TOMSK POLYTECHNIC UNIVERSITY

Physical interpretation and asymptotic analysis of particle's energy losses on the polarization radiation process

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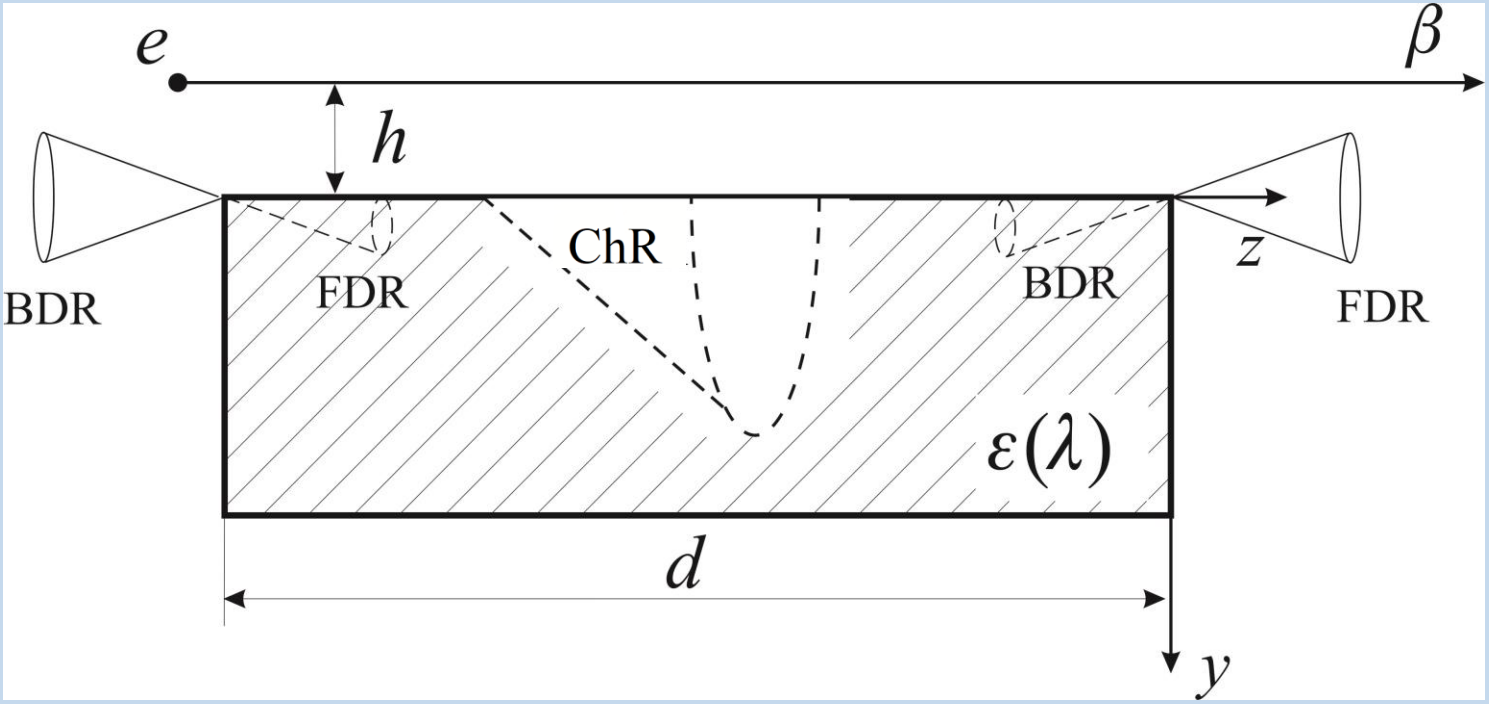
Motivation

- Beam instrumentation and beam dynamic purposes
- Novel acceleration techniques using dielectric material
- Sources of electromagnetic radiation

Geometry



D.V. Karlovets and A.P. Potylitsyn, JETP Lett. **90** (2009) 326.

