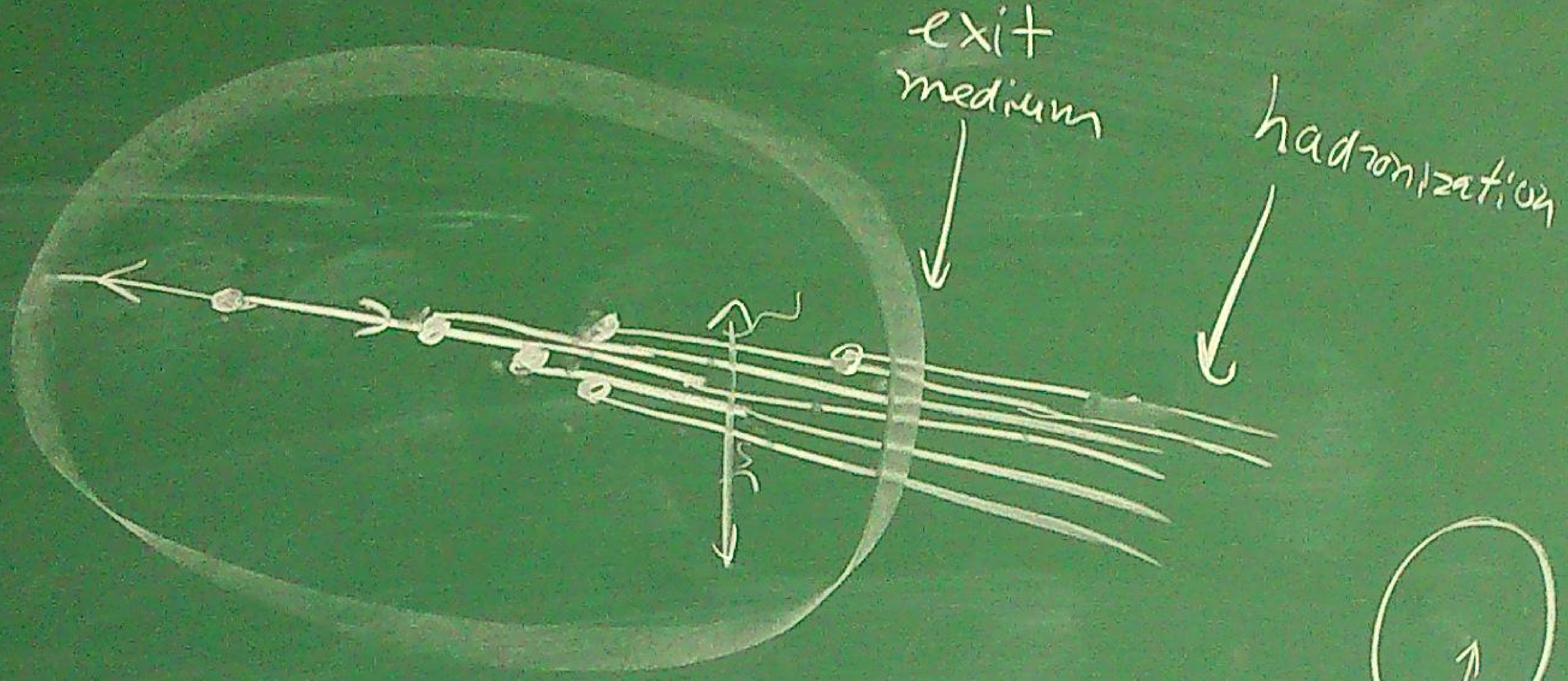
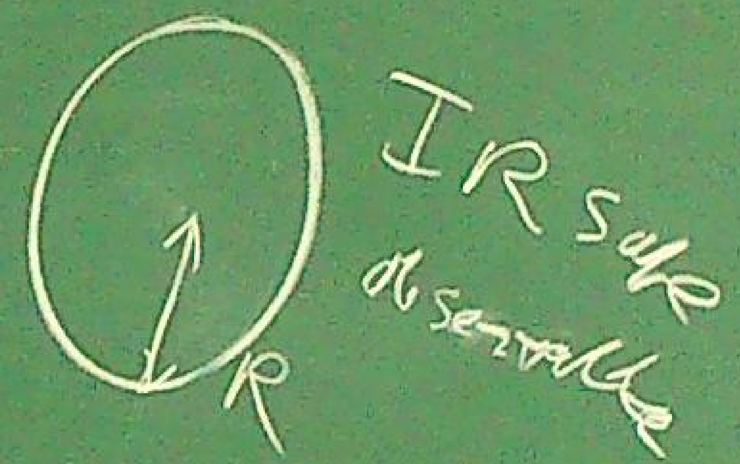




