^{-S_{tot,cl}}$$



$$V(\phi) = \frac{1}{4}\left|\lambda(\ln\phi)\right|\phi^4 = -\lambda_0\,\phi^4$$

$\ln\mu$

$$\lambda_0 = -\lambda(\ln\rho')$$

$$\vec{x}^2 + \rho^2 = t^2$$

$$\begin{cases}(-\partial_\tau^2 - \partial_x^2)\phi = -V'(\phi) = +\lambda_0\phi^3 \\ \phi \mapsto 0 \text{ при } \tau \mapsto \pm\infty\end{cases}$$

$\tau = it$

$$\phi = \frac{2\rho\sqrt{2}}{\sqrt{\lambda_0}\,(\rho^2 + x^2 - t^2)}$$

$$S_{\text{отскок}} = \frac{8\pi^2}{3|\lambda_0|}$$

$$\phi = \phi\left(\sqrt{\vec{x}^2 + \tau^2}\right), \quad \sqrt{\vec{x}^2 + \tau^2} = |X|$$

$$\phi = \frac{\rho\, 2\sqrt{2}}{(|x|^2 + \rho^2)\sqrt{\lambda_0}}$$

ϕ регулярна в нуле

$$\partial_{|x|}\phi\Big|_{|x|=0} = 0 \longrightarrow \begin{cases}\partial_{|x|}^2\phi + \frac{3}{|x|}\partial_{|x|}\phi = -\lambda_0\phi^3 \\ \phi \mapsto 0 \text{ при } |x| \mapsto \infty\end{cases}$$

$$\phi\Big|_{x=0} = \frac{2\sqrt{2}}{\rho\sqrt{\lambda_0}}$$

$$P - \max_{\rho} \left[V \, t \, \rho^{-4} \right] = e^{-\frac{8\pi^2}{3|\lambda(\rho^{-1})|}}$$

$V \to H_0^{-3}$, $t \to H_0^{-1}$, $\frac{1}{H_0^3}$

e^{-500} npu $m_t \sim 175\,GeV$

$\rho \sim (10^{16}\,GeV)^{-1}$

$\lambda(\rho^{-1}) \sim -0.02$ при $m_t = 173\,GeV$.

