Development of

SCSS: SPring-8 Compact SASE-FEL Source

RIKEN / SPring-8

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Contents

- What is SPring-8?
- What is FEL?
- What is SCSS?
- Development of machine and technology

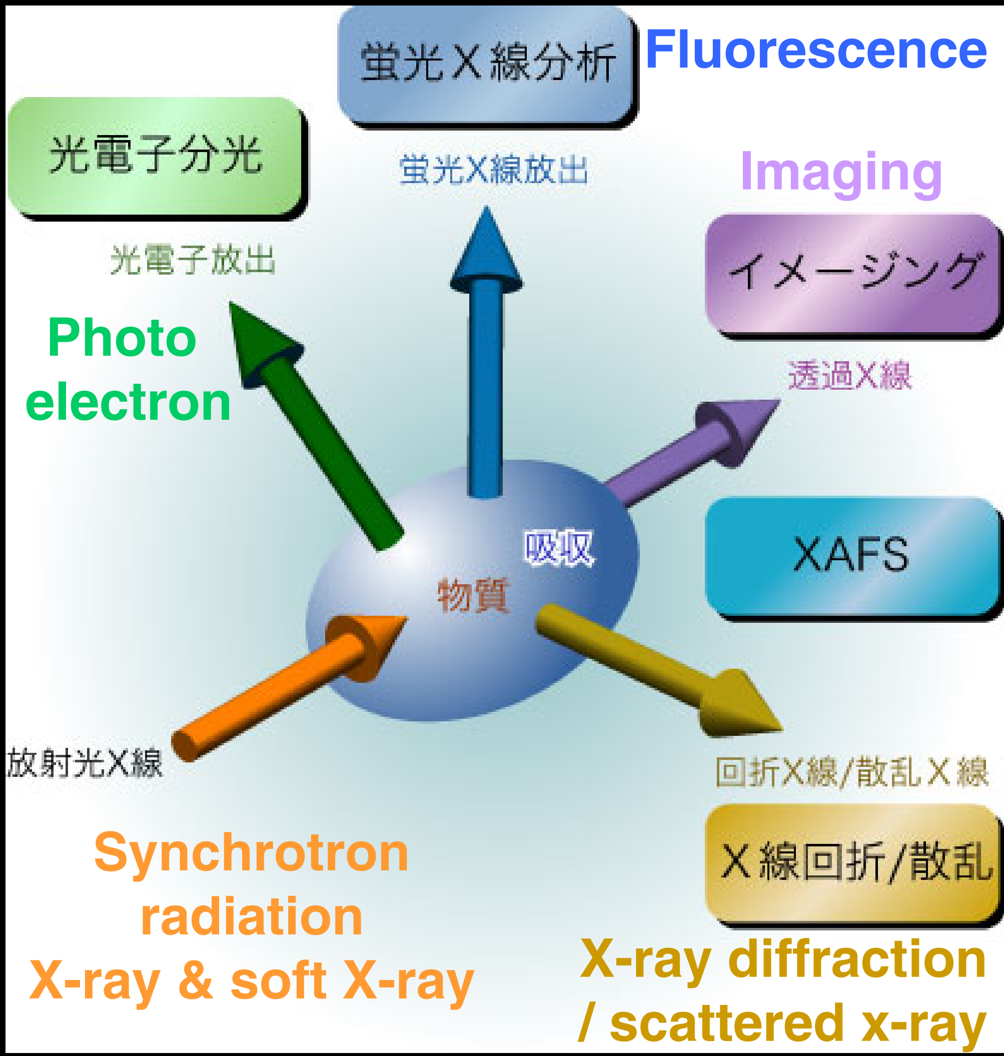
SPring-8