$[\hat{q}] = 3$

cross-correlate with viscosity thermalization.

- Elastic E-loss ($2 \to 2$, ...) n_L
- Enhance collinear splitting (Bremsstrahlung) incl. virtuality effects
- "Stripping" of softer components
- Reduced color coherence (~~angle ordering~~)
- (...)

$\simeq$ $\hat{q}$

$$\hat{q}_{q,g} = \frac{d}{dt}\langle q_\perp^2 \rangle$$

$$\hat{q}_g = \frac{2N_c^2}{N_c^2-1}\,\hat{q}_q .$$

LO
NLO.

NRQCD. Integrate out $\gtrsim M$

$$L = \sum_{i=1,2} \psi^+ \left(-i D_0 - \frac{\vec{D}^2}{2m_i} + \dots\right) \psi(\vec{x}_i, t)$$

$+ L_{QCD}$

pNRQCD. Int. out $\gtrsim \frac{1}{|x_1 - x_2|}$

$$L = \psi_s^+ \left[-i\partial_t - \sum_i \frac{\partial_{\perp i}^2}{2m_i} + V_s(x_1 - x_2)\right] \psi_s(\vec{x}_1, \vec{x}_2, t)$$

$$+ \psi_o \left[-i D_t \dots \dots \dots\right] \psi_o$$

$$+ \vec{E}\, V_{s\text{-}o}(x_1 - x_2)\, \psi_o(\vec{x}_1, \vec{x}_2) \vec{\partial} \psi_s(\,).$$

$+ L_{QCD}$

SCET

$$L = \sum_i \psi^+ \left[-i D_+ - \frac{D_\perp^2}{2E} + \dots\right] \psi[x_\perp, x^+, E]$$