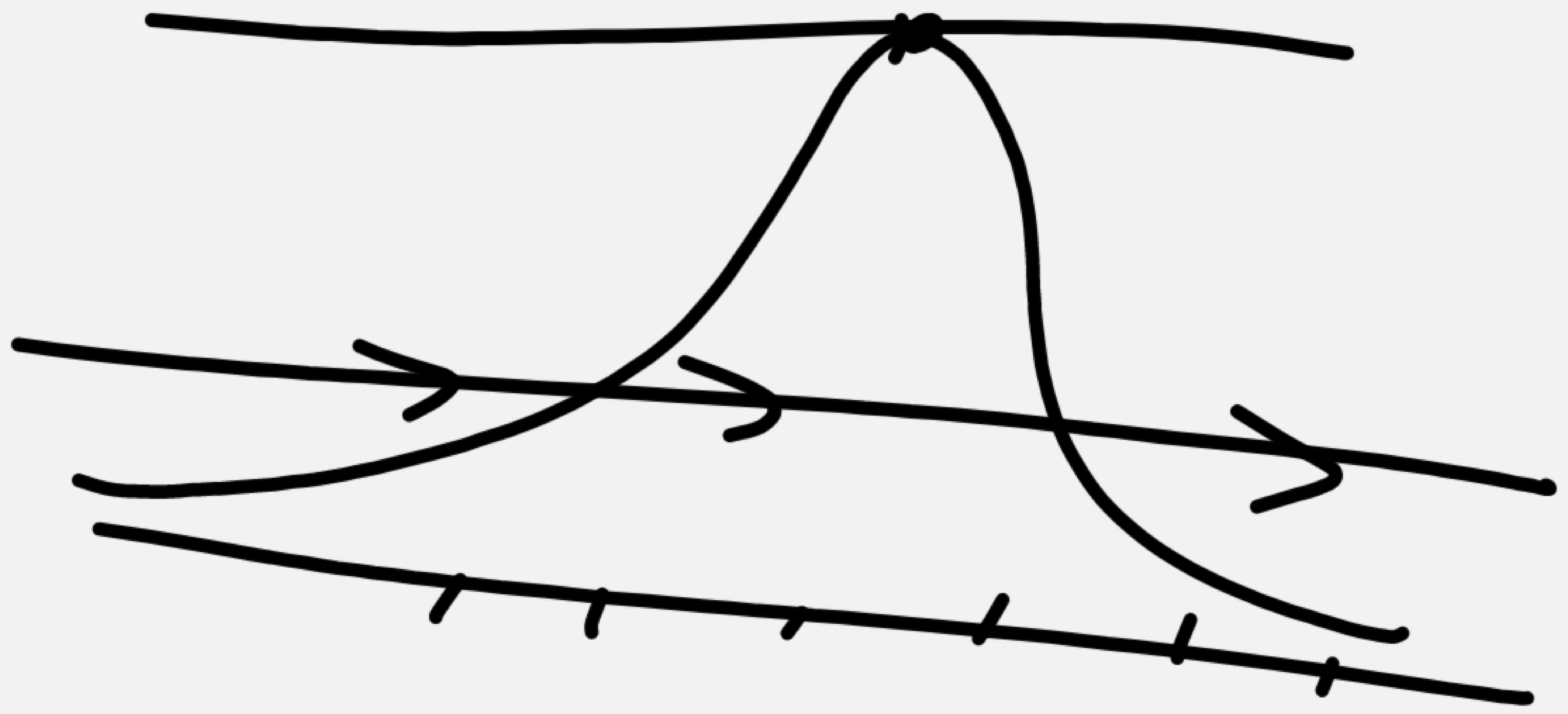
$H_0^{-4} \rho^{-4} \simeq e^{500}$

$e^{-S_b} = e^{-1000}$

$P \sim e^{-500}$

$t = P \rho^4 H_0^3 \, e^{\frac{8\pi^2}{3|\lambda_0|}}$

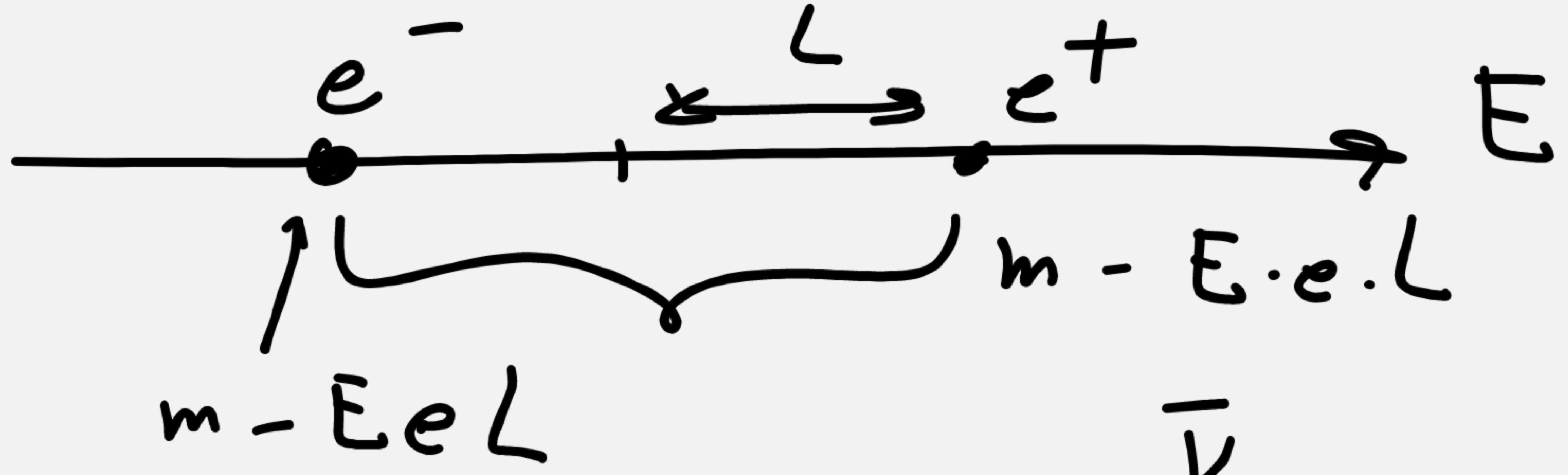
1D QM

1) 

$$\underline{P(E)} \sim \underbrace{e^{-S_{этск}}}_{} \sim 1 ?$$

2) $P_T(E) \sim e^{-\frac{E}{T}} \longleftrightarrow$ Терм. проц?

