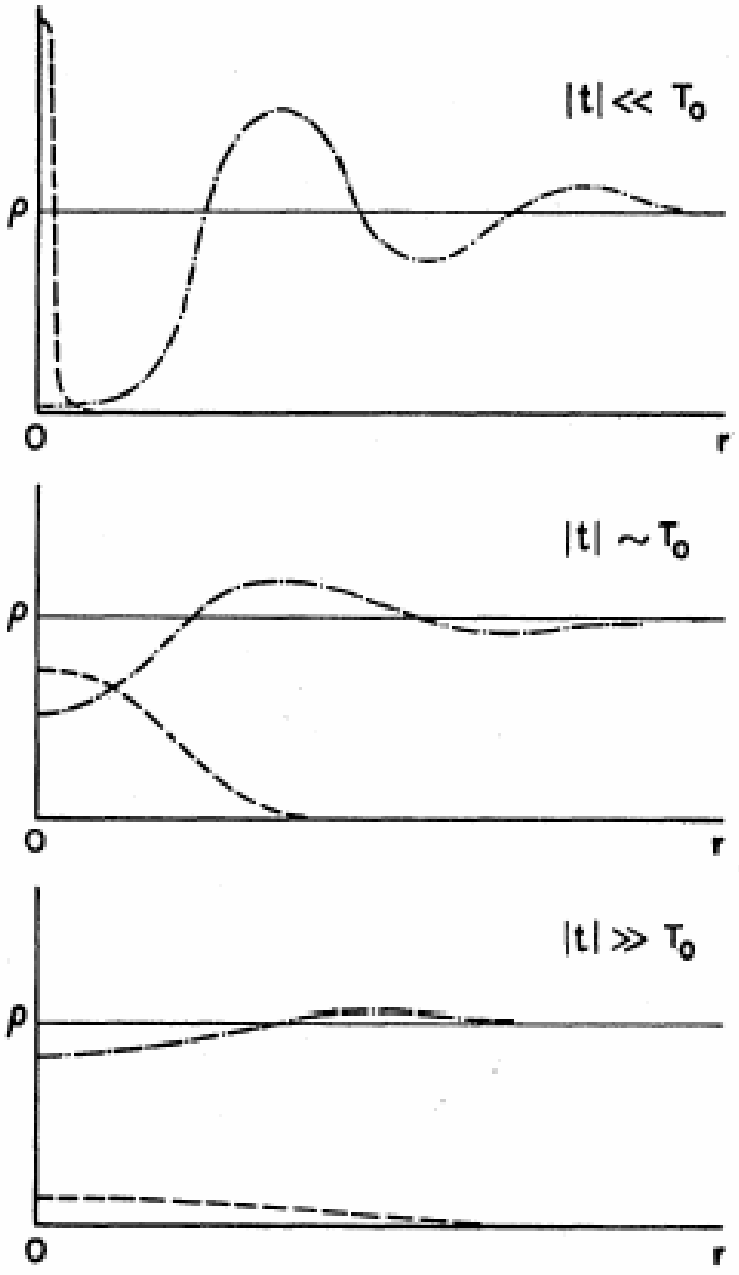
Korrelationsfunktionen in Flüssigkeiten oder Gasen



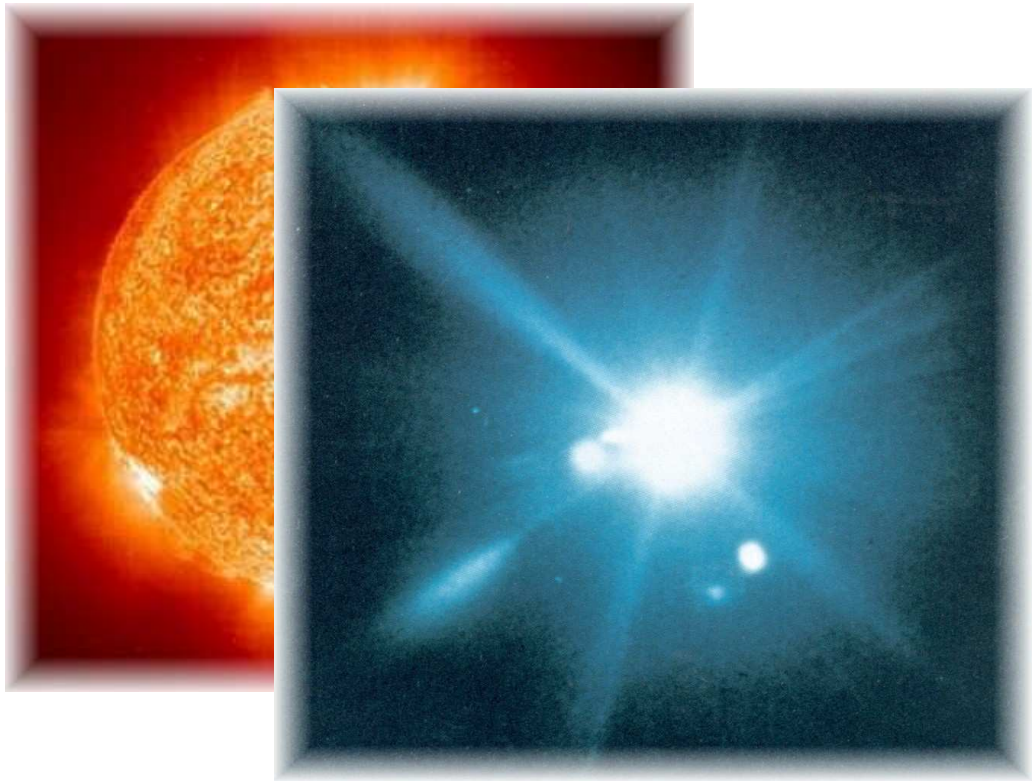
mittlere Dichte

Relaxationszeit T_0

L. Van Hove, *Phys. Rev.* **95**, 249 (1954)

Introduction to synchrotron radiation

Martin Müller
Institut für Experimentelle und Angewandte Physik
der Christian-Albrechts-Universität zu Kiel



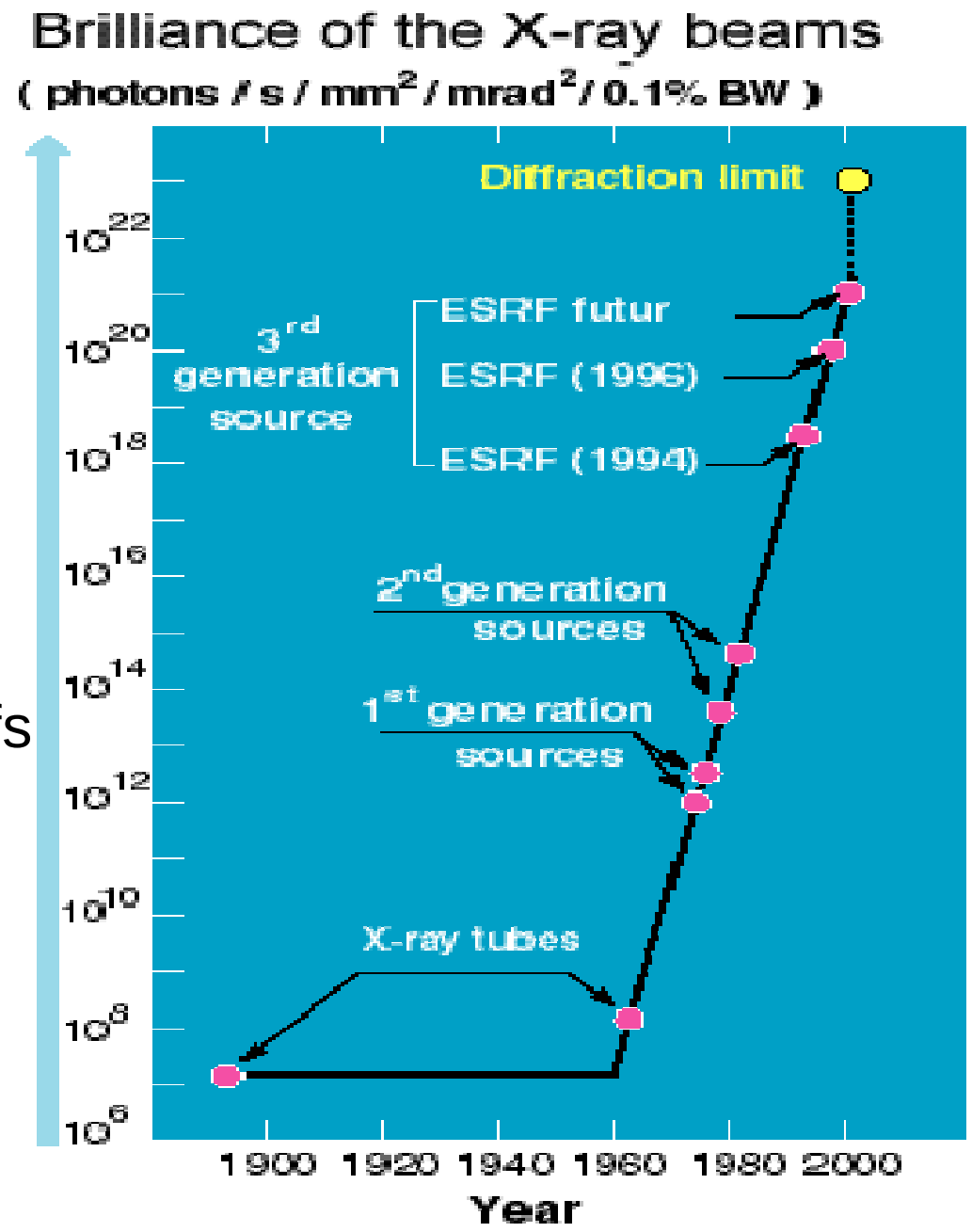
Brighter than the sun!