$+ L_{QCD}$

H Meyer: (Tue) 14:00 instead of 10:00

pSCET. int. out. $p^- > \frac{1}{x_{\perp\ell}} \sim \frac{p_\perp^2}{E}$

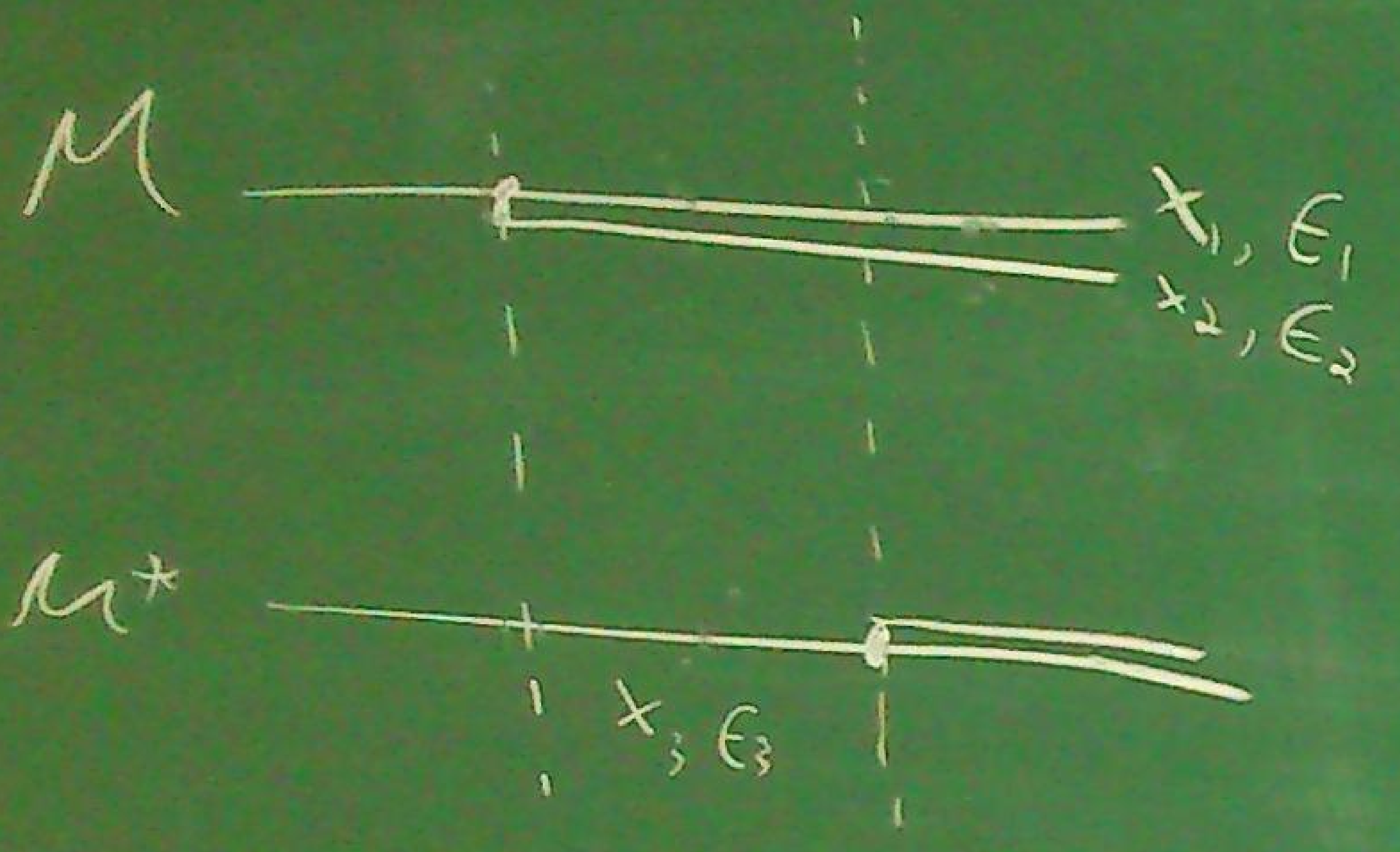
$$L = \psi^+ \left[-i D_+ - \sum_i \frac{\partial_\perp^2}{2E_i} - i C(x_{\perp}, x^+) + n_L \frac{d}{dE}\right] \psi(x_{\perp i}, E_i, x^+)$$

$$+ \psi^+(x_1)\, V\, \psi(x_1, x_1)$$

1) "Wee" collinear particles (e.g. $E \lesssim 2\,\mathrm{GeV}$)

2) Approach L.C. from spacelike direction. ($\underline{\text{Still}}$ E cut-off ?)
(commutators come from collinear fields).

