Positron production in collision of heavy nuclei

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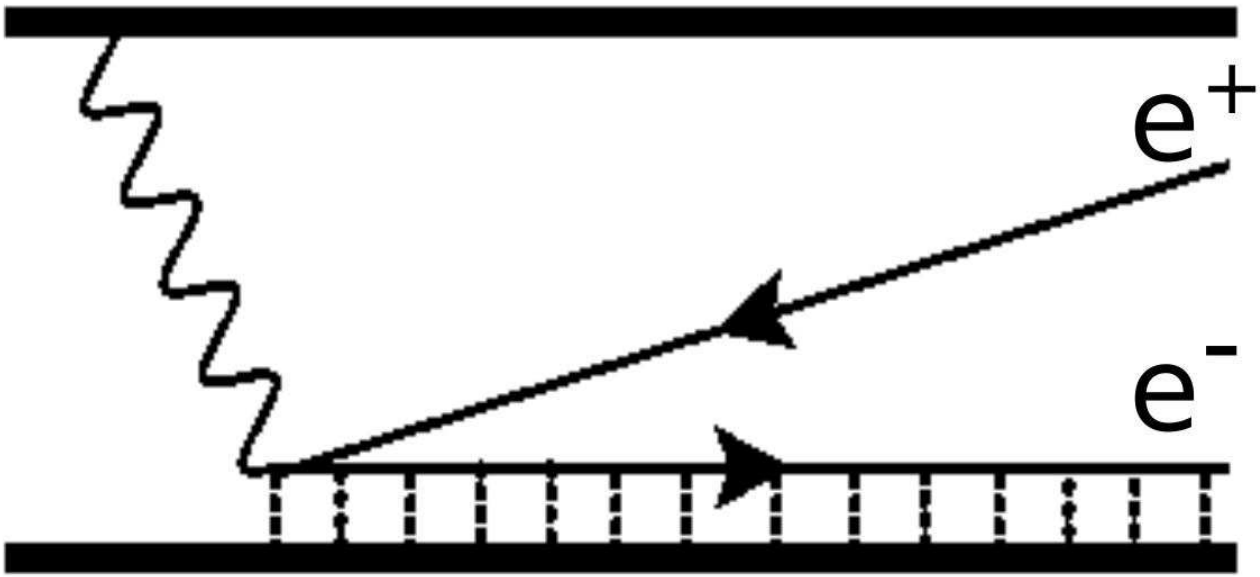
We consider the electromagnetic production of positron in collision of **slow heavy nuclei**, with the simultaneously produced electron captured by one of the nuclei.

The cross-section of the discussed process **exceeds** essentially the cross-section of e^+e^- production.



Feynman diagram of positron production

The electromagnetic vertex on the upper heavy line reduces to $(p' + p)/2M \approx v$.
The total cross-section is proportional to v: $v^2/v = v$.
We assume that $v \simeq 0.1$.
The additional overall factor: $4Z^2\alpha^2$.
The total cross-section is obviously a scalar, and its essential part is $1/m^2$.

We arrive at the following result:

$$\sigma = 4Z^2\alpha^2 \frac{v}{m^2} \, .$$

The total cross-section is

$$\sigma = 4Z^2\alpha^2\frac{v}{m^2}\,.$$

Numerically,

$$\sigma = 10^{-22}\ \text{cm}^2\,.$$

This cross-section exceeds essentially the cross-section of e^+e^- production in collision of the uranium nuclei, which is close to 10^{-25} cm^2.

For the maximum velocity of nucleus, $v \simeq 1$, we arrive at the cross-section

$$\sigma \simeq 10^{-21}\ \text{cm}^2\,.$$

Thank you for your attention!