Synchrotronstrahlung

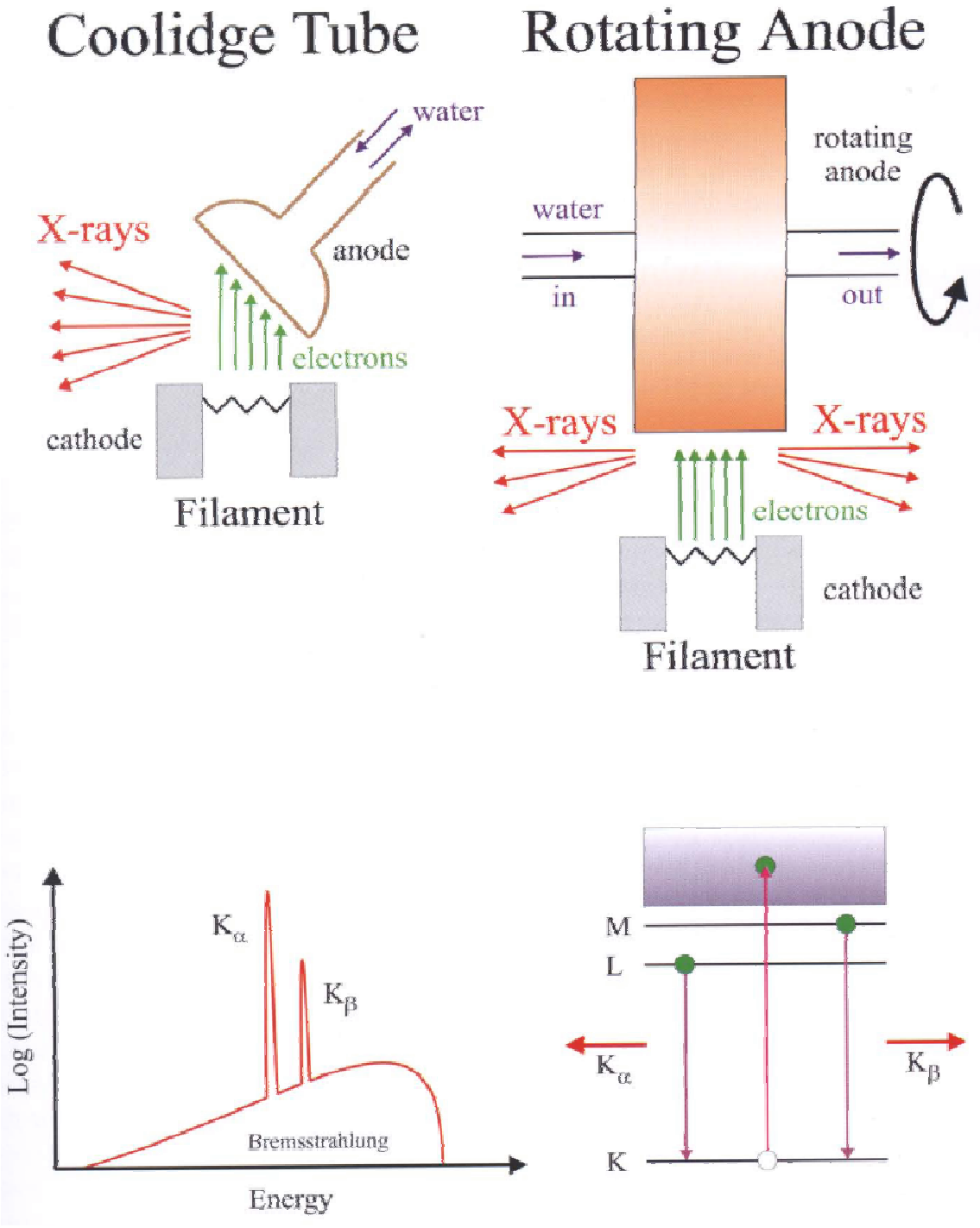
Synchrotron-Infos
auf Kieler Website:

Komitee
Forschung mit
Synchrotronstrahlung

http://www.physik.uni-kiel.de/kfs



Konventionelle Röntgenquellen

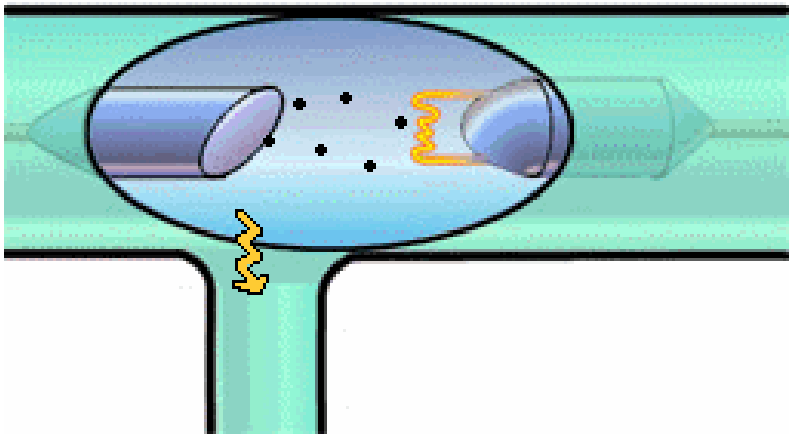


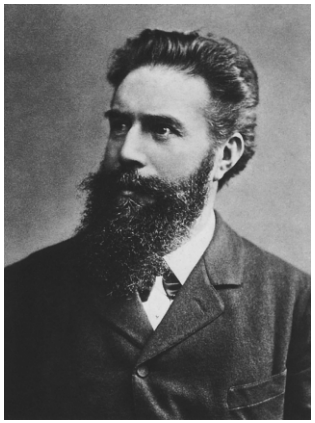
Als-Nielsen 2001, Abb. 2.1

Generation of X-rays…

...by decelerated / accelerated electrons

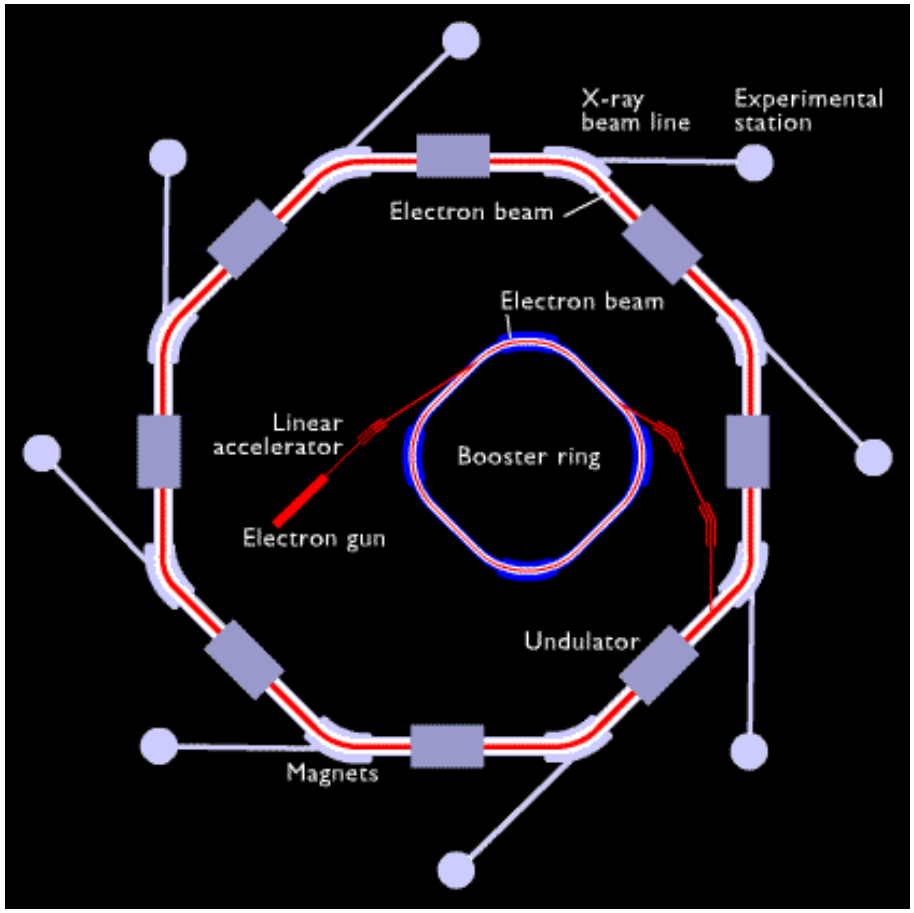
X-ray tube (anode)



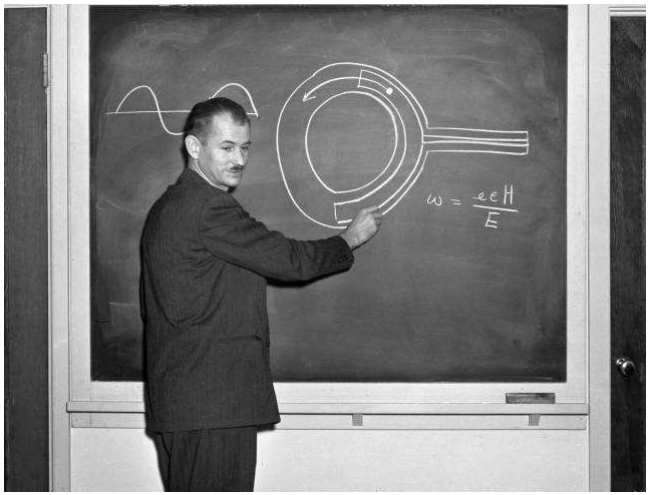


1895

Electron Synchrotron



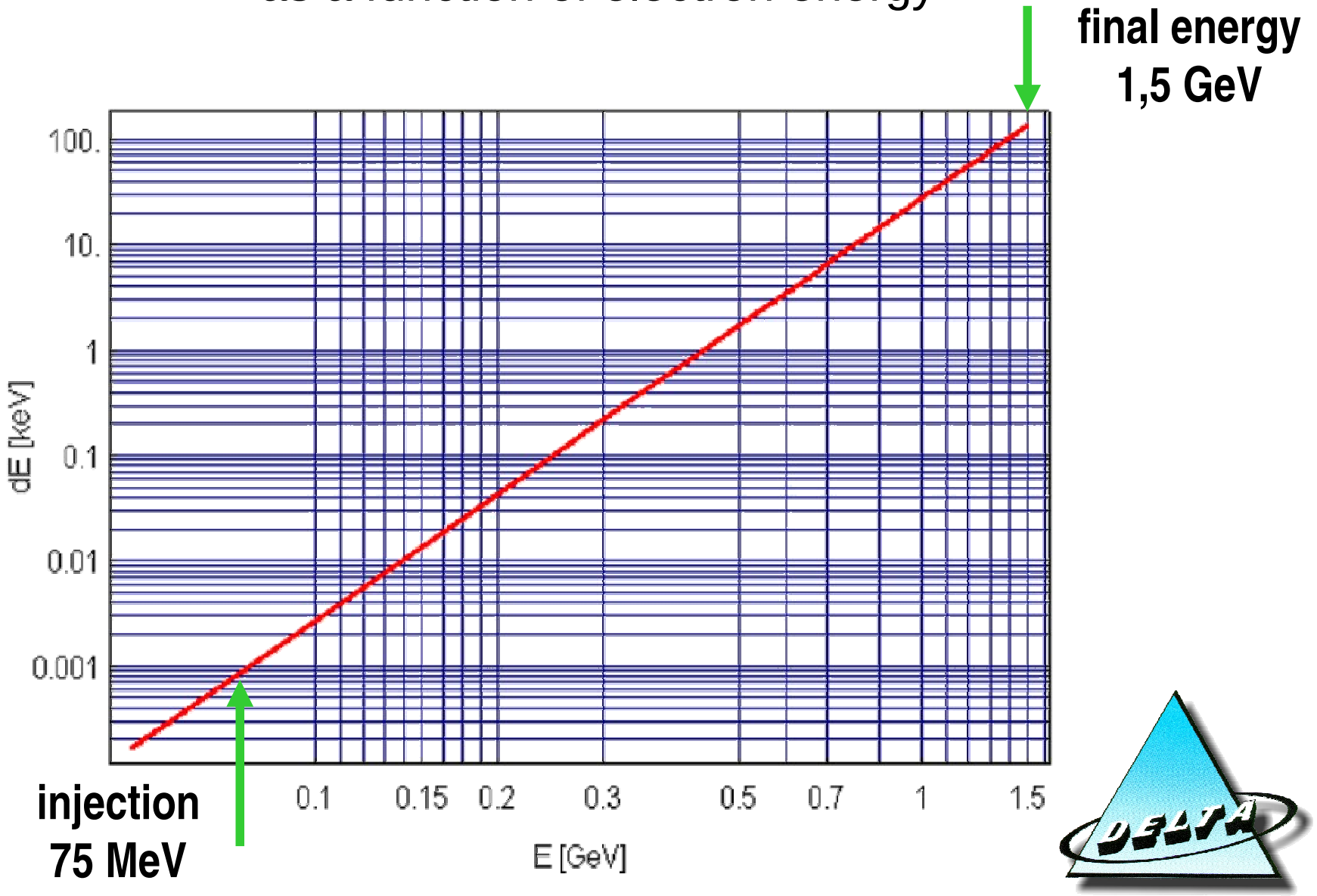
The first synchrotron (1948)