M. Shevelev, A. Konkov, A. Aryshev, Phys. Rev. A. **92** (2015) 053851.

Approximations

- Non-polar, nondispersive mediums with $\varepsilon > 2$
- Ultrarelativistic particle's energy
- Small radiation angles

Main equations

$$W_{DR} = \frac{3}{8}\frac{e^2}{h}\gamma\left[\frac{\sqrt{\varepsilon}\pm 1}{\sqrt{\varepsilon}\mp 1}\right]^2$$

Forward DR – upper sign
Backward DR – lower sing

$$W_{ChR} = \frac{e^2}{32\sqrt{2}h^2}\gamma d\frac{\sqrt{\varepsilon-1}}{\varepsilon}$$

Non-stationary ChR

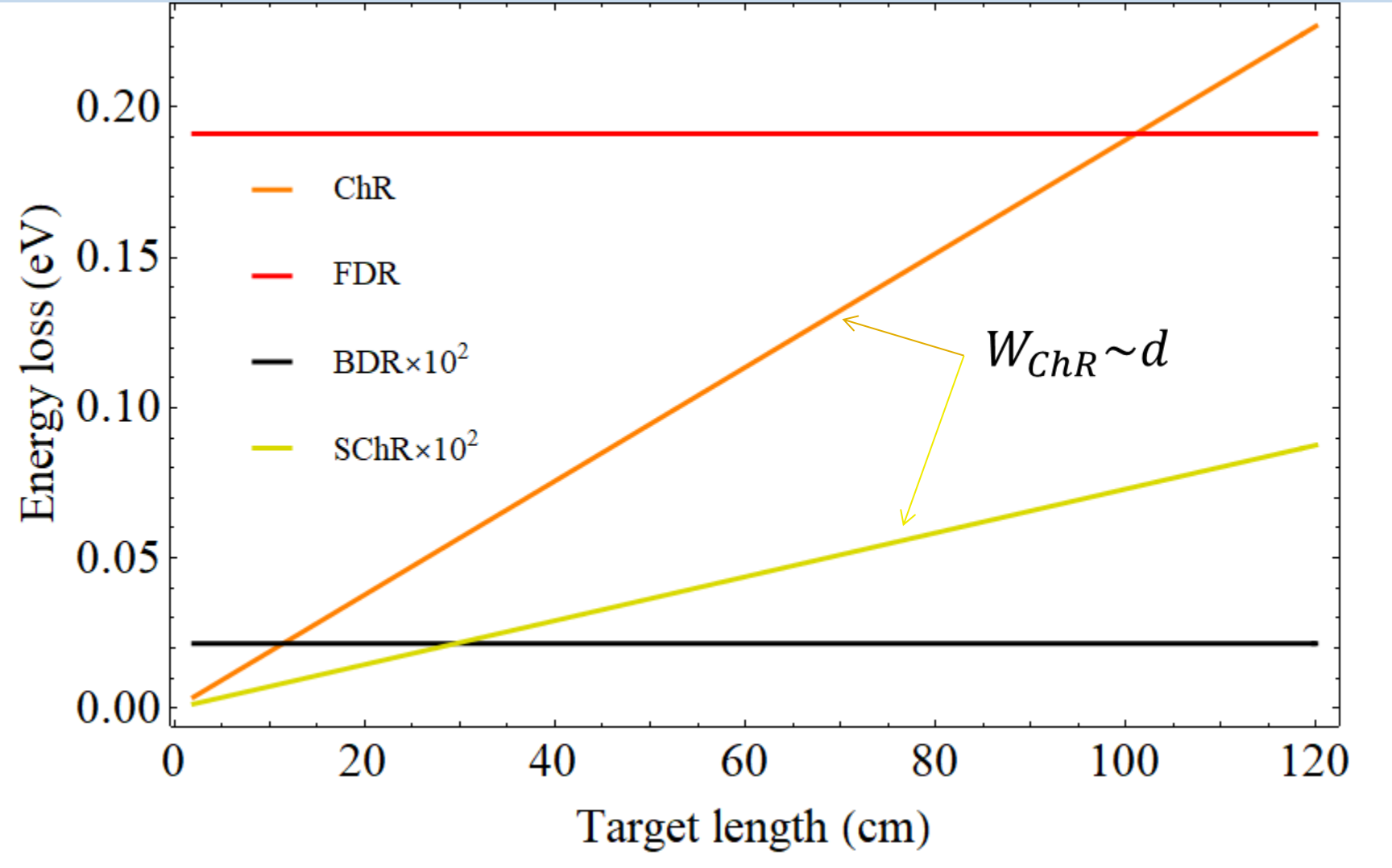
Stationary ChR [A.I. Morozov, JETP **32** (1957) 1260]:

$$W_{SChR} = \frac{e^2}{2\beta h^2}\frac{z}{\varepsilon-1}\left[\frac{\varepsilon}{\sqrt{1+\gamma^{-2}\varepsilon}} - \gamma^{-1}\sqrt{\varepsilon-1} - \beta\right] \approx \frac{e^2}{2h^2}z$$

