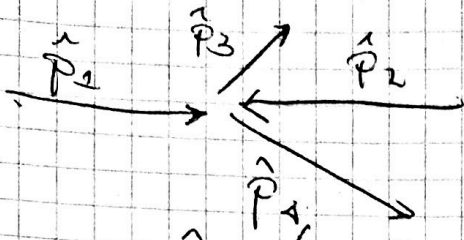


# SET 2 - QGP

PARIO PIANI



$$P_1 = (\epsilon, 0, 0, \epsilon)$$

$$P_2 = (\epsilon, 0, 0, -\epsilon)$$

$$\hat{p}_1 = (x_1 \epsilon, 0, 0, x_1 \epsilon), \hat{p}_2 = (x_2 \epsilon, 0, 0, -x_2 \epsilon)$$

a)  $\hat{p}_1 + \hat{p}_2 = ((x_1 + x_2)\epsilon, 0, 0, (x_1 - x_2)\epsilon)$

$$\hat{p}_3 + \hat{p}_4 = (\text{Pr}(\cosh y_3 + \cosh y_4), 0, 0, \text{Pr}(\sinh y_3 + \sinh y_4))$$

$$\epsilon = \frac{\sqrt{s}}{2}$$

$$\begin{cases} (x_1 + x_2) = \frac{\text{Pr}}{\epsilon} (\cosh y_3 + \cosh y_4) \\ (x_1 - x_2) = \frac{\text{Pr}}{\epsilon} (\sinh y_3 + \sinh y_4) \end{cases}$$

$$(x_1 - x_2) = \frac{\text{Pr}}{\epsilon} (\sinh y_3 + \sinh y_4)$$

$$x_1 = \frac{\text{Pr}}{2\epsilon} (e^{y_3} + e^{y_4}) = \frac{\text{Pr}}{\sqrt{s}} (e^{y_3} + e^{y_4})$$

$$x_2 = \frac{\text{Pr}}{\sqrt{s}} (e^{-y_3} + e^{-y_4})$$

b)  $y_{cm} = \frac{1}{2} \ln \left( \frac{1 + \beta_{cm}}{1 - \beta_{cm}} \right)$

$$\hat{p}_1' = (\gamma(x_1 \epsilon - \beta x_1 \epsilon), 0, 0, \gamma(x_1 \epsilon - \beta x_1 \epsilon))$$

$$\hat{p}_2' = (\gamma(x_2 \epsilon + \beta x_2 \epsilon), 0, 0, \gamma(-x_2 \epsilon - \beta x_2 \epsilon))$$

$$\hat{p}_1' + \hat{p}_2' \stackrel{!}{=} 0 \Leftrightarrow x_1 - \beta_{cm} x_1 = -x_2 - \beta_{cm} x_2$$

$$\Rightarrow \beta_{cm} = \frac{x_1 + x_2}{x_1 - x_2} \Rightarrow y_{cm} = \frac{1}{2} \ln \left( \frac{\frac{2x_1}{x_1 - x_2}}{\frac{2x_2}{x_1 - x_2}} \right) = \frac{1}{2} \ln \frac{x_1}{x_2}$$