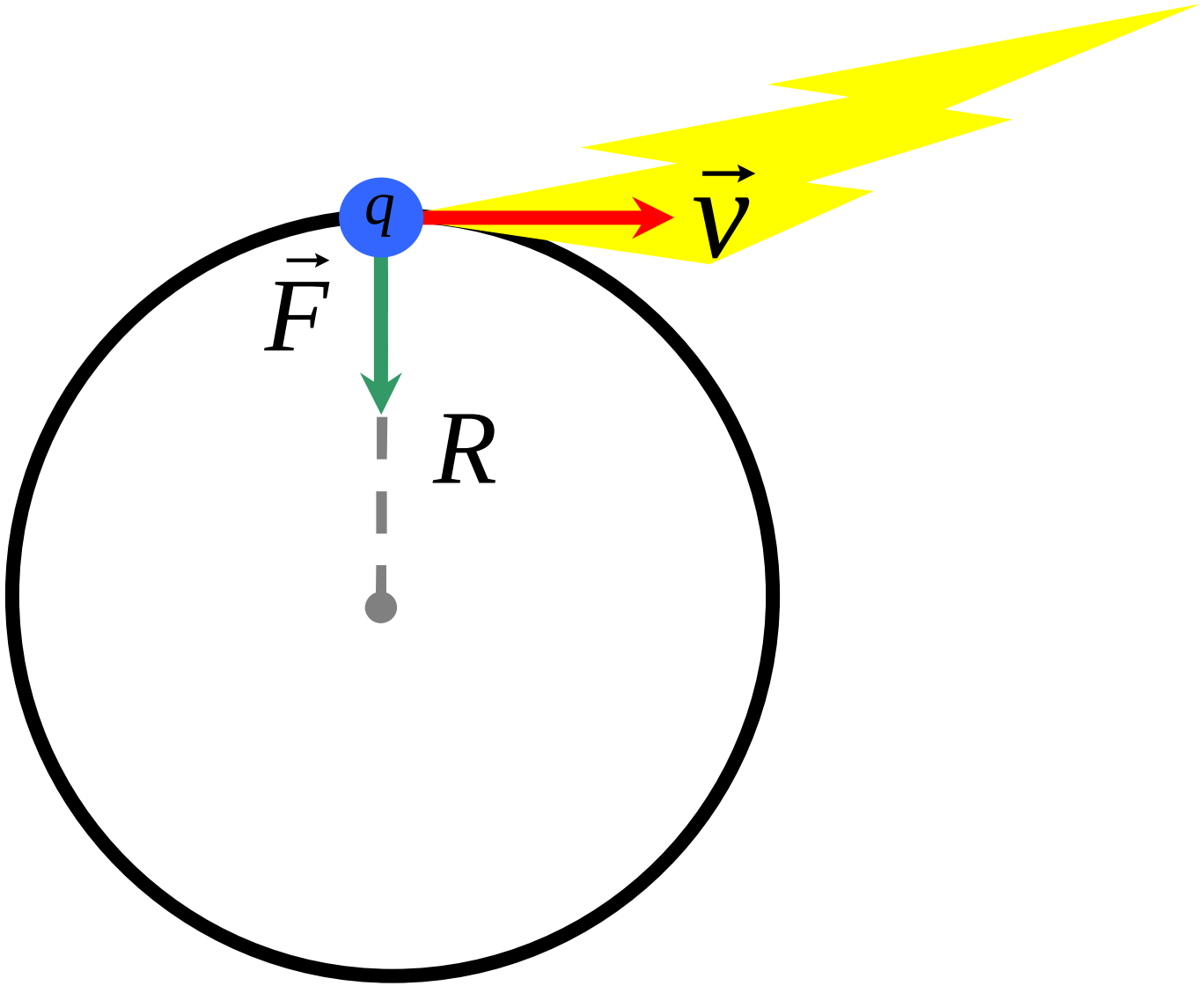
Edwin McMillan,
Berkeley Laboratory

Energy loss per cycle

as a function of electron energy

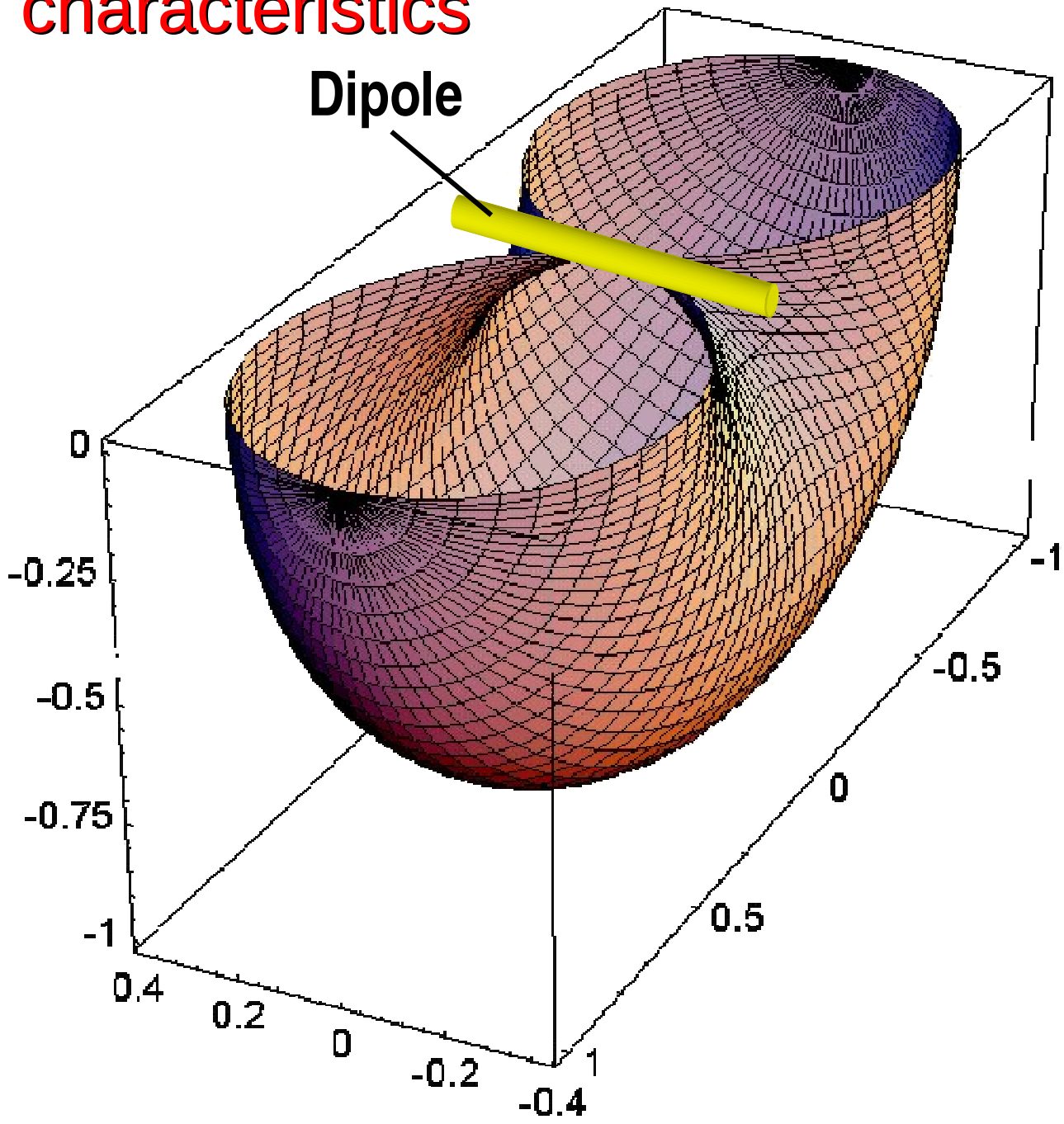


Charge (e.g. electron) in circular orbit

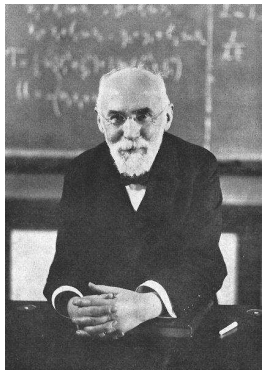


Dipole radiation characteristics

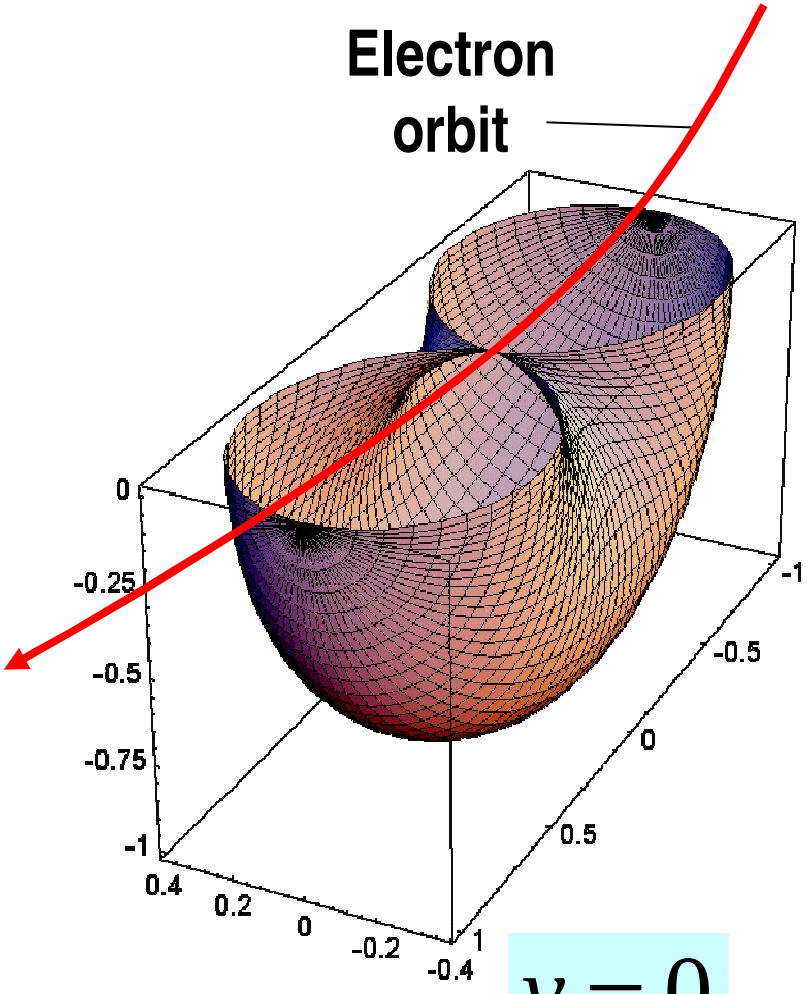
$v << c$