X-ray FEL

e^- beam energy:	8 GeV
Storage ring:	1436 m
Photon beam line:	62

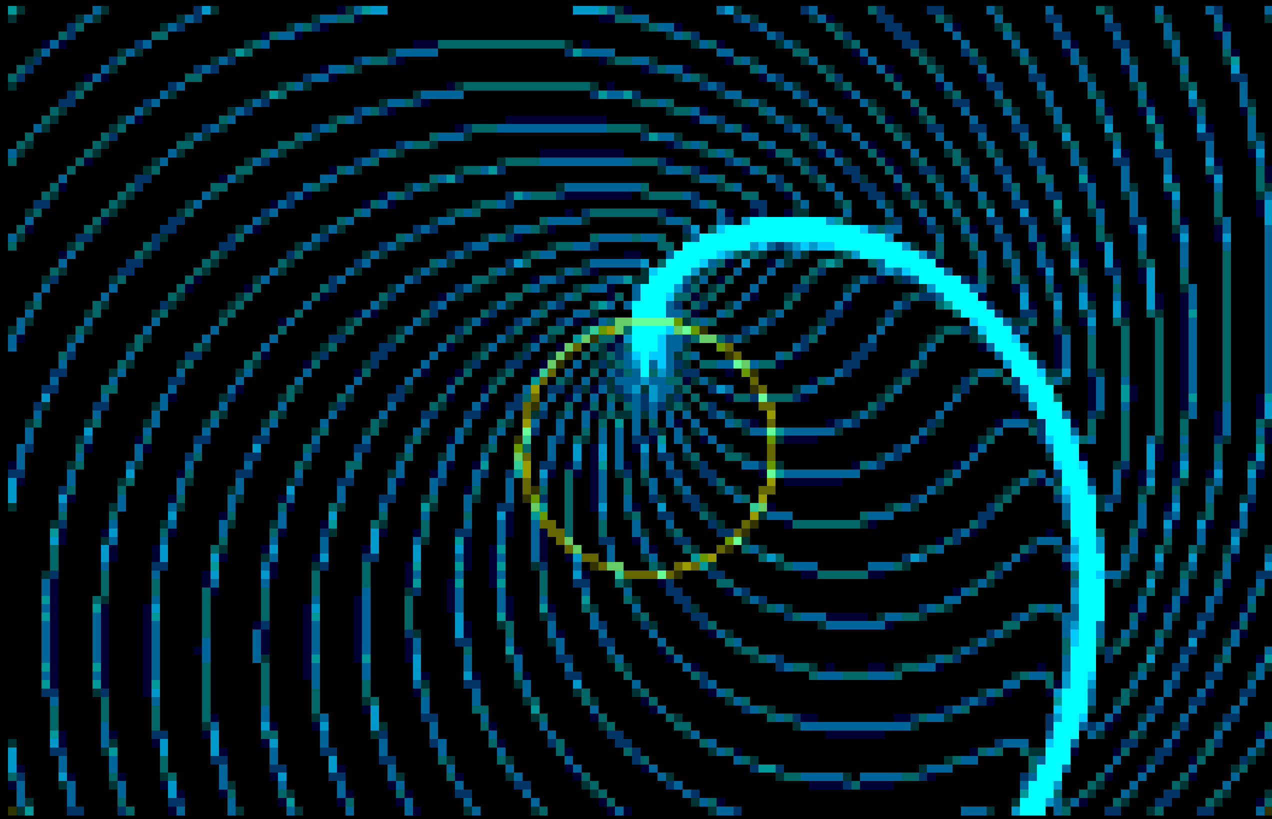
From… http://www.spring8.or.jp

Various Application of X-ray



See…
http://www.spring8.or.jp

Radiation Simulator



Made by
T. Shintake (RIKEN)
(= our Boss)