$\underset{\text{large}}{p^+}, p^-$



i) $\Psi(x_1, x_2, x_3) = \Psi(x_1 - x_3, x_2 - x_3)$

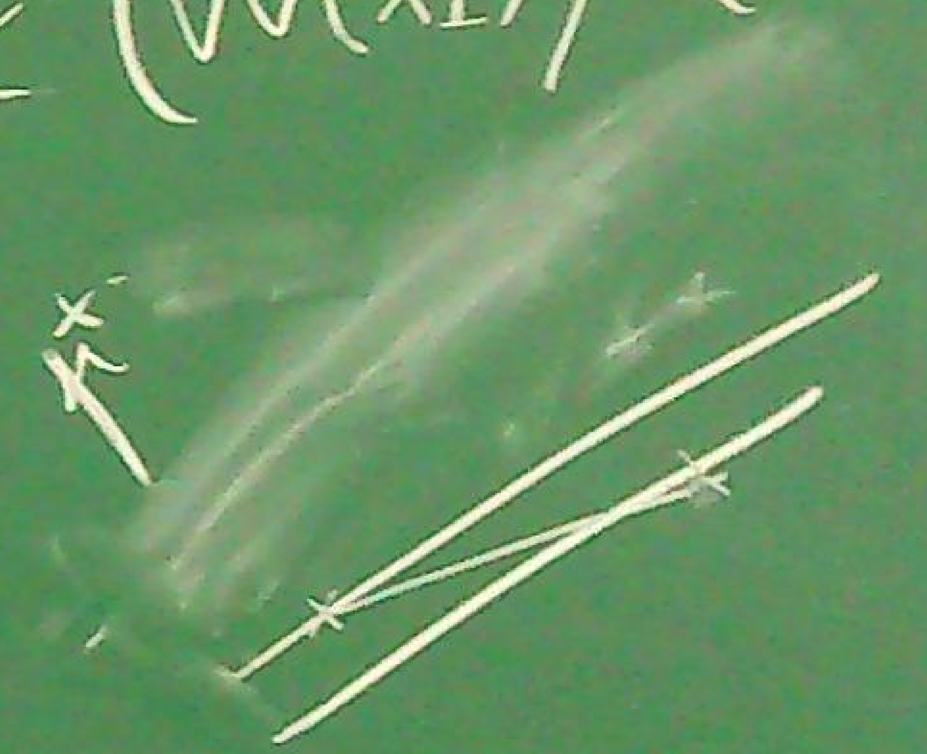
homogeneous in $x_\perp$

ii) Boost invariance $\left(E_1 \frac{d}{dp_{\perp 1}} + E_2 \frac{d}{dp_{\perp 2}} - E_3 \frac{d}{dp_{\perp 3}}\right)\Psi = 0$

$$\Rightarrow \Psi = \delta^2\left(E_1 x_{\perp 1} + E_2 x_{\perp 2} - E_3 x_{\perp 3}\right) \Psi(x_{\perp 1} - x_{\perp 3})$$