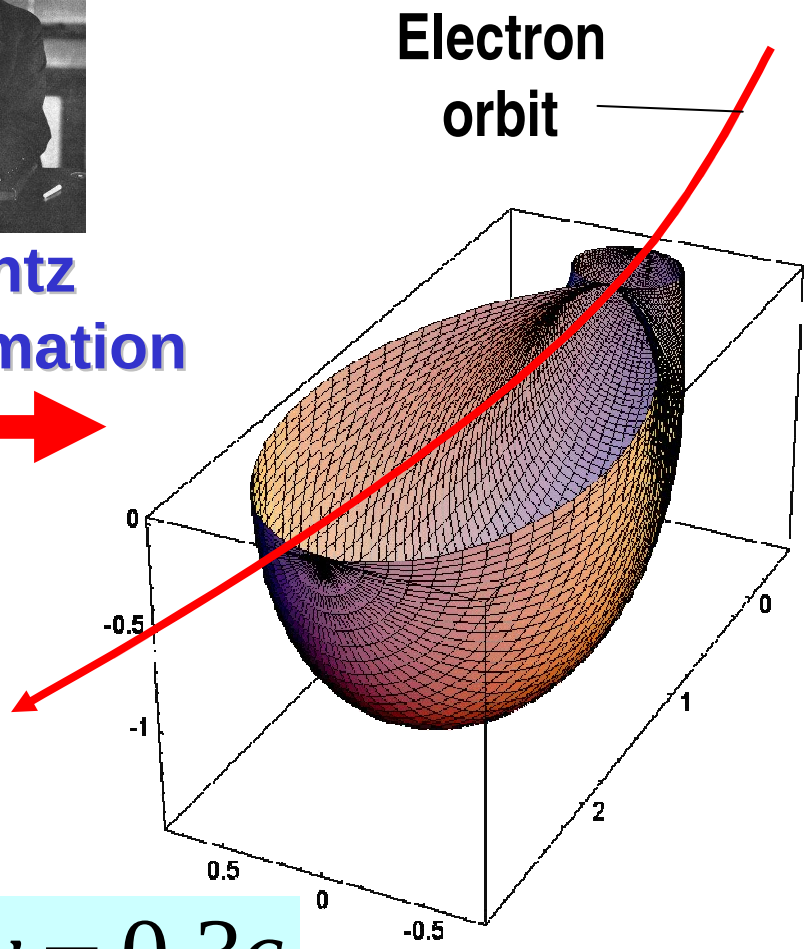
Lorentz transformation



Lorentz transformation

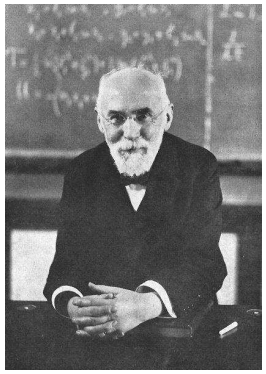


$v = 0$

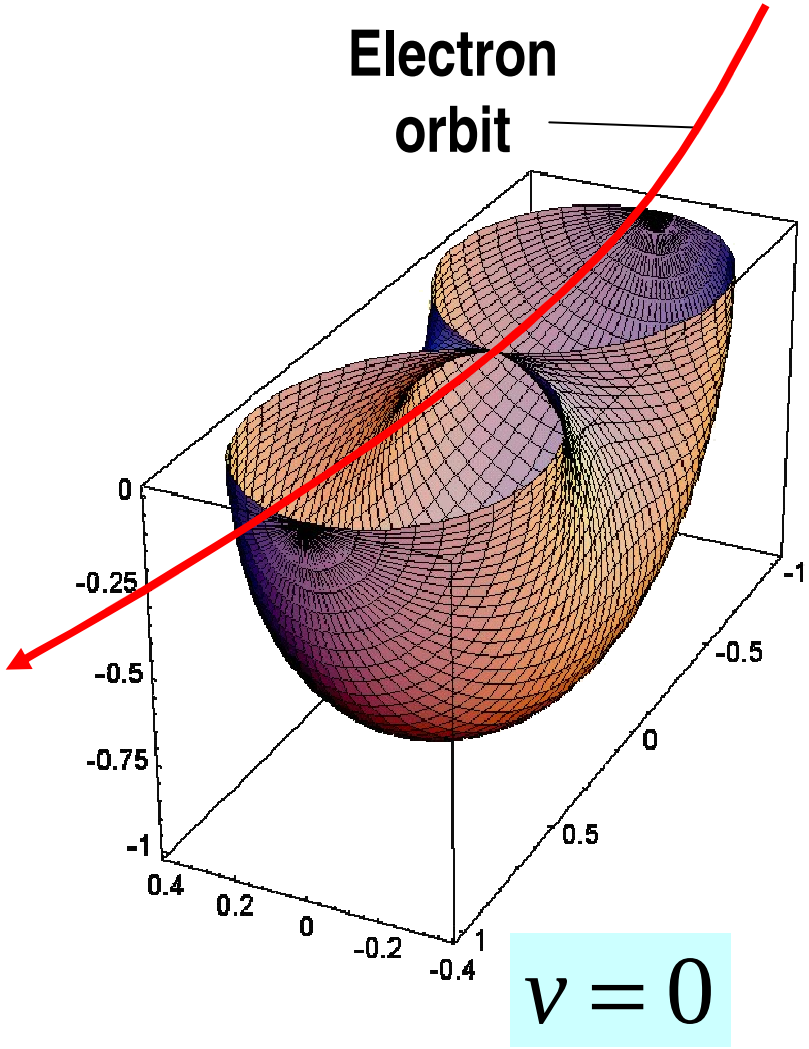


$v = 0.3c$

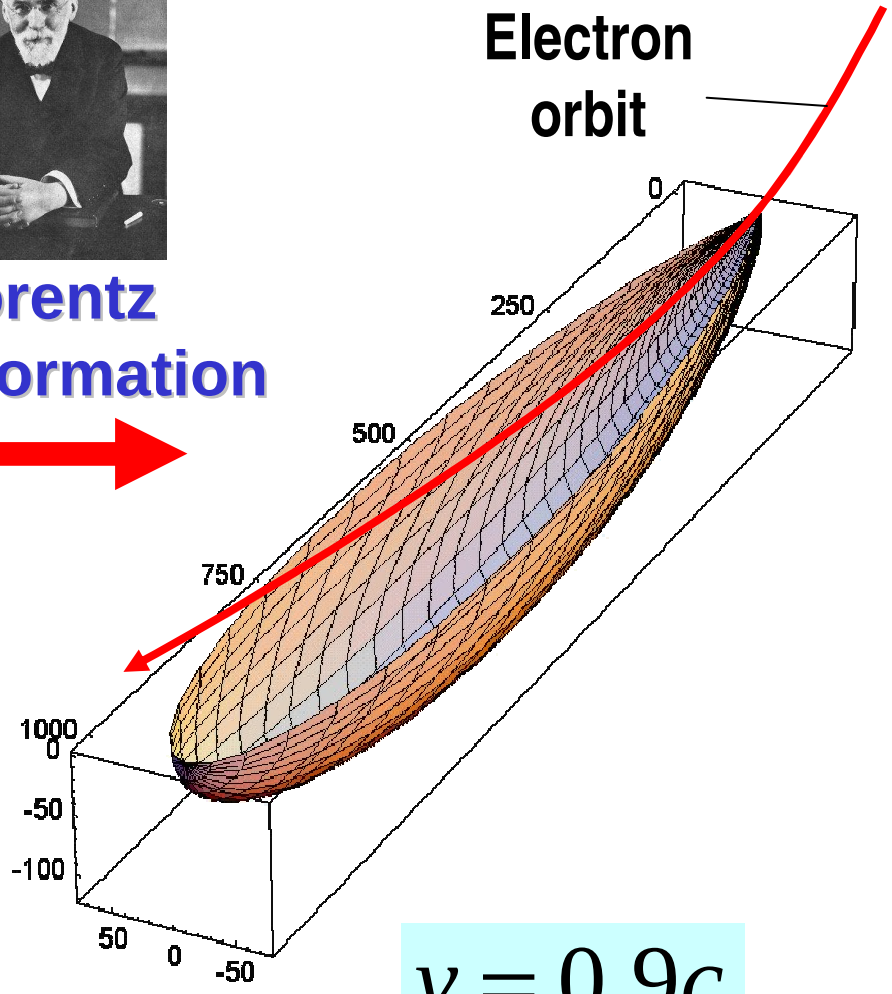
Lorentz transformation



Lorentz transformation

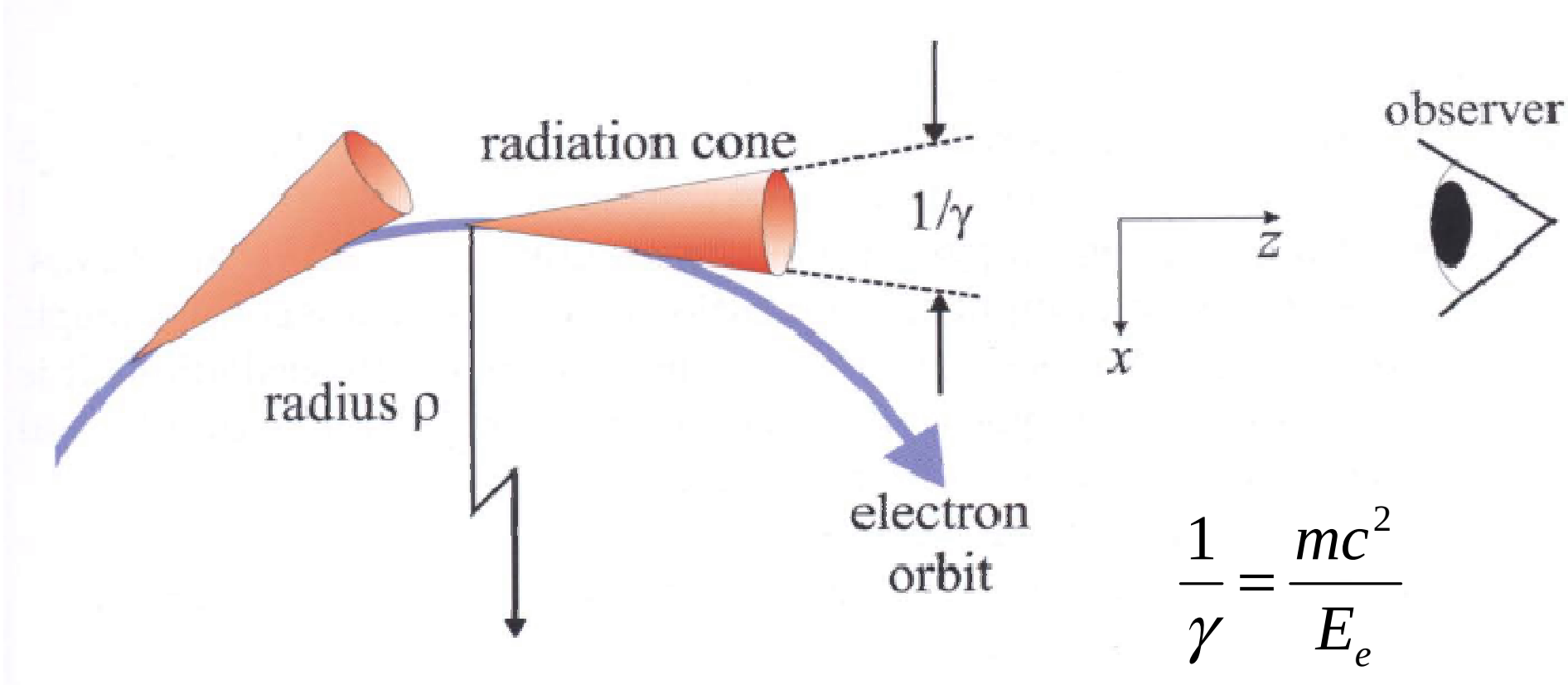


$v = 0$



$v = 0.9c$