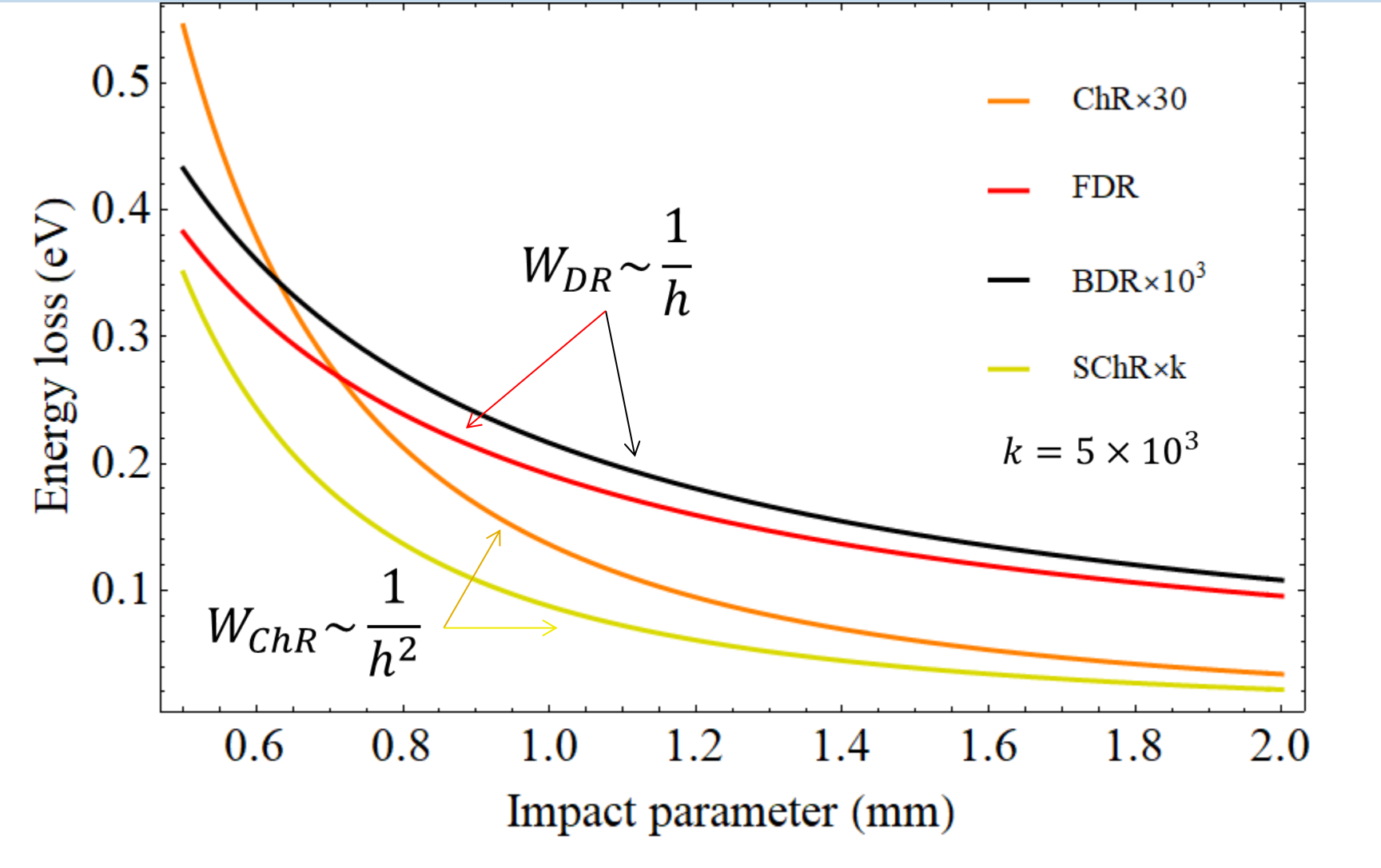
$$\gamma = \sqrt{1-\beta^2}$$

Particle‘s Lorentz factor

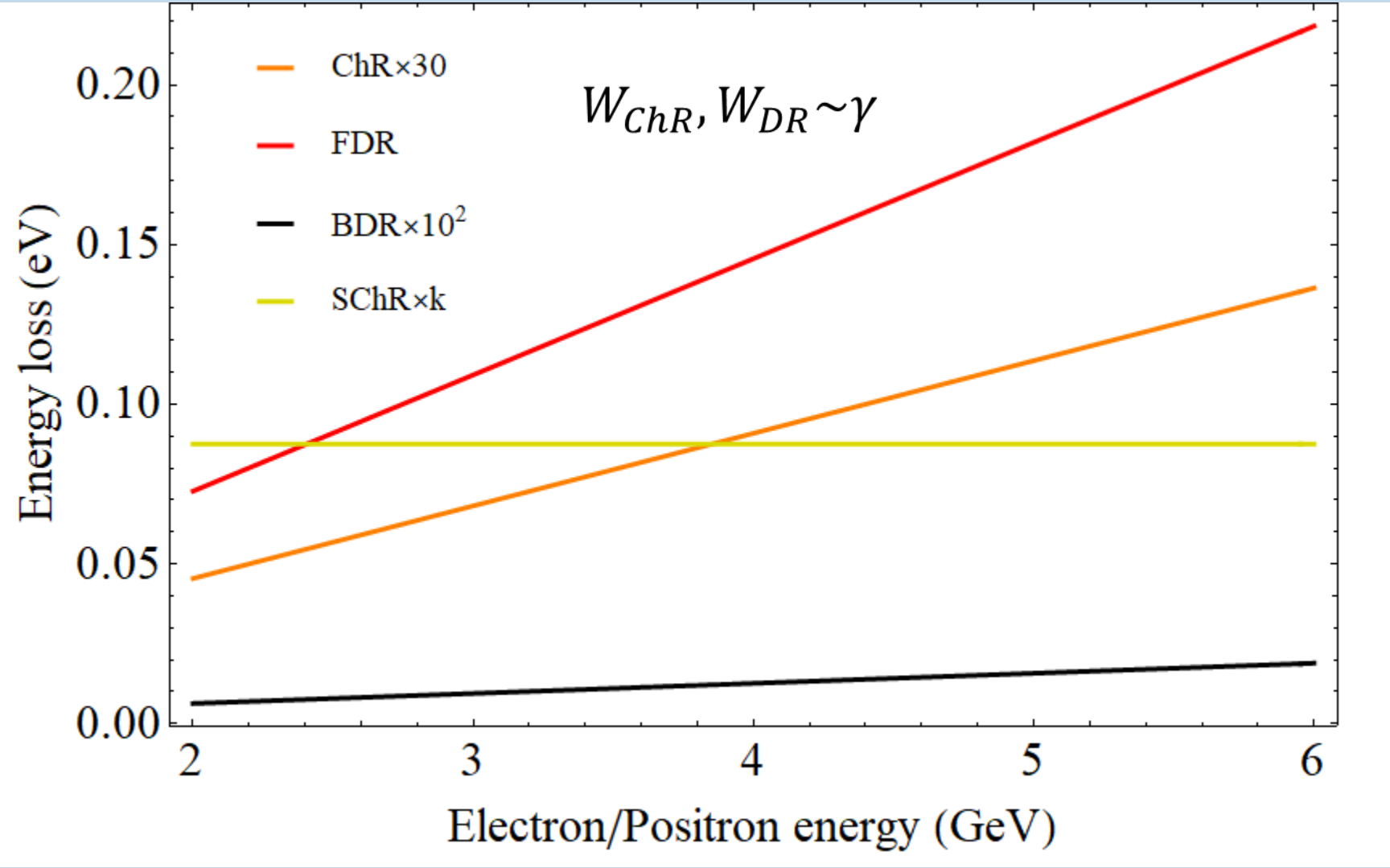
Target length influence