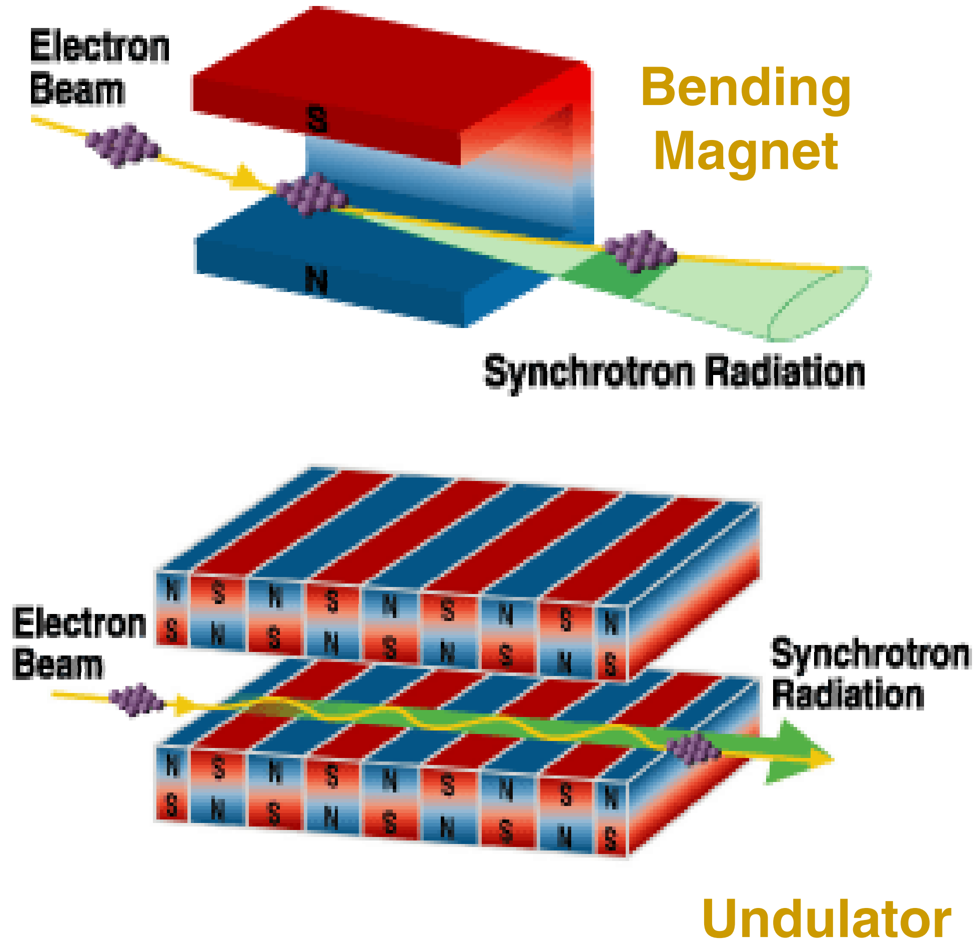
Free download from

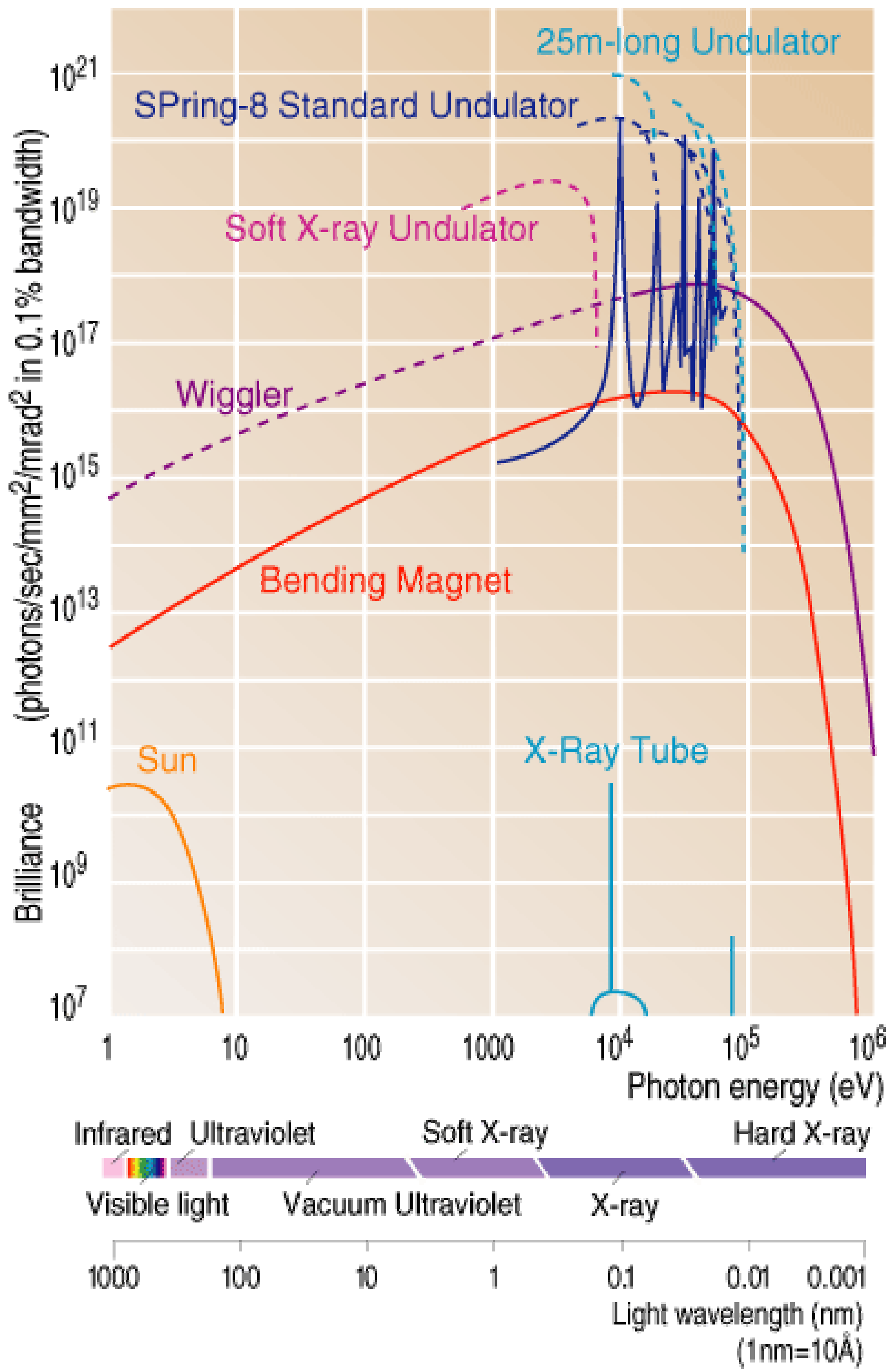
http://www-xfel.spring8.or.jp

(Windows, Linux, Mac)

Generation of Synchrotron Radiation

X-ray FEL





History of Synchrotron Radiation

X-ray FEL

- 1st generation : Electron synchrotron

  1970 ~

- 2nd generation : SR ring (ex. KEK-PF)

  1980 ~

- 3rd generation : Undulator (ex. SPring-8)