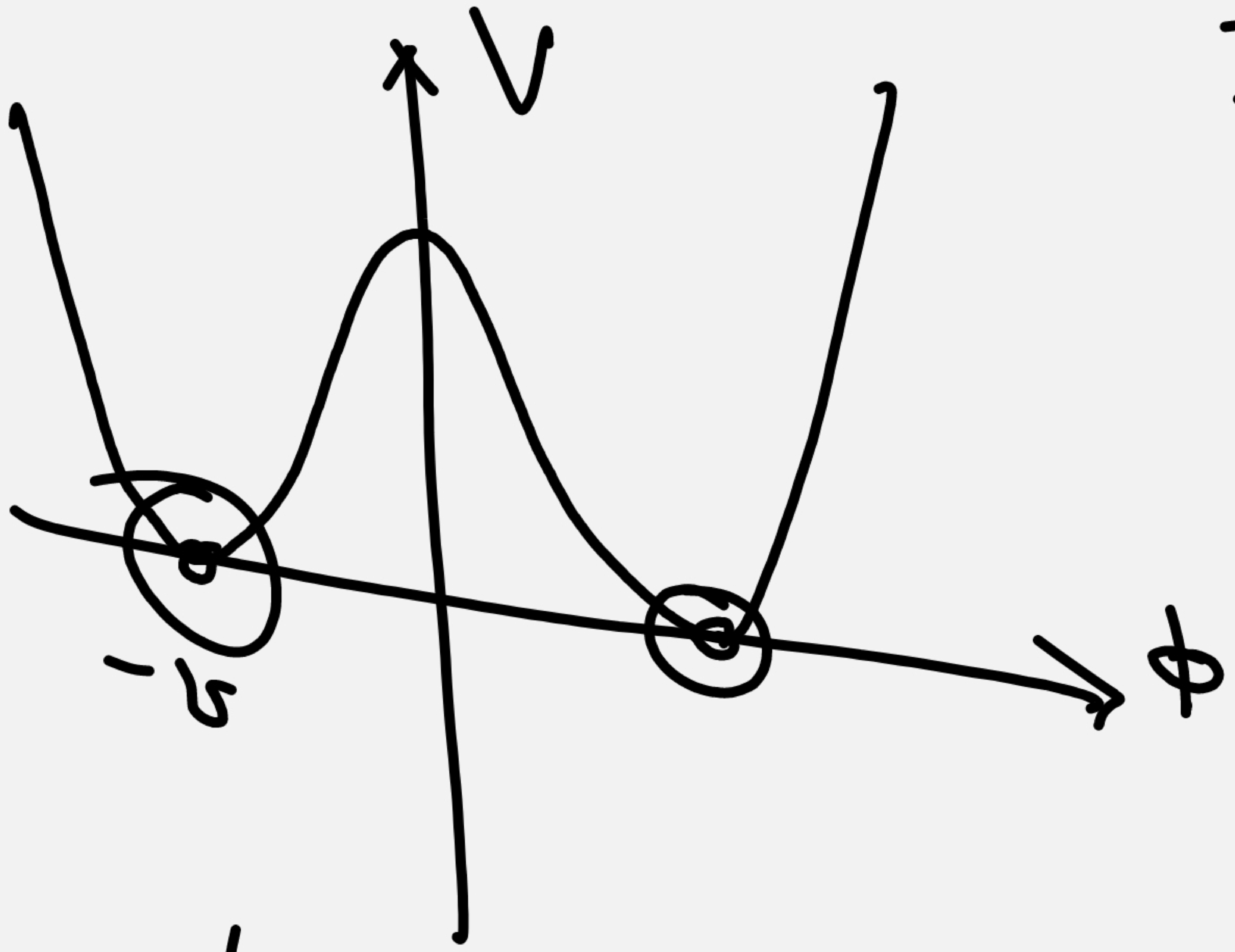
3) $\underline{\langle (\delta\phi)^2 \rangle \sim \frac{H^2}{2\pi}} \Leftrightarrow$ Огр. на масс. инфл.



$$2m = 2E e \cdot L$$

1D скал. поле

$$A_\mu + \partial_\mu \alpha$$



$$S = \int d^2x \left(\frac{(\partial_\mu \varphi)^2}{2} - V(\phi) + j^\mu A_\mu \right)$$