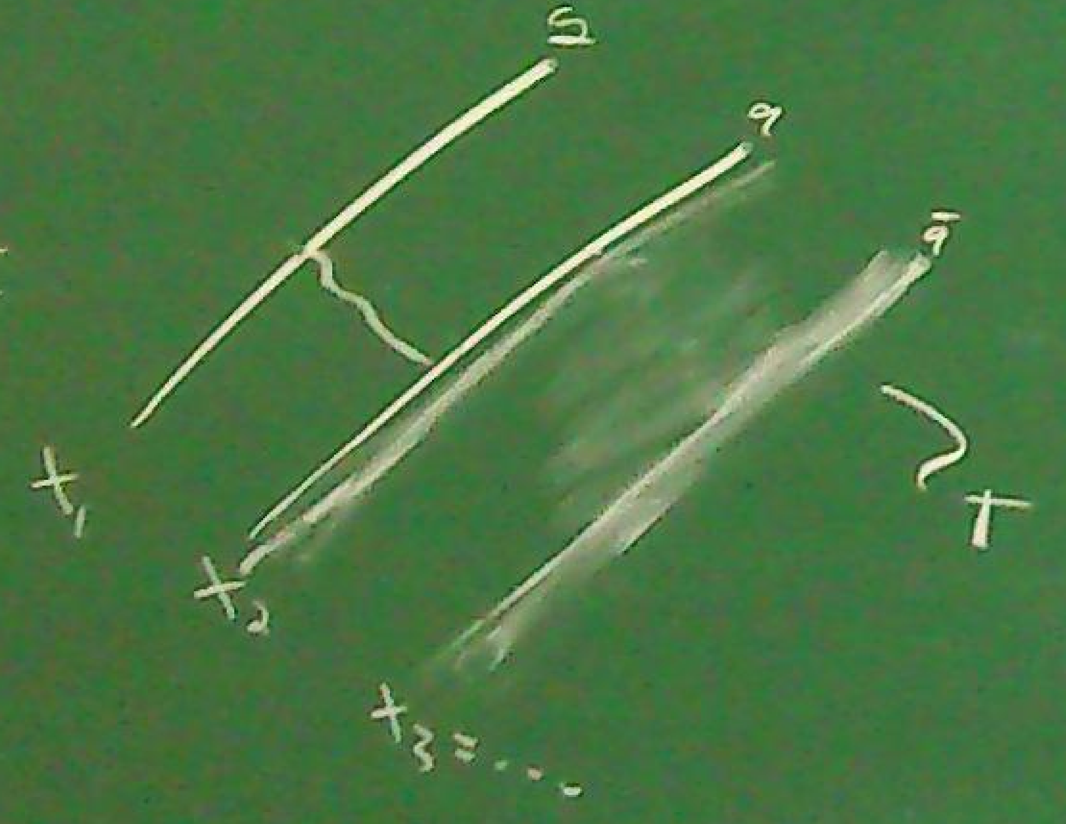
$= x$

$$\langle \left(W(x_\perp)\right) \left(W(0)\right) \rangle$$



$$\frac{d}{d\tau}\Psi(x) = \left[\frac{-i\partial_\perp^2}{E_3\, x(1-x)} - C^{(3)}(x)\right]$$

$C(x) = \langle$



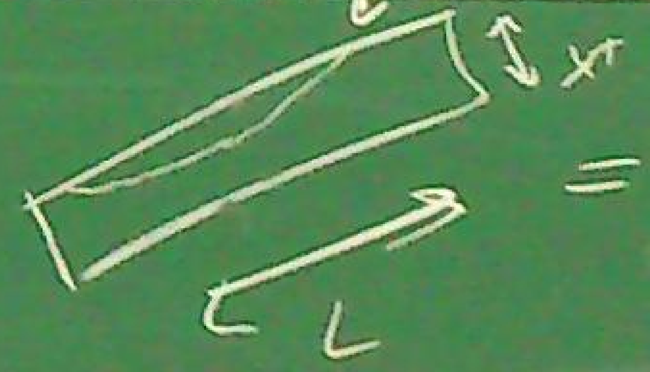
"Minimality assumption"

$$C^{(3)} = C_1^{(2)} + C_2^{(2)} + C_3^{(2)}$$

Soft gluons $= C^{(2)}$

depends on E-cutoff

$C^{(2)}(x_\perp) = \log$



$= -L\, C(x_\perp)$.