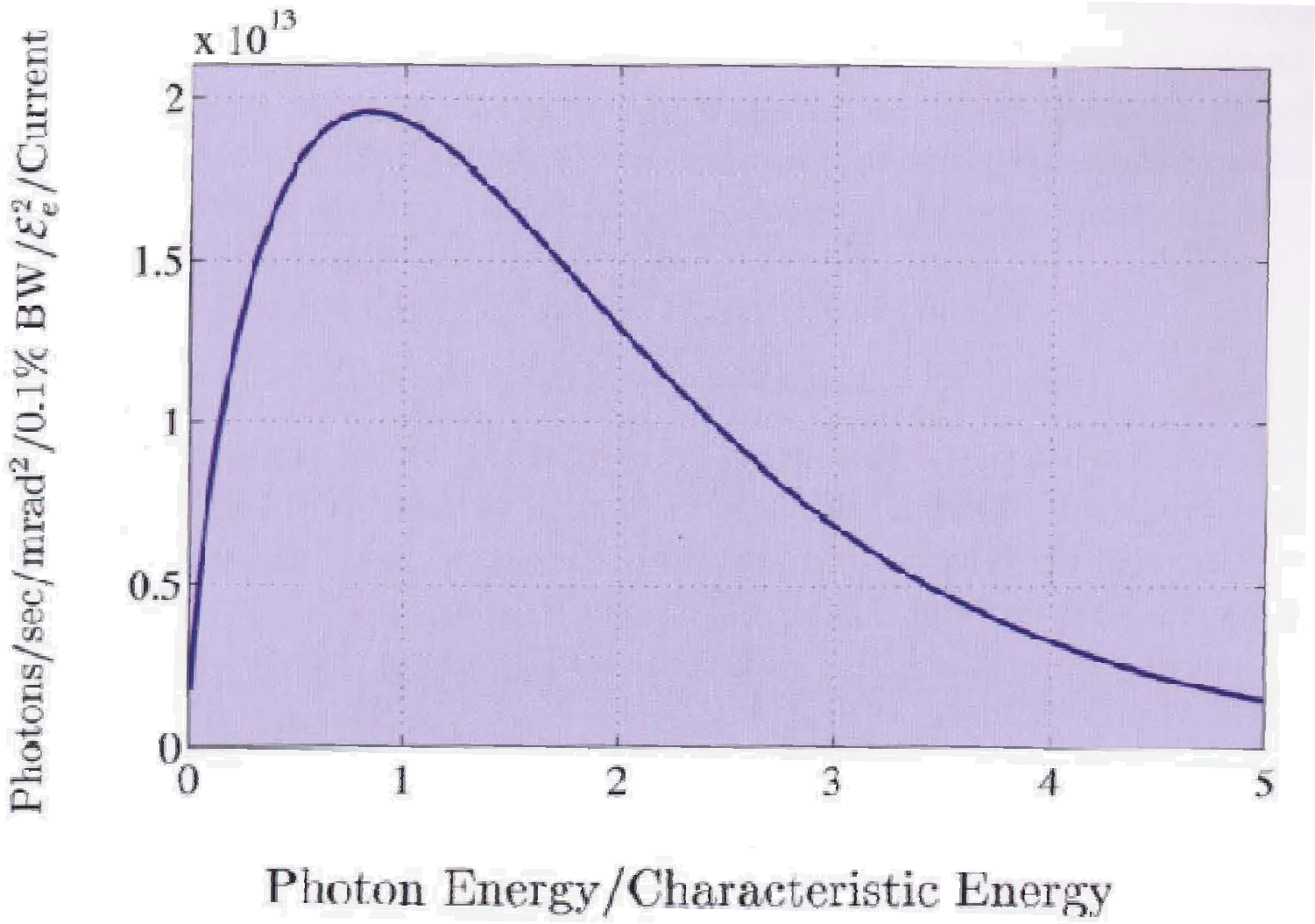
Synchrotronstrahlung von einem Kreisbogen



$$\frac{1}{\gamma} = \frac{mc^2}{E_e}$$

Als-Nielsen 2001, Abb. 2.2

Spektrum eines Ablenkmagneten

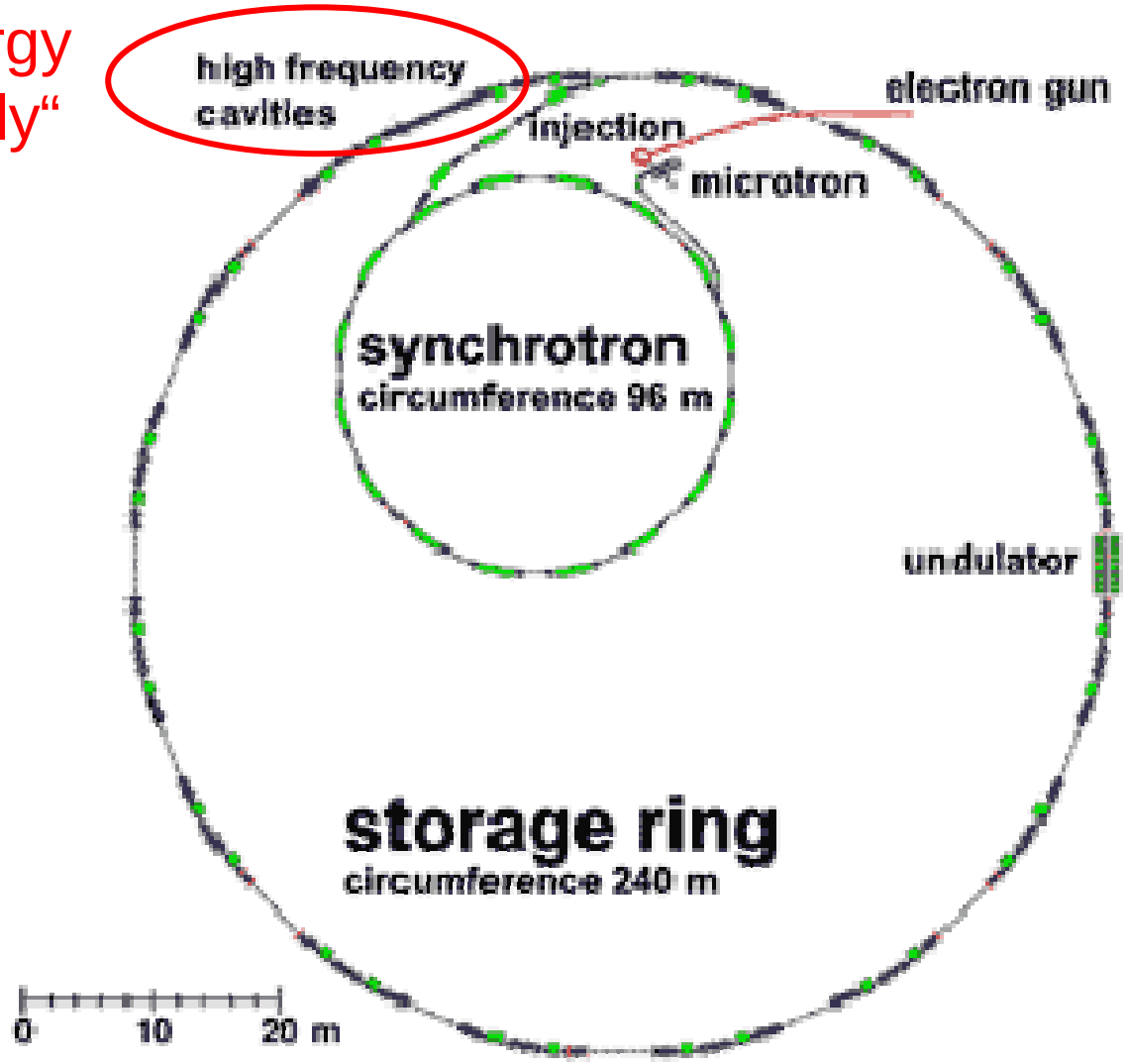


Beispiel: ESRF-Ablenkmagnet

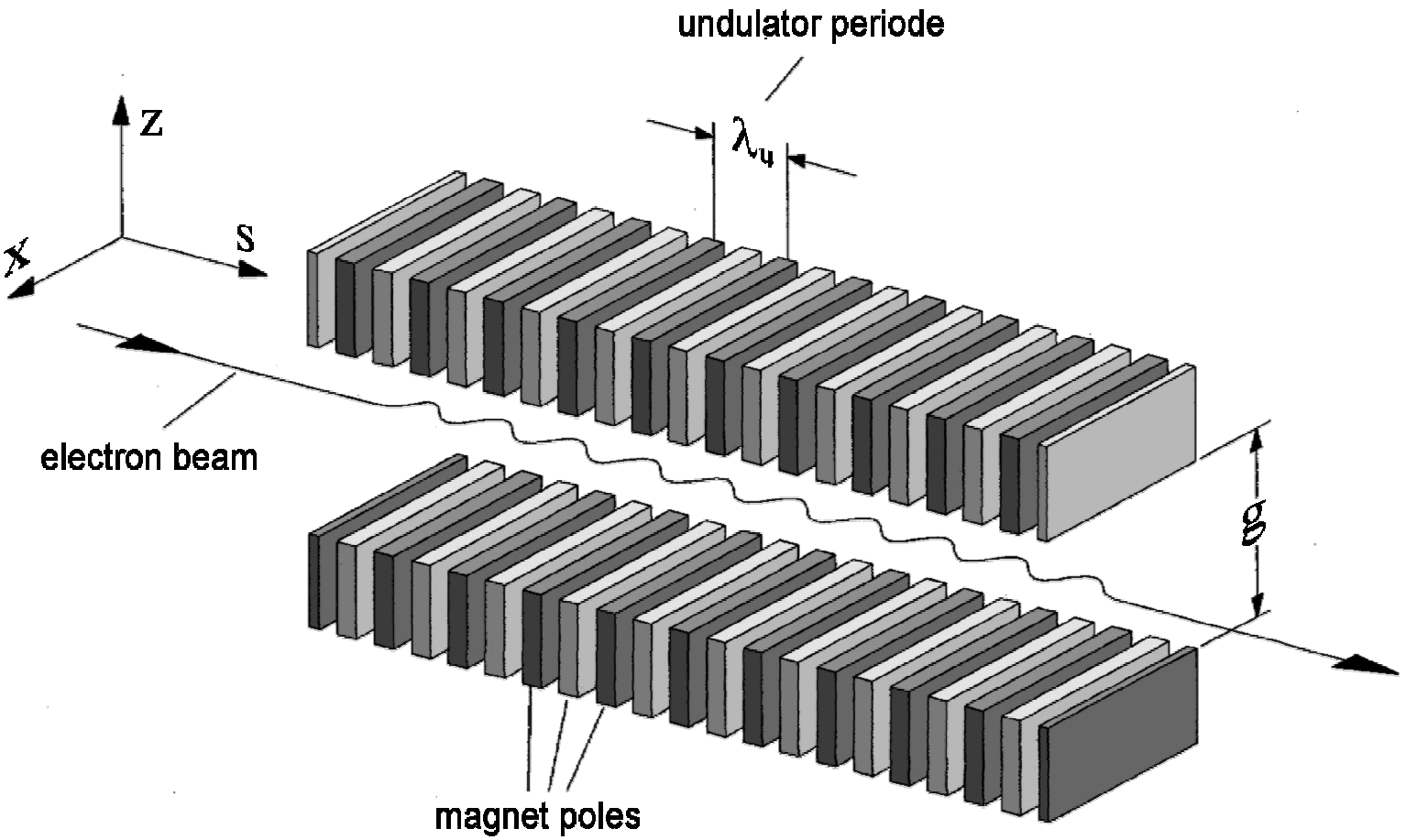
Als-Nielsen 2001, Abb. 2.5

3rd generation synchrotron (BESSY II)