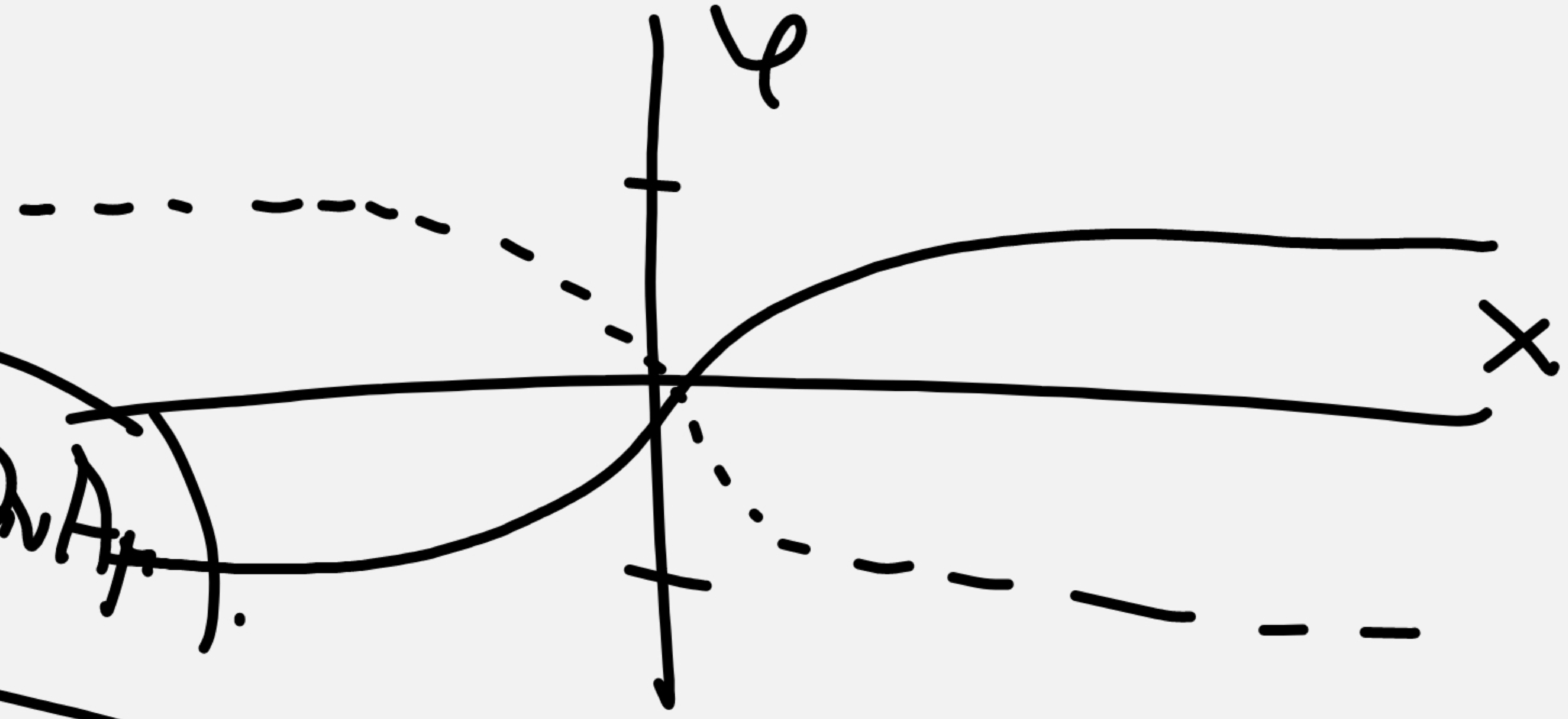
$$V = \frac{1}{4}\left(\varphi^2 - v^2\right)^2$$