$x_\perp \ll \frac{1}{T}$

$$C(x_\perp) \approx \frac{\hat{q}\, x_\perp^2}{4}$$

$$C(x_\perp) = \int \frac{d\Gamma_{el}}{d^2 q_\perp}\, q_\perp^2$$

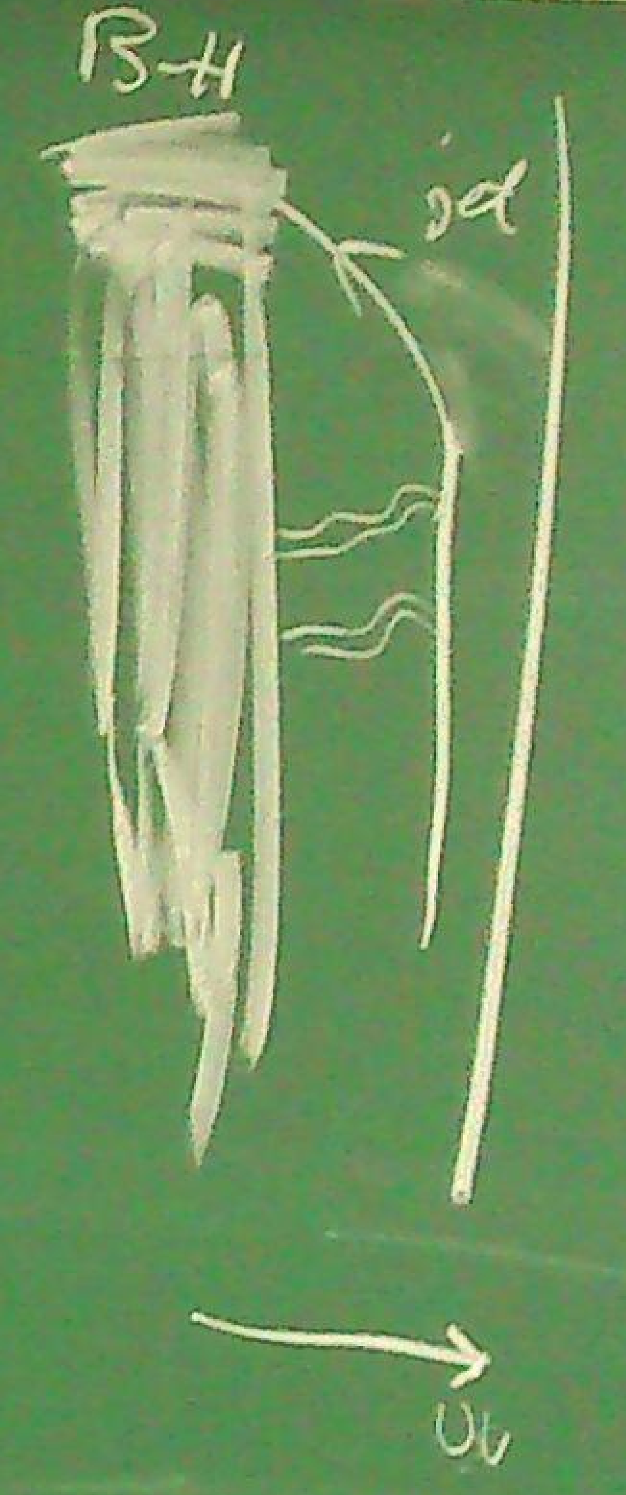
Strong coupling:

$$C(x_\perp) = -i\,\#\,\underbrace{\epsilon_{jet}\,T^4\,x_\perp^4}_{\sim\langle T_{++}\rangle}$$

attractive T-even gravity couples to energy dim. analysis

Rough properties of jets depend on position and size $x_\perp$.

$$\frac{\partial}{\partial\tau}\psi(x_\perp) = \left[\frac{-i\,\partial_\perp^2}{\epsilon} + C\right]\psi(x_\perp)$$



Two regimes. i) Diffusion $\Rightarrow x_\perp \sim \sqrt{\tau/\epsilon}$ $=$ $\tau\cdot C \sim 1$

$\tau\cdot\epsilon\,T^4\,\frac{\tau^2}{\epsilon^2} \sim 1 \Rightarrow \boxed{\tau \sim \epsilon^{1/3}\,T^{-4/3}}$

$\underline{C(x_\perp)\text{ depends on }\epsilon}$

Explains absorption rate of last photons

$\hookrightarrow$ $p_\perp^2 \sim \epsilon\,p^-$

$\delta p^- \sim \frac{1}{L}$

$\delta p_\perp \sim \sqrt{\epsilon/L}$

ii) Classical.

$$\frac{dx}{d\tau} = \frac{p}{\epsilon}$$

$$\frac{dp_\perp}{d\tau} = \epsilon\,T^4 x_\perp^3 \Rightarrow \ddot{x}_\perp = +\,x_\perp^3 T^4$$

$$\tau \sim \frac{1}{\sqrt{\ddot{x}_\perp(\tau=0)}}\,\frac{1}{T} \sim \frac{(L\epsilon)^{1/4}}{T}$$

(Arnold + Vaman)