„energy supply“

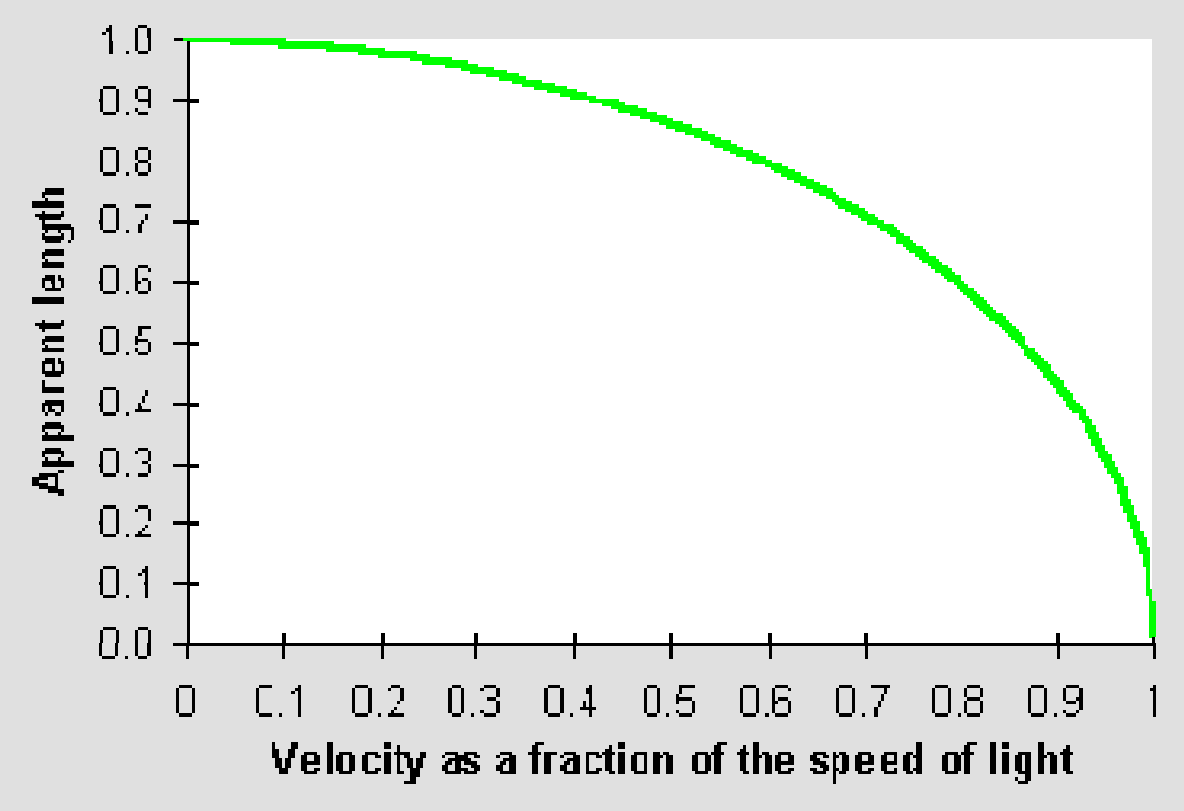


Principle of an undulator



constructive **interference** of all waves: how?

Lorentz contraction



$$l' = l\sqrt{1 - \frac{v^2}{c^2}} = l / \gamma$$

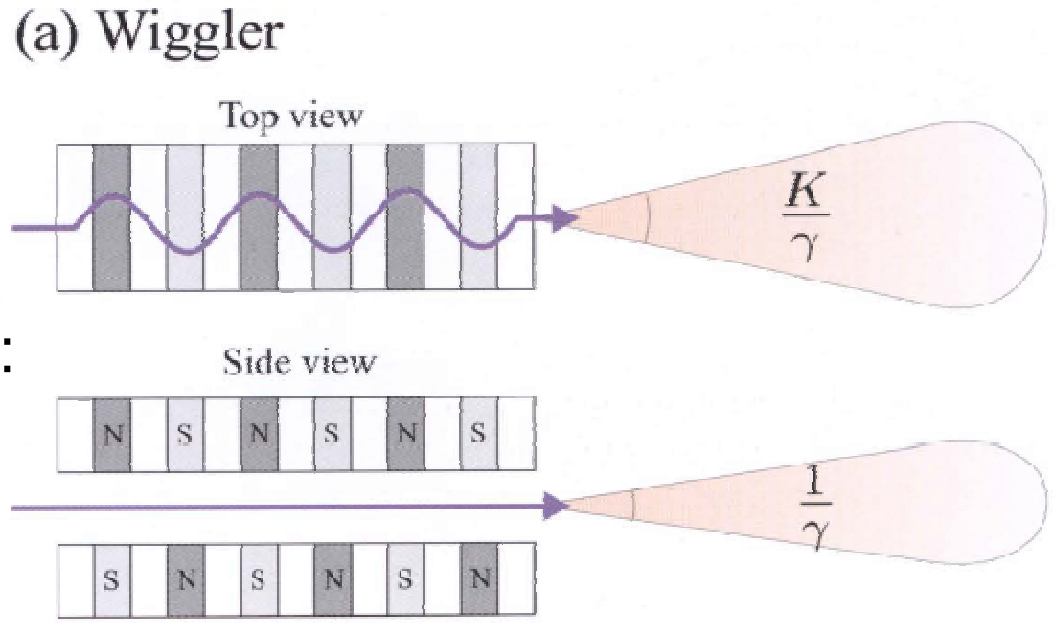
typical γ: 10^3 - 10^4

additional factor $= 1/(2\gamma)$ from Doppler effect

$\Rightarrow$ from **cm** (undulator structures) to **Å** (X-ray wavelengths)

Wiggler und Undulatoren

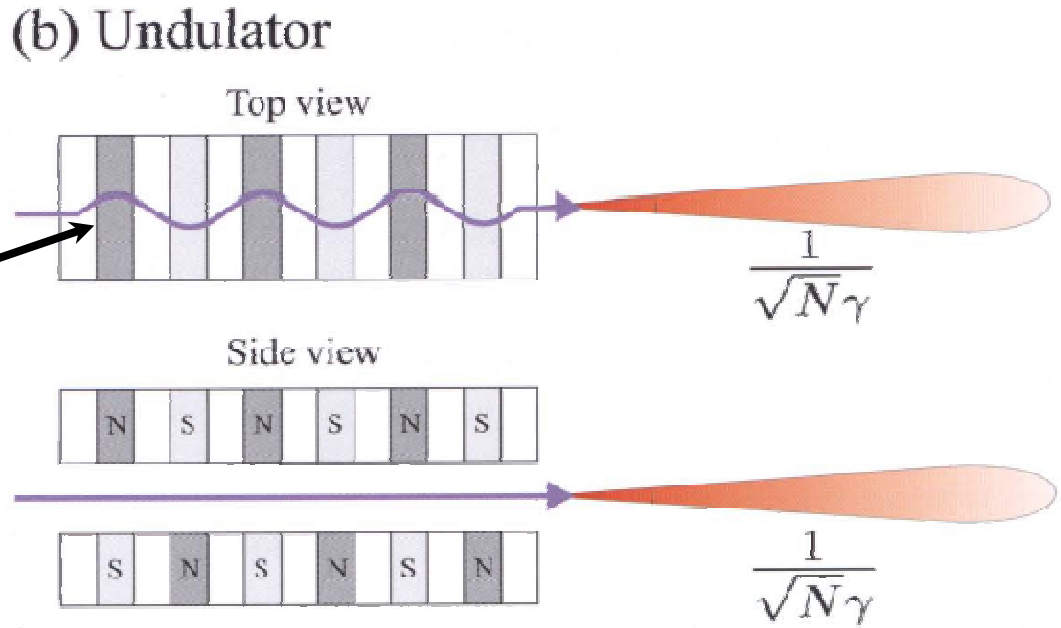
Summation von Intensitäten:
$I \times N$