$$\varphi(x) = v\, \mathrm{th}\left(\frac{v}{\sqrt{2}} x\right)$$

$$E = \frac{1}{2}\varepsilon_{\mu\nu}F_{\mu\nu}.$$

$$-\varepsilon_{\mu\nu}\partial_\mu A_\nu = F_{\mu\nu}$$

$$= \frac{1}{2}\varepsilon_{\mu\nu}(\partial_\mu A_\nu - \partial_\nu A_\mu).$$



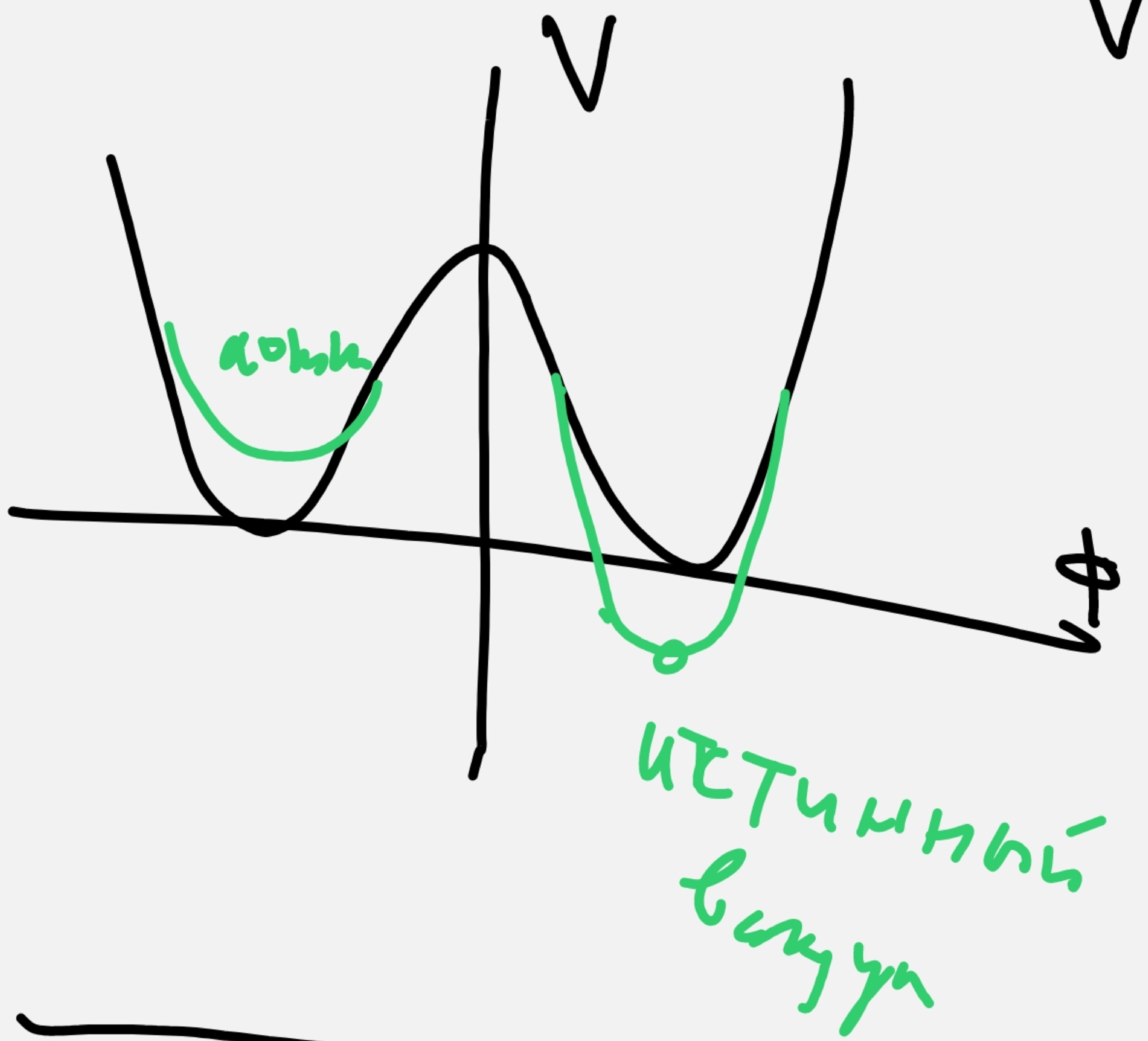
$$j_\mu = \varepsilon_{\mu\nu}\frac{\partial_\nu \varphi}{2v}$$

