# Comparison of the Smith-Purcell radiation yield for different models

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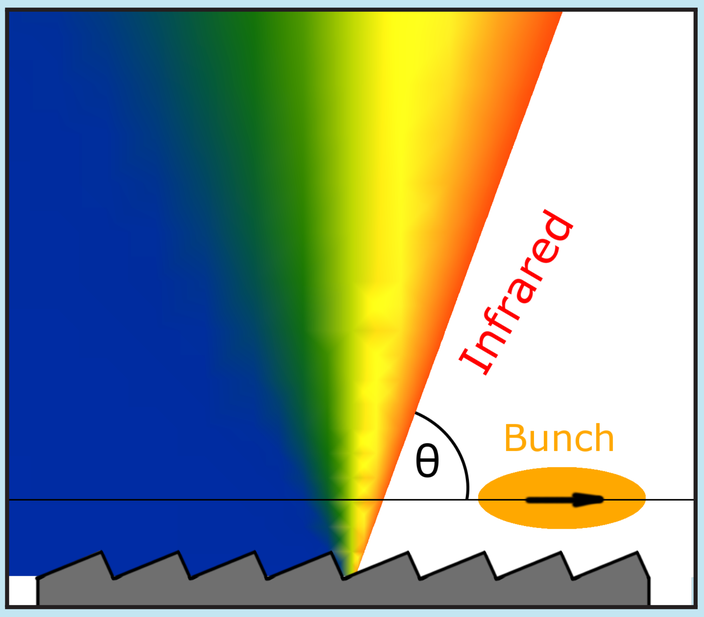
## Smith-Purcell radiation

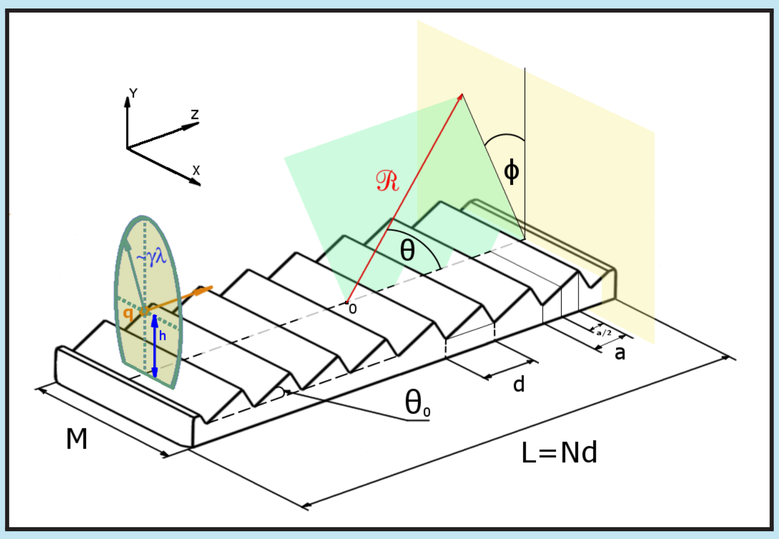
Smith-Purcell radiation is a phenomenon observed, when a charged particle moves near a periodical grating




It has a specific wavelength dependency:

$$\lambda = \frac{d}{n}\left(\frac{1}{\beta} - \cos\theta\right)$$

## Parameters




| Symb. | SPESO | E203 | Units | Description |
|---|---|---|---|---|
| $\gamma$ | 200 | $4\times10^4$ | 1 | The Lorentz factor (E=100 MeV) |
| $d$ | 10 | 0.25 | mm | The grating period |
| $a$ | 7.5 | 0.187 | mm | The width of one strip |
| $R_0$ | 310 | 220 | mm | The distance between detector and grating |
| $L$ | 90 | 40 | mm | The length of the grating |
| $M$ | 20 | 20 | mm | The width of the grating |
| $h$ | 5 | 1 | mm | The beam-grating separation |
| $\theta_0$ | 30 | 30 | deg | The blaze angle |
| $C_1'$ | 400 | 6395 | $mm^{-3}$ | The normalization constant for the RRR model |

## References

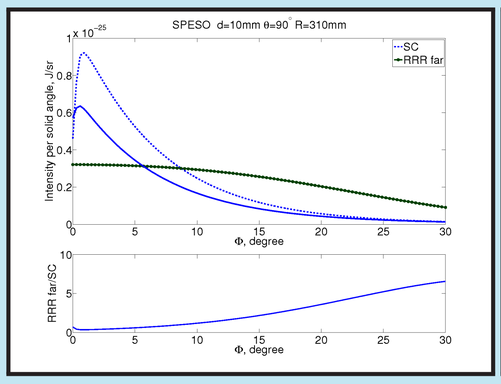
[1] D. V. Karlovets and A. P. Potylitsyn., *Phys. Rev. ST Accel. Beams*, vol. 9, p. 080701, 2006.
[2] J. H. Brownell, J. Walsh, G. Doucas, *Phys. Rev. E* vol. 57, pp. 1075–1080, 1998.
[3] D. V. Karlovets and A. P. Potylitsyn., *JETP Letters*, vol. 84, no. 9, pp. 489-–493, 2006.