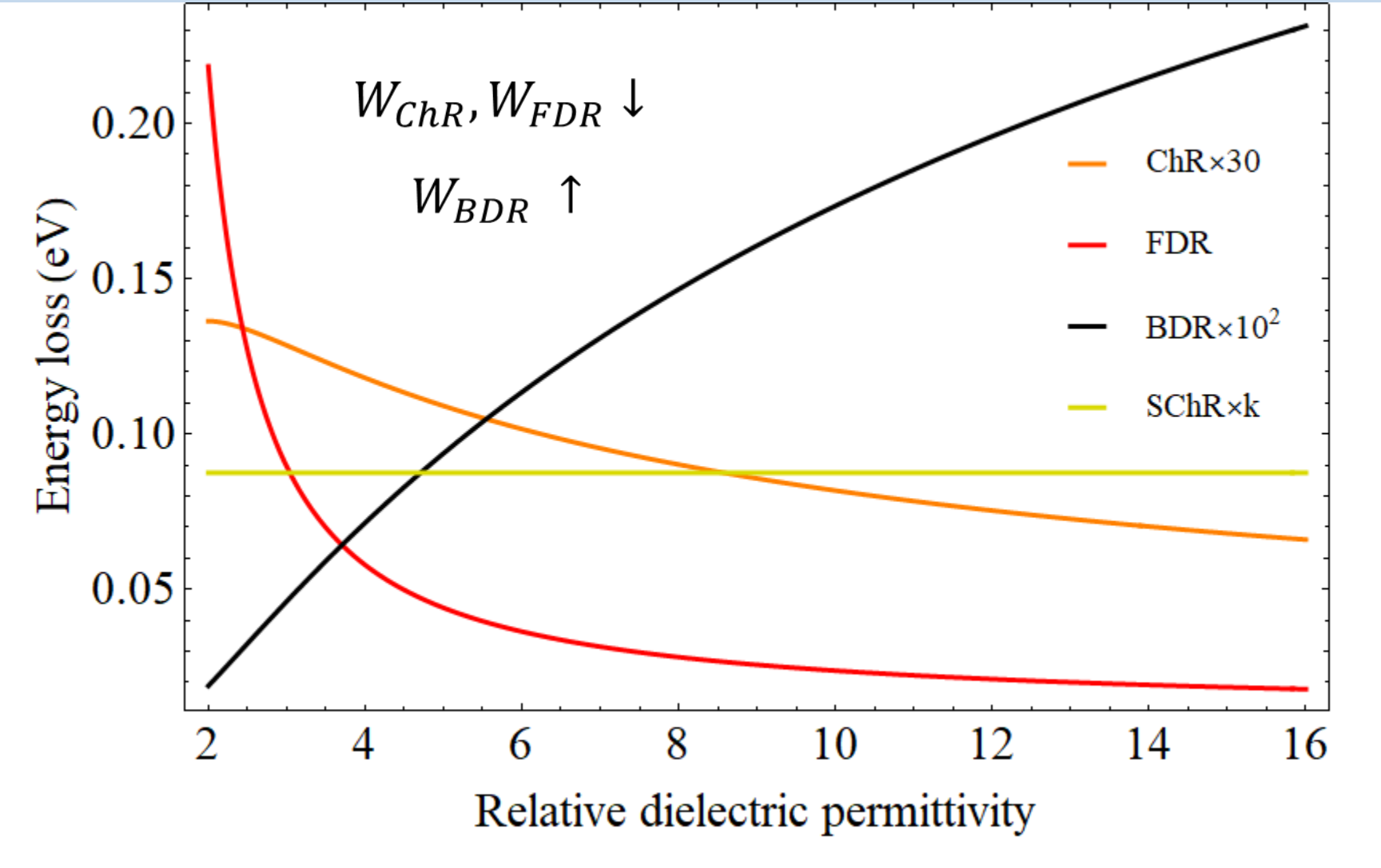
Impact parameter influence



Particle's energy influence



Dielectric properties influence



Conclusion

The devil is in the detail

- Stationary ChR ≠ ChR from the finite size target
- The borders are the cause of the field renormalization effect

Thank you for your attention!

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