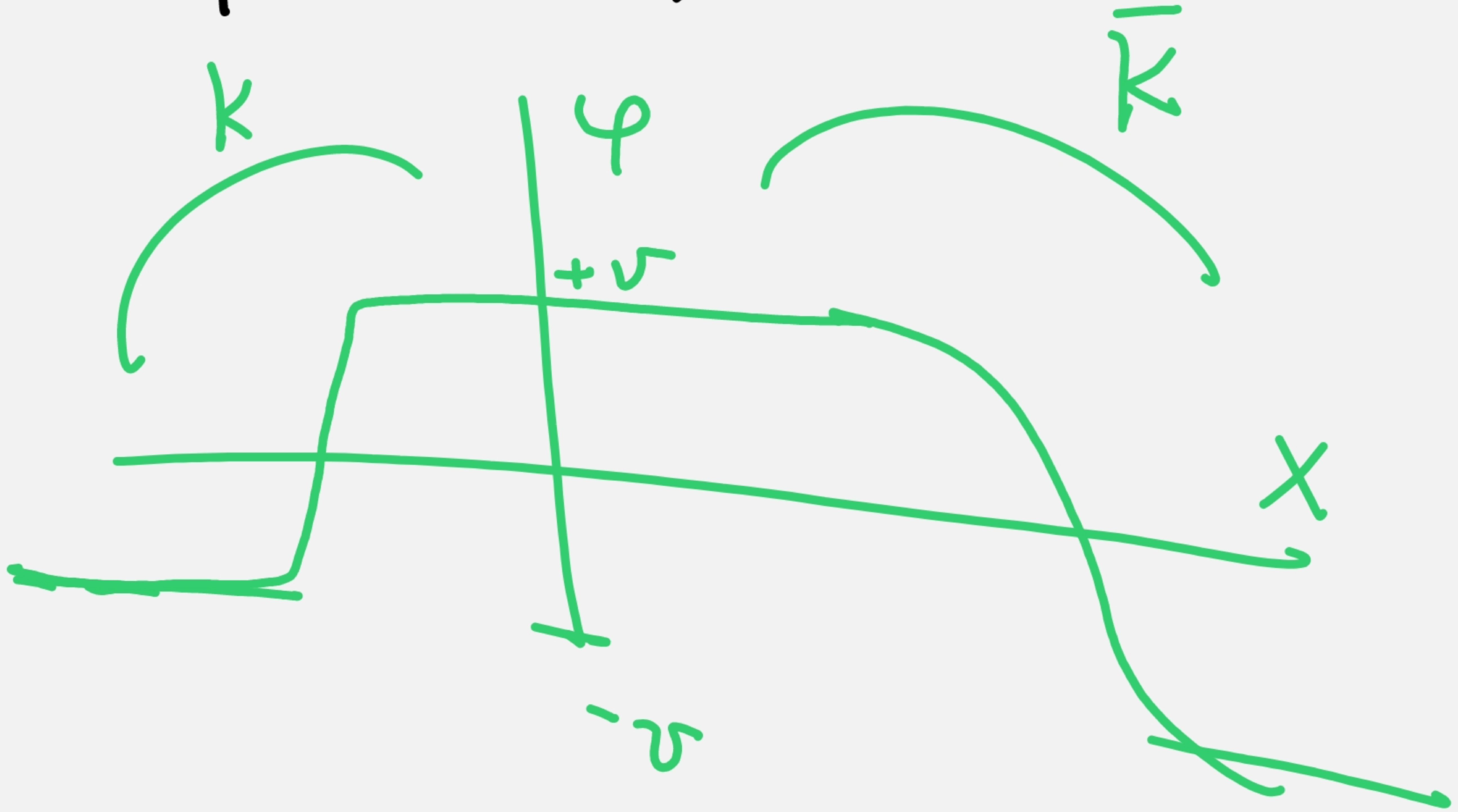
$$\partial_\mu j^\mu = \frac{\varepsilon_{\mu\nu}}{2v}\partial_\mu\partial_\nu\varphi = 0$$

$$Q = \int dx\, j^0 = \int dx\, \frac{\partial_x \varphi}{2v} = \frac{\varphi(+\infty) - \varphi(-\infty)}{2v}$$

$$S_{int} = \int d^2x\, j_\mu A_\mu = -\int \frac{d^2x}{2v}\varepsilon_{\mu\nu}\, \varphi\, \partial_\nu A_\mu = -\int \frac{d^2x}{2v}\varphi \cdot E(x)$$