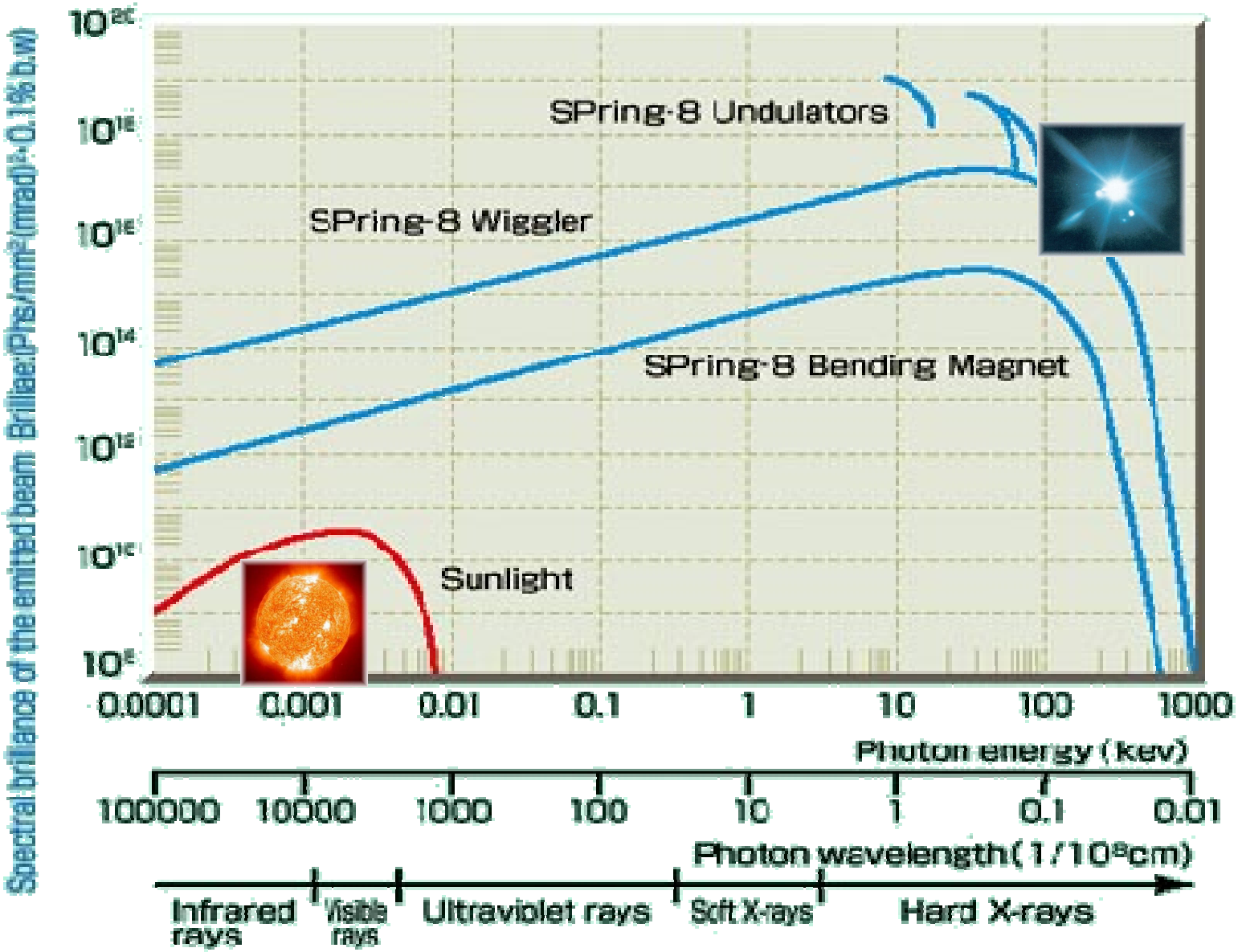
Als-Nielsen 2001, Abb. 2.7

Summation von Amplituden (Oszillationen in Phase):
$I \times N^2$

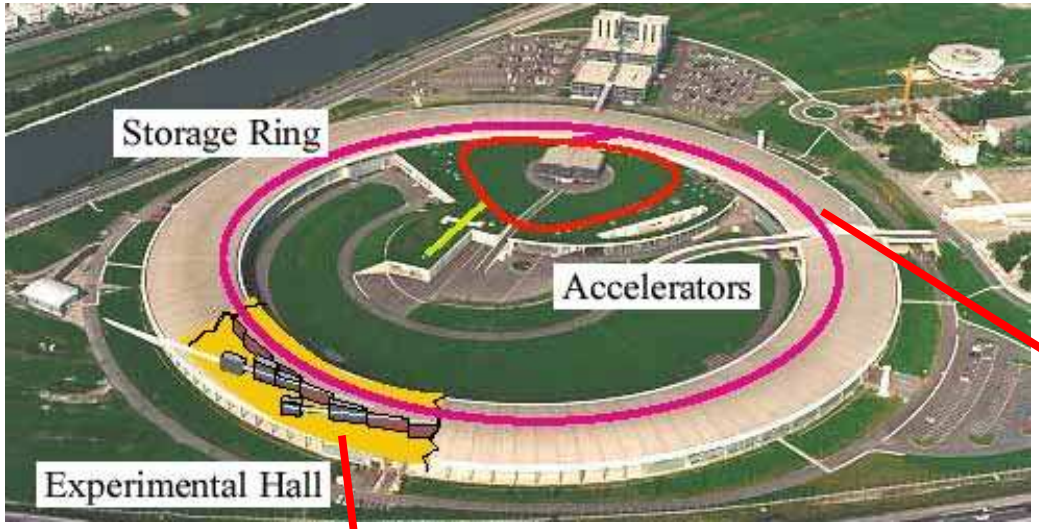
kleine Auslenkungen, Winkel K



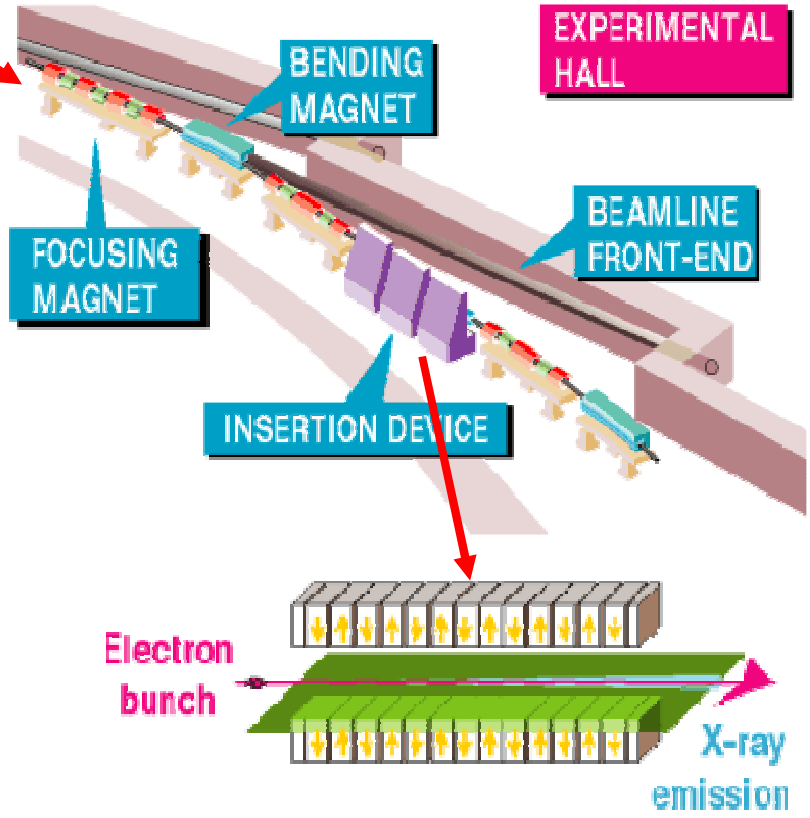
Spectral brilliance: Brighter than the sun!