## Models

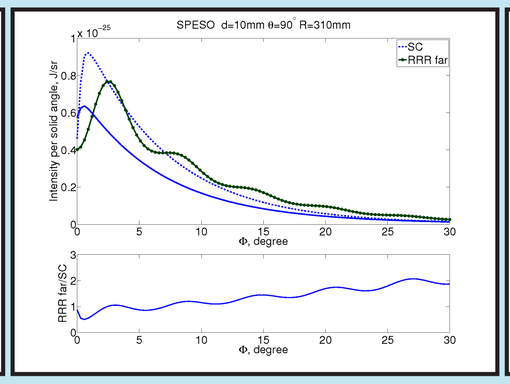
The models, that were used: **R**esonance **D**iffraction **R**adiation (**RDR**) [1], **S**urface **C**urrent (**SC, GFW**)[1,2], **R**esonance **R**eflection **R**adiation (**RRR**) [3].
By SC we mean the Surface current model, with the assumption, that the width of the grating is infinite, whether the GFW model takes it into account.

## Width dependance

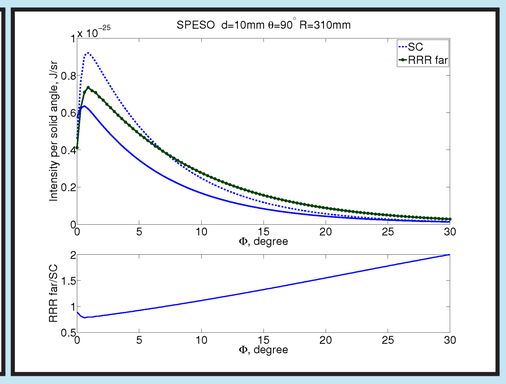
With the increase of the grating width, the RRR model tends to be like the SC and RDR models.
The parameters are from the SPESO experiment.




M=20mm



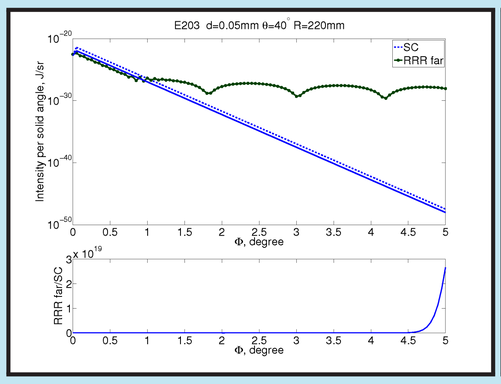

M=200mm



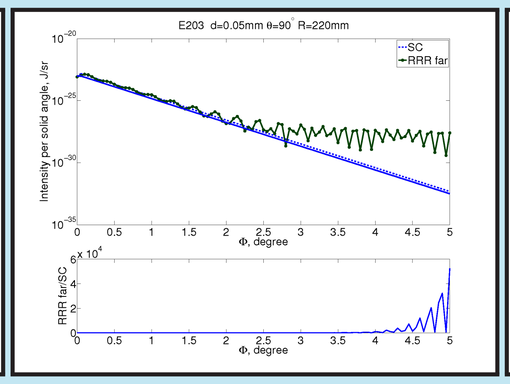

M=2000mm

## Angle dependance

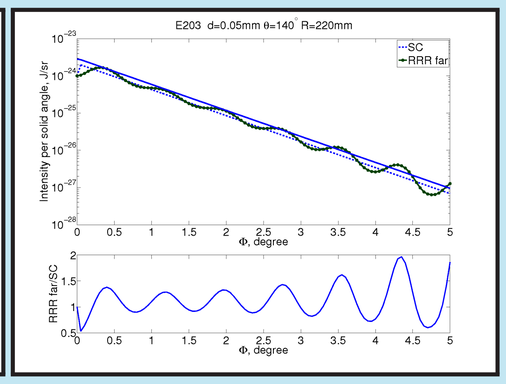
Increasing the observation angle means the decrease of the wavelength, as result the influence of the grating width will be more intense at larger phi. The parameters are from the E203 experiment, the pitch is d=50$\mu m$.




$\theta = 40°$




$\theta = 90°$




$\theta = 140°$

## Comparison of the models