$$V = \frac{1}{4}(\varphi^2 - v^2)^2 - \frac{1}{2v} E \varphi$$

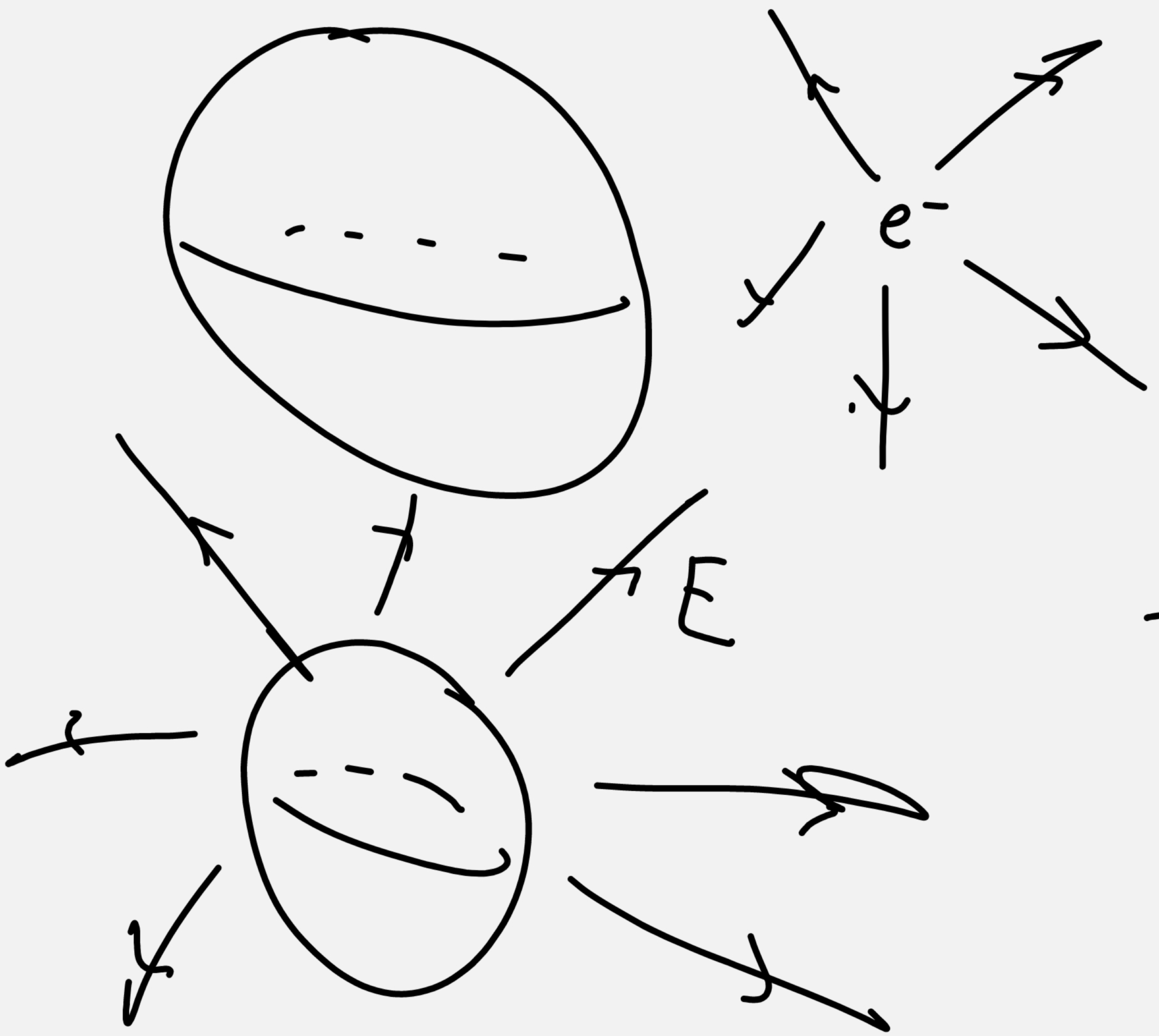


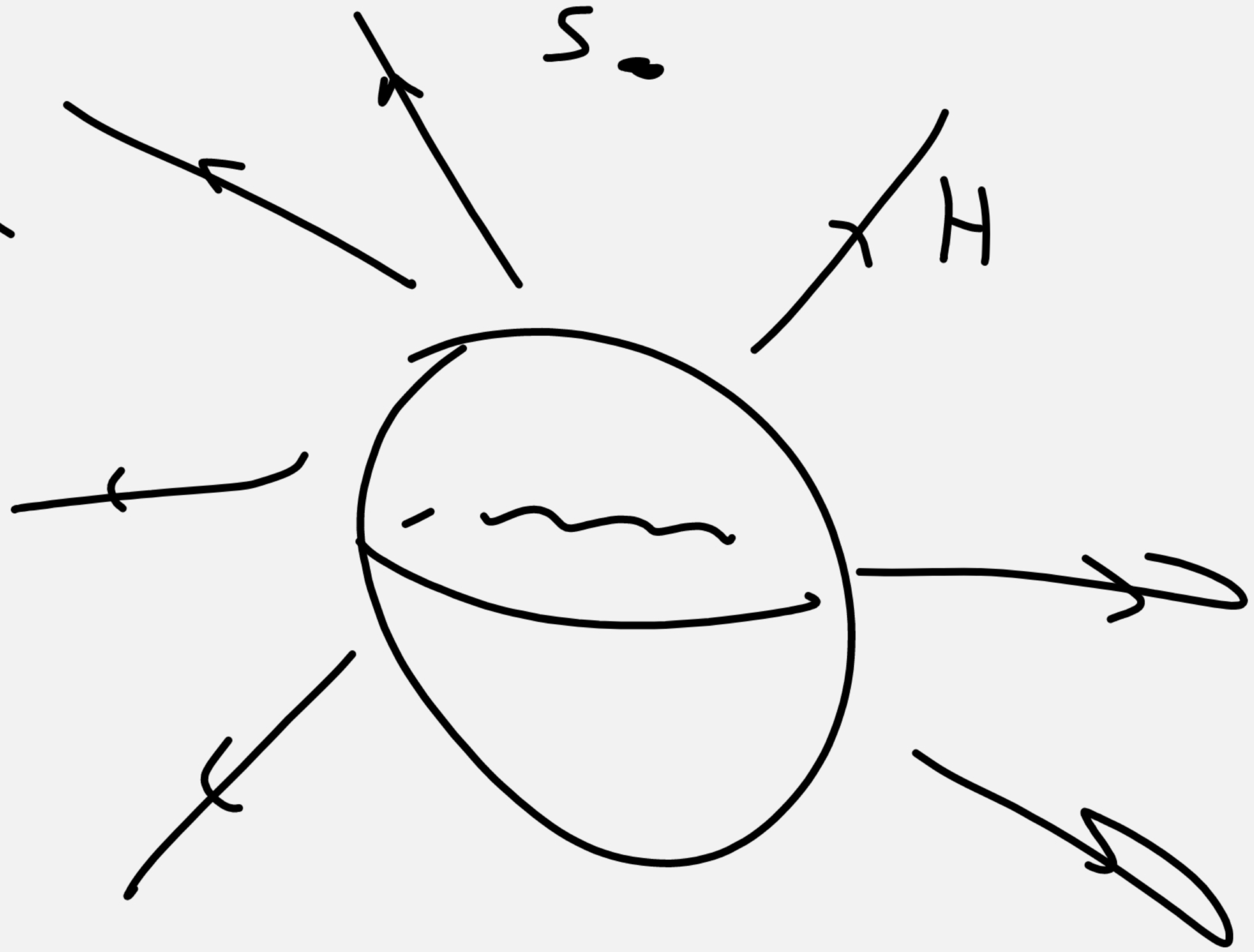


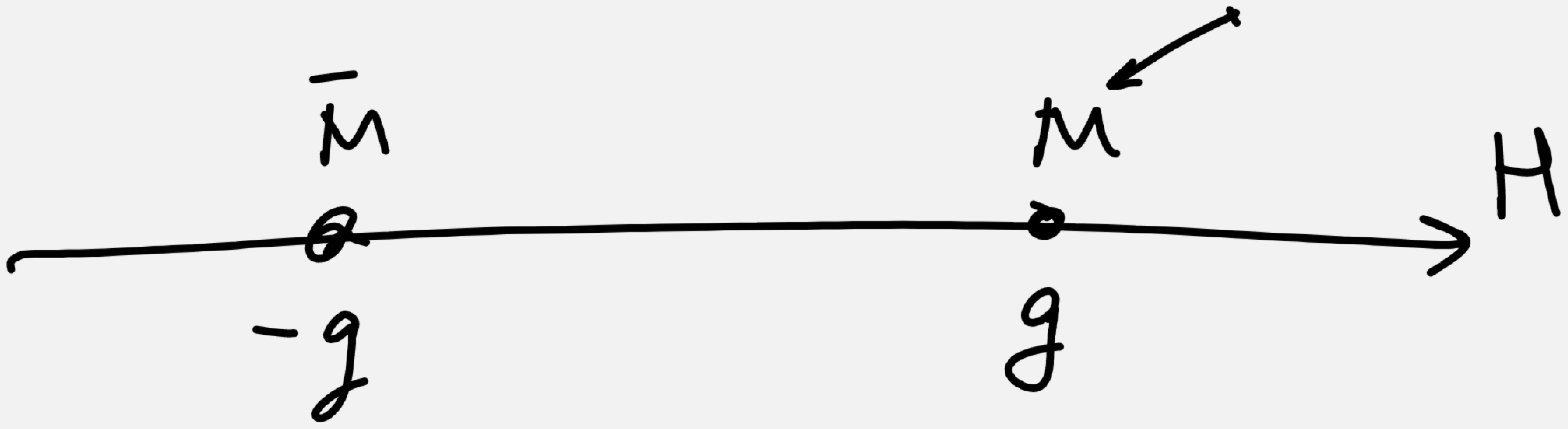
Монополь

$$g_m = \int d^2\sigma \; \vec{H}\vec{n}$$

$$4\pi Q = \int_{S_\infty} d^2\sigma \; F_{\mu\nu} \Sigma_{\mu\nu}$$







$$P \sim e^{-S_{inst}}$$

$$P(E \mapsto \infty) \sim e^{-\frac{S_{inst}}{2}}$$

q

$$\vec{x}^2 = \rho^2 + t^2$$