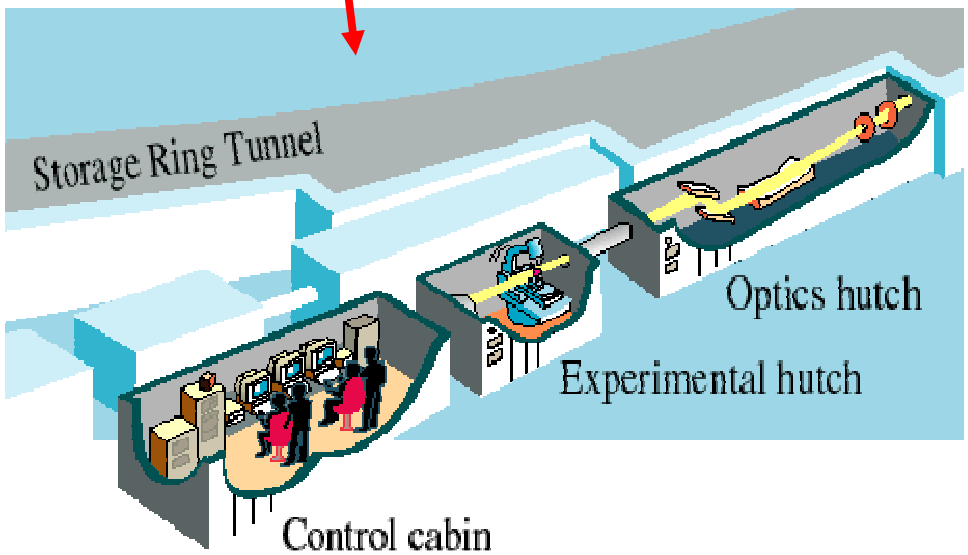


Synchrotrons today: user facilities

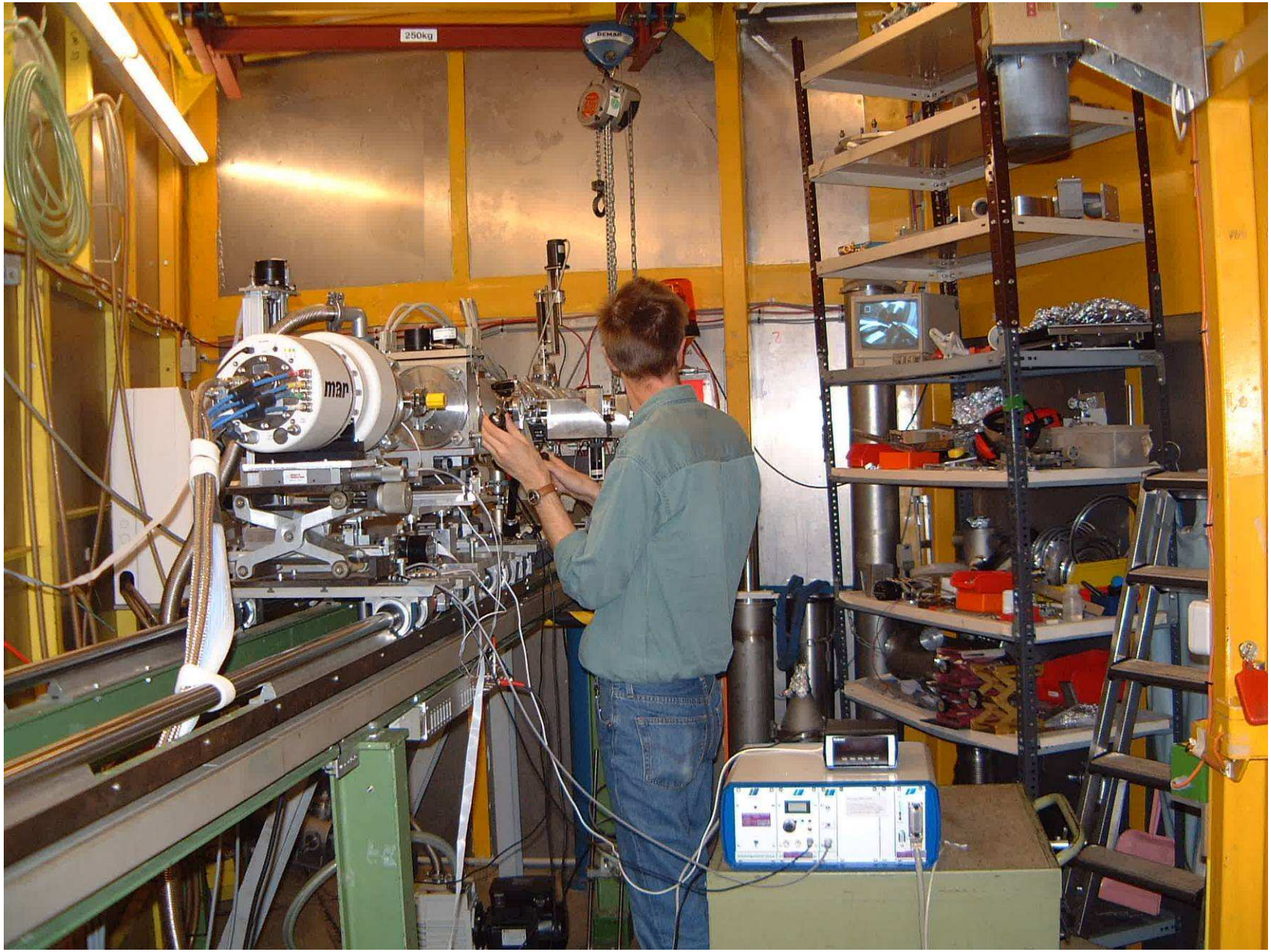


ESRF



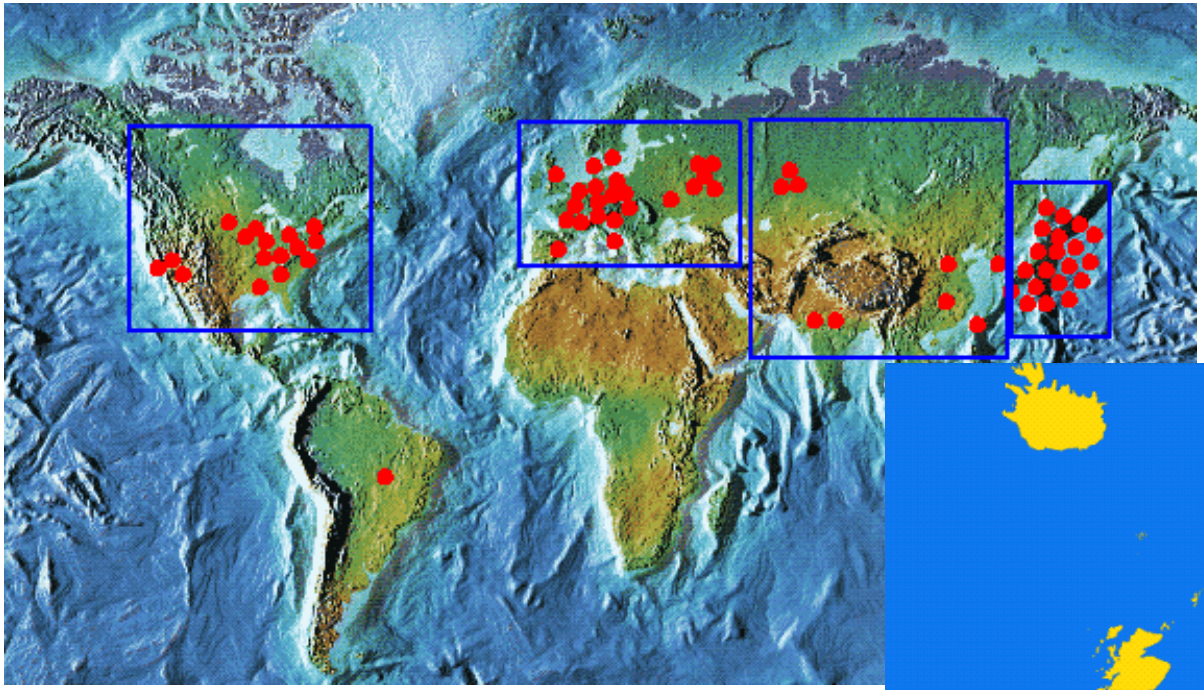


user@work

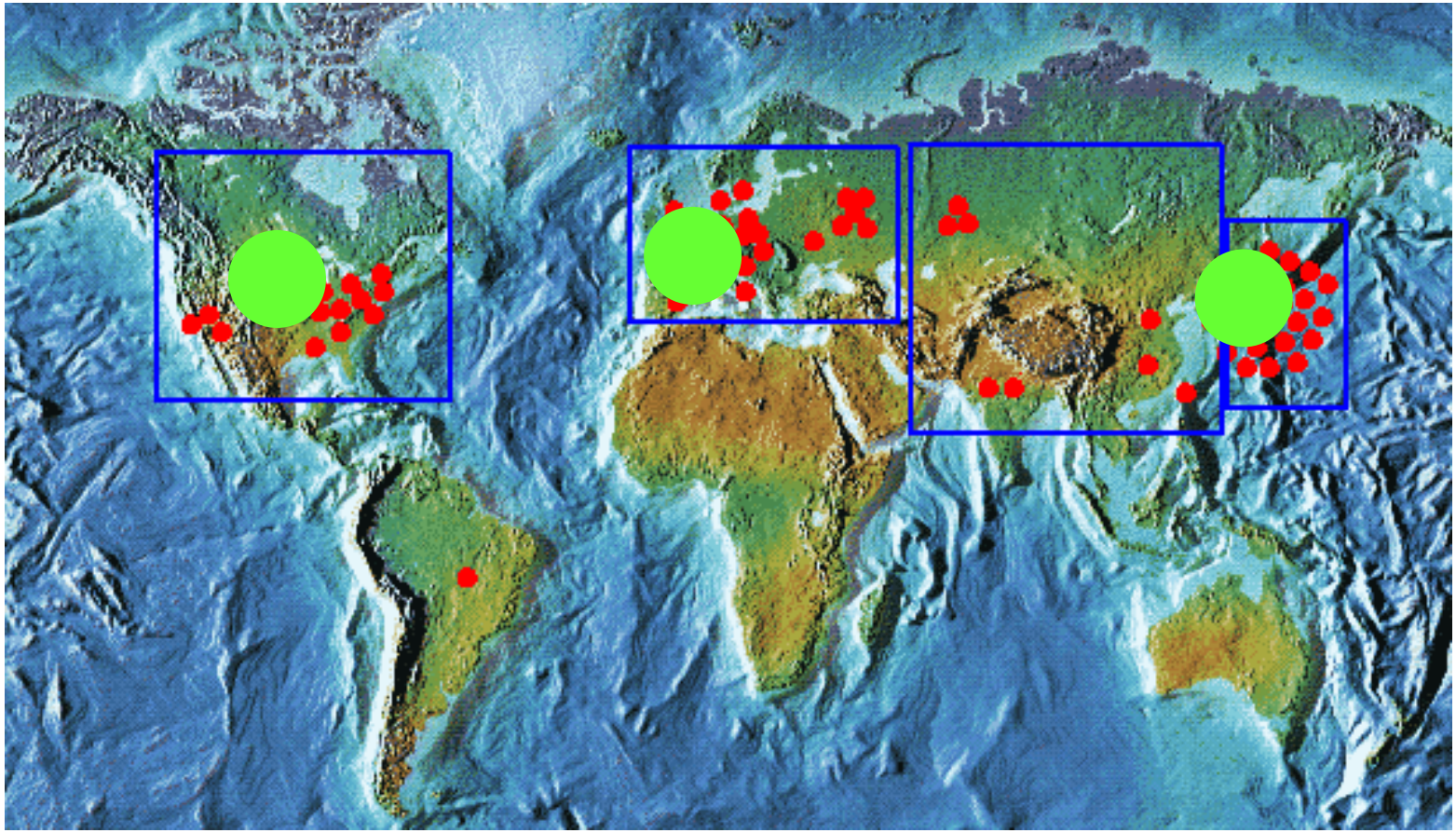


Storage ring and undulator

Synchrotrons worldwide



The three big synchrotrons

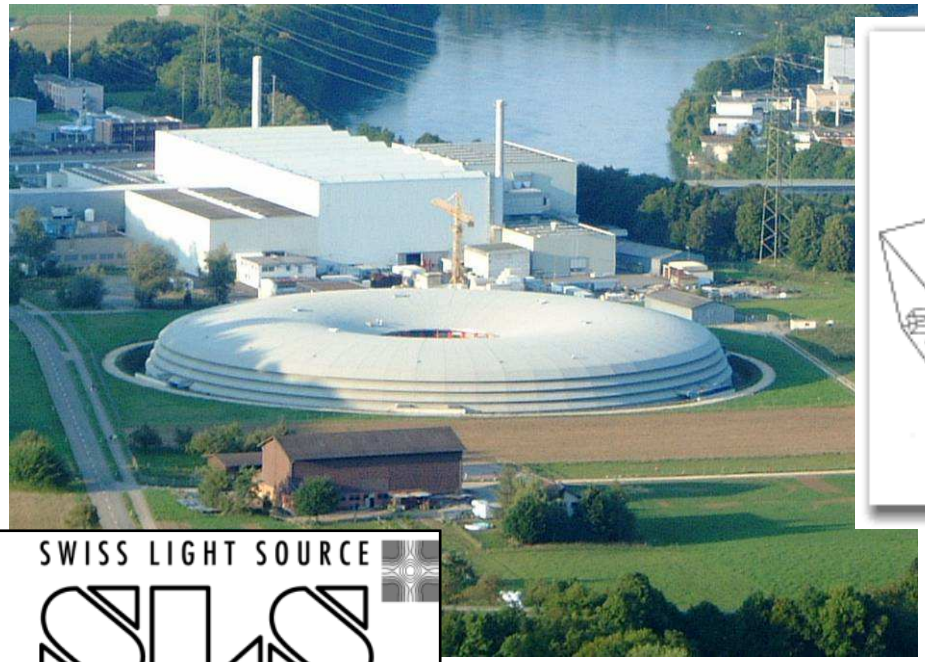



SPring-8
SPring-8: E = 8 GeV, U = 1436 m
Harima Science Garden City (Japan)

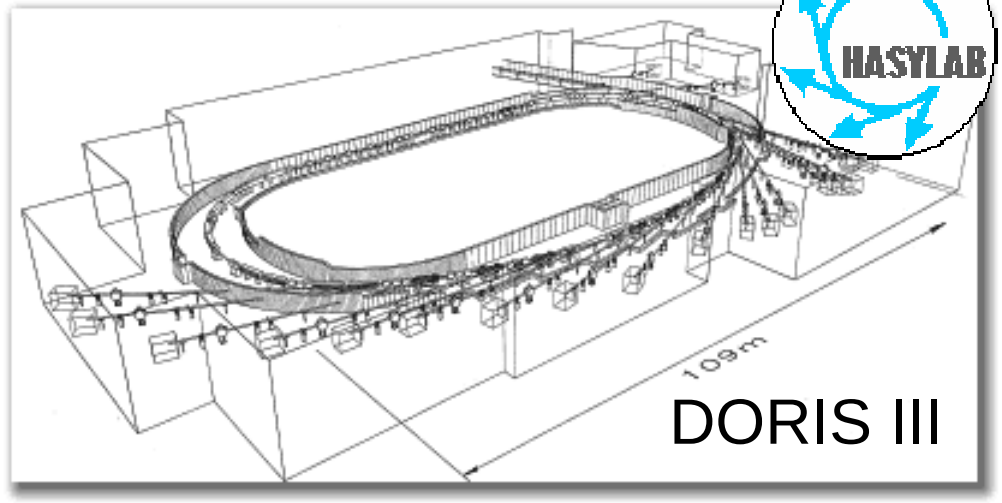

ADVANCED
PHOTON
SOURCE
APS: E = 7 GeV, U = 1104 m
Argonne, Chicago


ESRF
European Synchrotron Radiation Facility
Grenoble (France): E = 6 GeV, U = 844 m

Examples of smaller (national) synchrotrons



SWISS LIGHT SOURCE
SLS



BESSY

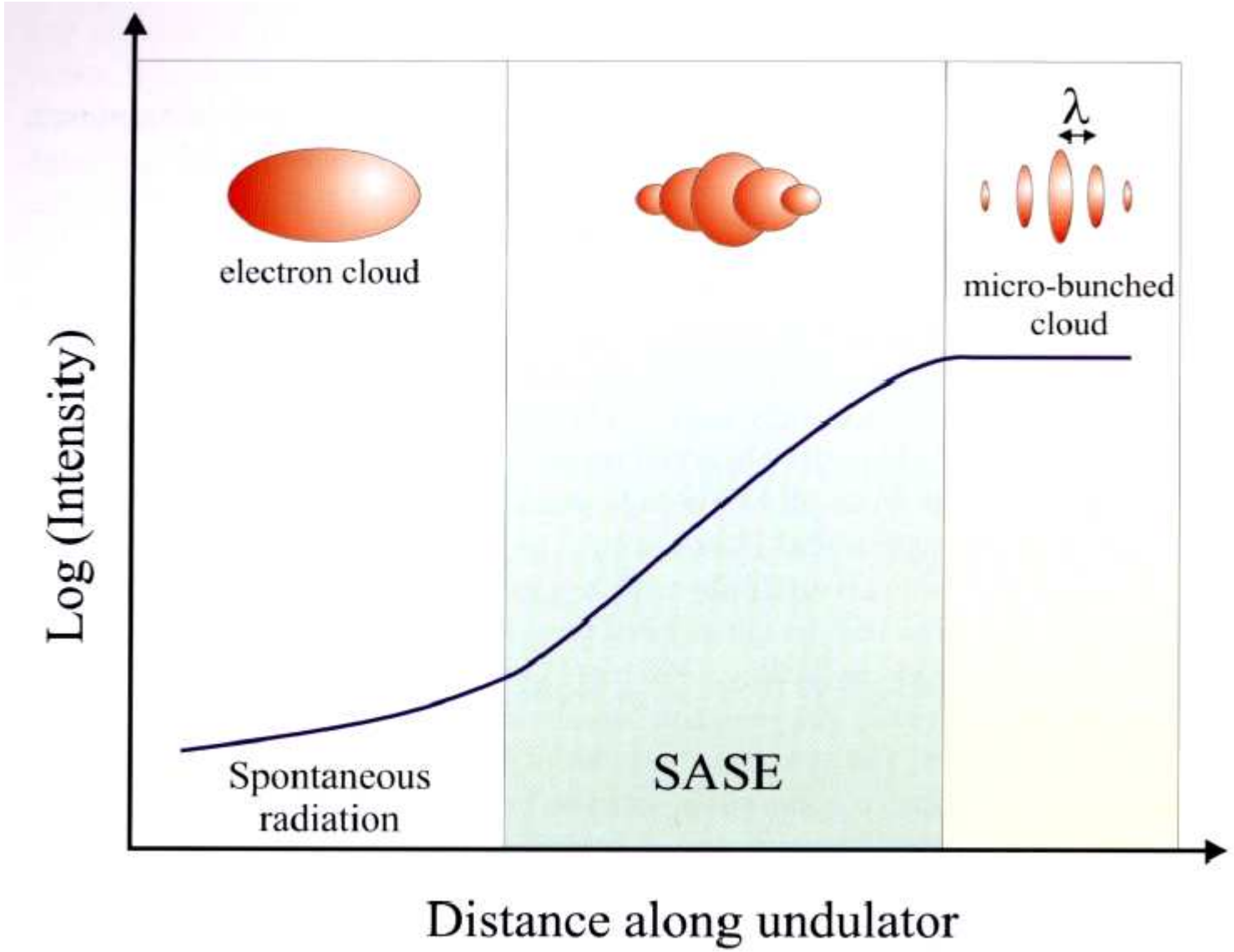
ANKA

(Northern) German project

PETRA III, HASYLAB, Hamburg

E = 6 GeV, U = 2304 m

Freier Elektronenlaser: Kohärenz



http://xfelinfo.desy.de/de/artikel.fel-prinzip/2/index.html

Als-Nielsen 2001, Abb. 2.15