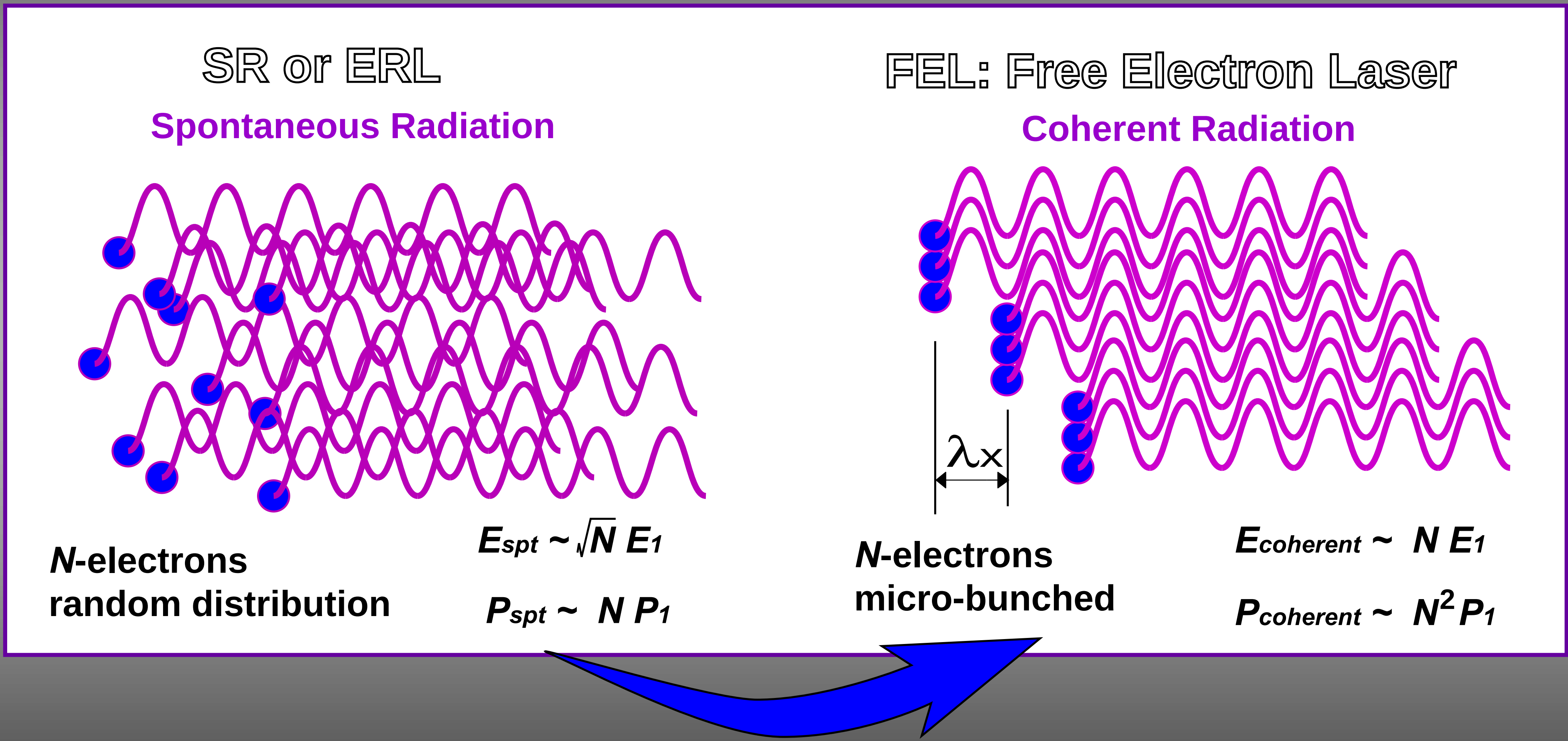
  1990 ~

- 4th generation : Coherent light = FEL

  FEL: Free Electron Laser

  2000 ~

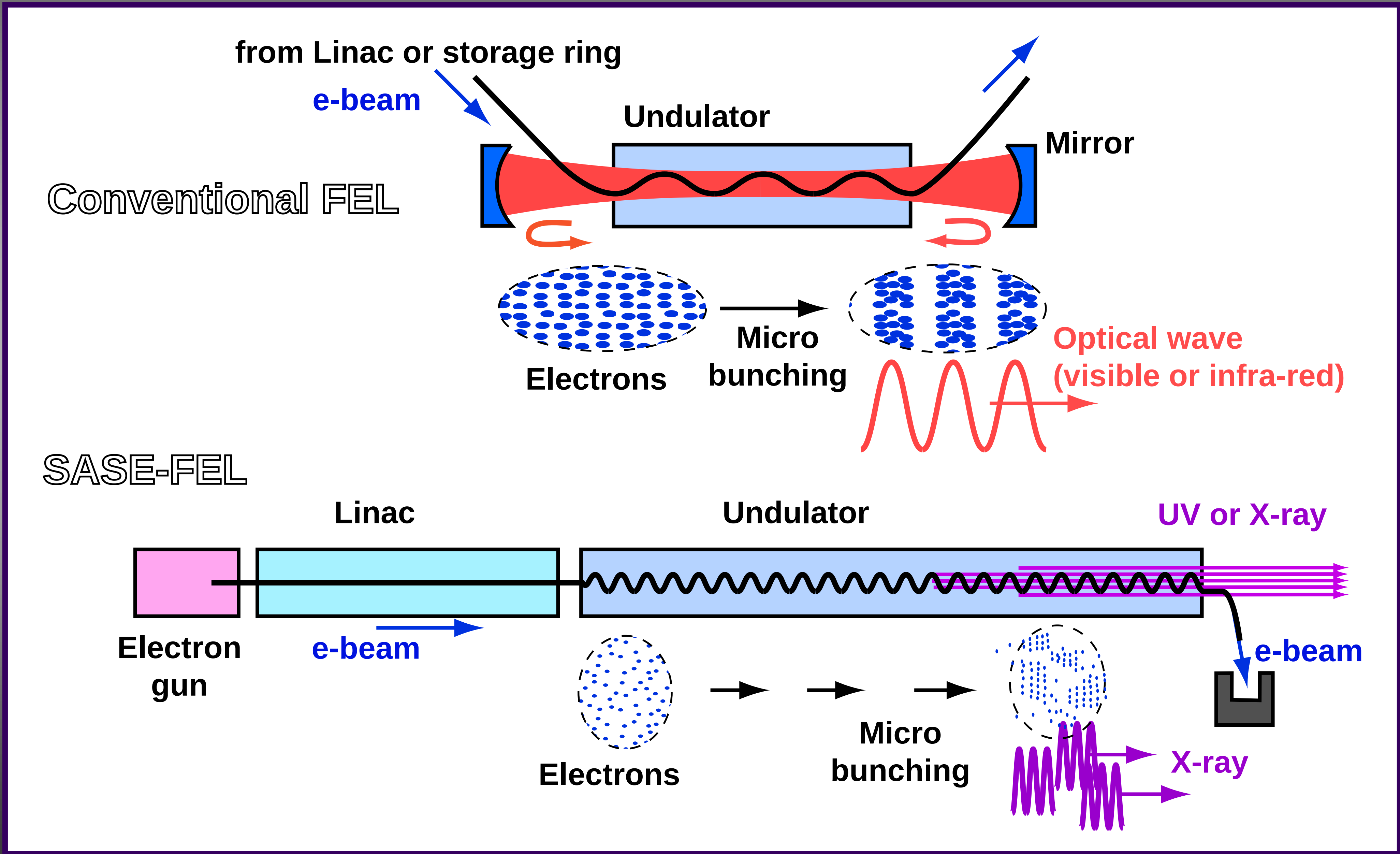
From SR to FEL



Optical Power Enhancement

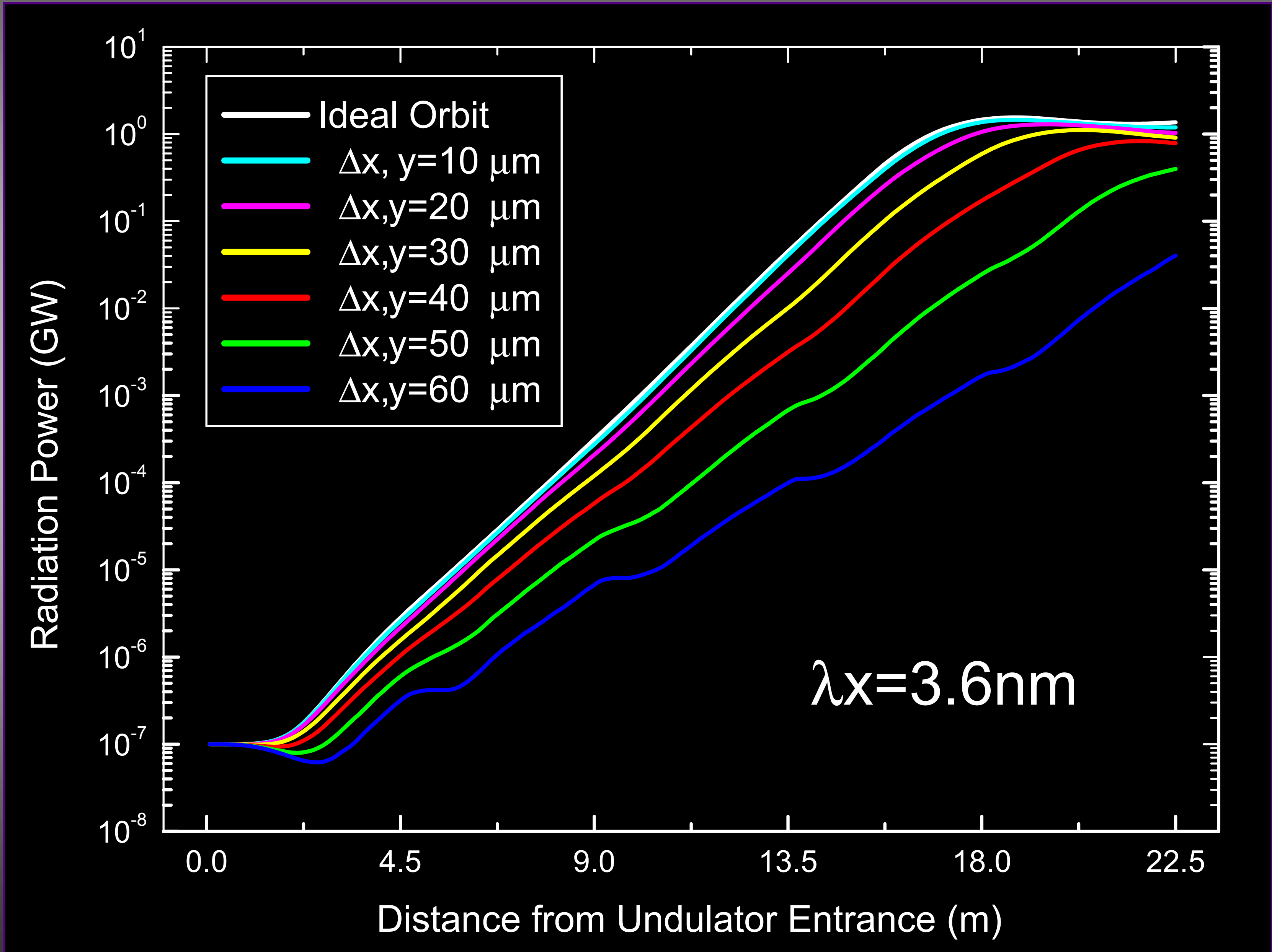
$\times\ 10^5 \sim 10^8$

From Cavity Type FEL to SASE-FEL



FEL Gain Loss due to Alignment Error

by Takashi Tanaka



X-FEL (SASE) vs Normal Undulator Light

- **Peak Brilliance**
  10^{30}~10^{33} [Photons/sec/mm2/mrad2/0.1%bandw]
  undulator ~10^{24}
- **Pulse Length**
  100~10 fsec **undulator ~1 psec**
- **Coherent Length**
  a few micron-meter (shorter than light pulse) **undulator Non**
- **Pulse Repetition Rate**
  10 Hz ~ 10 kHz **undulator 100 kHz**
  pulse machine **cw machine**
- **Spectral Stability < 10^{-3}** **undulator <10^{-6}**
- **Power Stability < 30%** **undulator <10^{-6}**