Sistema di cariche che si muovono lentamente $\Rightarrow$ $\lambda \gg$ grandezza del sistema

$$E = \frac{e}{c}\,\frac{\hat{n}\wedge(\hat{n}-\bar{\beta})\wedge\dot{\bar{\beta}}}{R(1-\bar{\beta}\cdot\hat{n})} \xrightarrow{\beta \ll 1} \frac{e}{c}\,\frac{\hat{n}\wedge\hat{n}\wedge\dot{\bar{\beta}}}{R}$$

$$\bar{d} = \sum e\bar{r} \longrightarrow \frac{d}{dt}\bar{d} = \sum e\,\frac{d\bar{r}}{dt} = \sum e\bar{v}$$

momento di dipolo

$\bar{J} = \rho\bar{v} = e\,\delta(\bar{x})\,\bar{v}$

$$\bar{A} = \frac{1}{cR}\int \bar{J}\,\Big|_{rit} dV = \frac{1}{cR}\sum e\bar{v} = \frac{1}{cR}\dot{\bar{d}}$$

$$\bar{E} = \hat{n}\wedge\hat{n}\wedge\ddot{\bar{d}}\,, \qquad I = \frac{2}{3c^3}\ddot{\bar{d}}^{\,2} \qquad I \propto E^2$$

considériamo $\frac{e_i}{m_i} = \frac{e_j}{m_j},\ \forall i,j$ $\qquad$ R_{cm} baricentro

$$\bar{d} = \sum_i e_i\bar{r}_i = \sum_i \frac{e_i}{m_i}\,m_i\bar{r}_i = \frac{e}{m}\sum_i m_i\bar{r}_i = \frac{e}{m}\underbrace{\sum_j m_j}_{M_{TOT}}\,\frac{\sum_i m_i\bar{r}_i}{\sum_i m_i} = \frac{e}{m}M_{TOT}\bar{R}_{cm}$$

Se $\bar{R}_{cm}$ si muove di moto uniforme $\rightarrow$ $\ddot{\bar{d}} \propto \ddot{\bar{R}}_{cm} = \bar{0} \Rightarrow I = 0$

Senza accelerazione, possiamo spostarci in un SR in cui $\bar{R}_{cm} = \bar{0}$, dunque non c'è emissione. Con accelerazione, non abbiamo un SR inerziale

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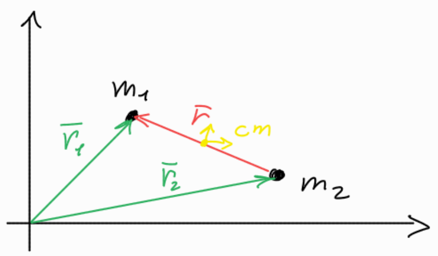
<u>2 cariche</u> $\qquad \bar{d} = e_1\bar{r}_1 + e_2\bar{r}_2 \qquad \frac{m_1\bar{r}_1 + m_2\bar{r}_2}{m_1+m_2} = \bar{r}_{cm} \qquad \bar{r} = \bar{r}_1 - \bar{r}_2$

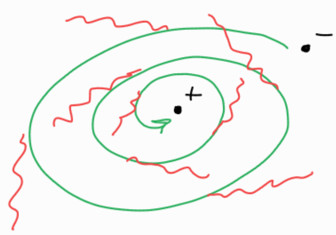
$$\frac{m_1(\bar{r}+\bar{r}_2) + m_2\bar{r}_2}{m_1+m_2} = \bar{r}_{cm} = \bar{0}$$ nel SR del CM



$$(m_1+m_2)\,\bar{r}_2 + m_1\bar{r} = \bar{0} \Longrightarrow \begin{cases} \bar{r}_2 = -\dfrac{m_1}{m_1+m_2}\,\bar{r} \\ \bar{r}_1 = \dfrac{m_2}{m_1+m_2}\,\bar{r} \end{cases}$$

$\mu = \frac{m_1 m_2}{m_1+m_2}$

$$\bar{d} = \frac{e_1 m_2}{m_1+m_2}\,\bar{r} - \frac{e_2 m_2}{m_1+m_2}\,\bar{r} = \mu\left(\frac{e_1}{m_1} - \frac{e_2}{m_2}\right)\bar{r}$$



$$I = \frac{2}{3c^3}\ddot{\bar{d}}^{\,2} = \frac{2}{3c^3}\,\mu^2\left(\frac{e_1}{m_1} - \frac{e_2}{m_2}\right)^2 \ddot{\bar{r}}^{\,2} \Longrightarrow$$ tempo di collasso $T \sim 10^{-10}\,s$

Serve meccanica quantistica per risolvere