

PAUL SCHERRER INSTITUT



WIR SCHAFFEN WISSEN – HEUTE FÜR MORGEN

Rasmus Ischebeck

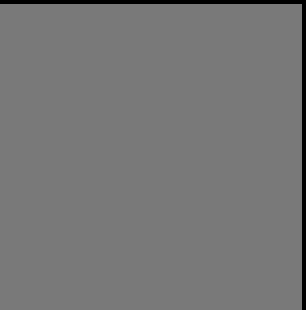
# Synchrotron Radiation

Joint Universities Accelerator School

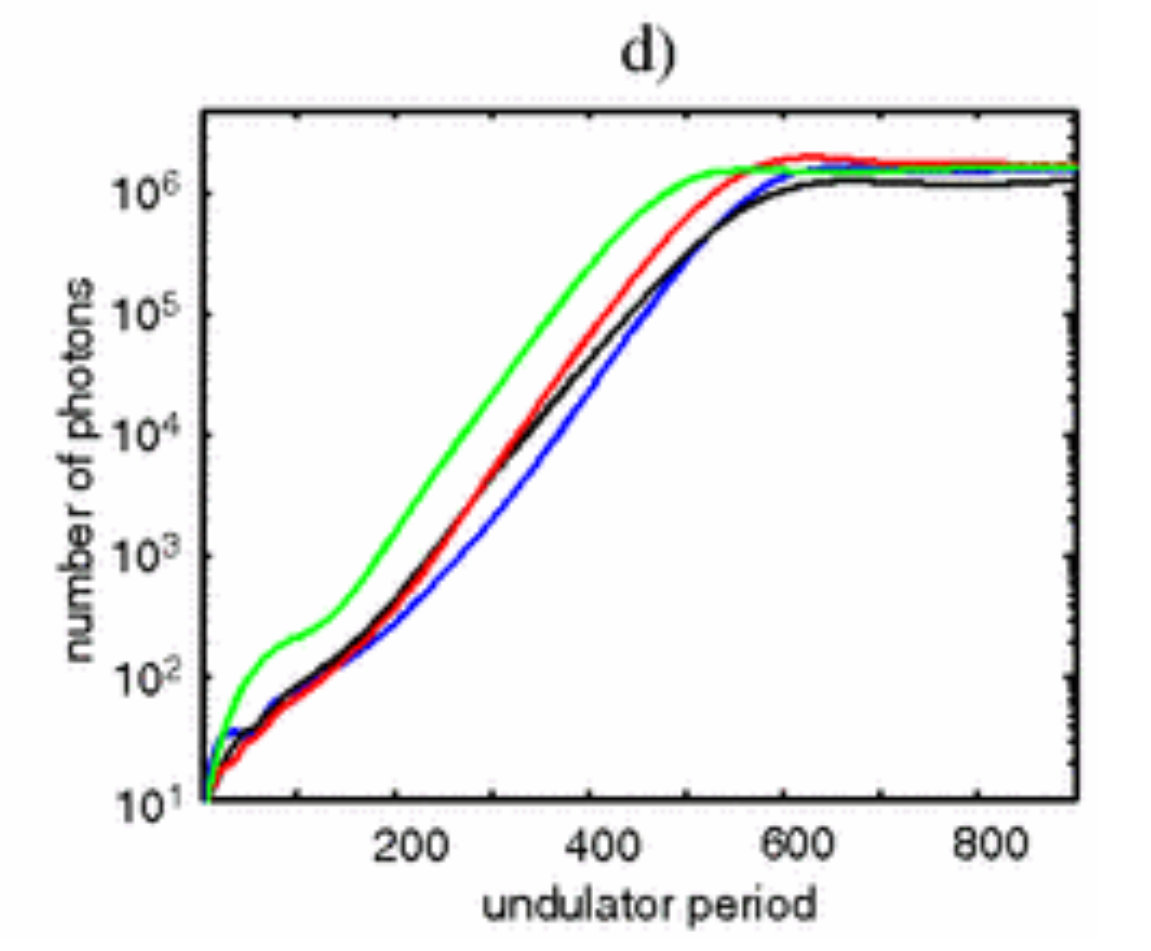
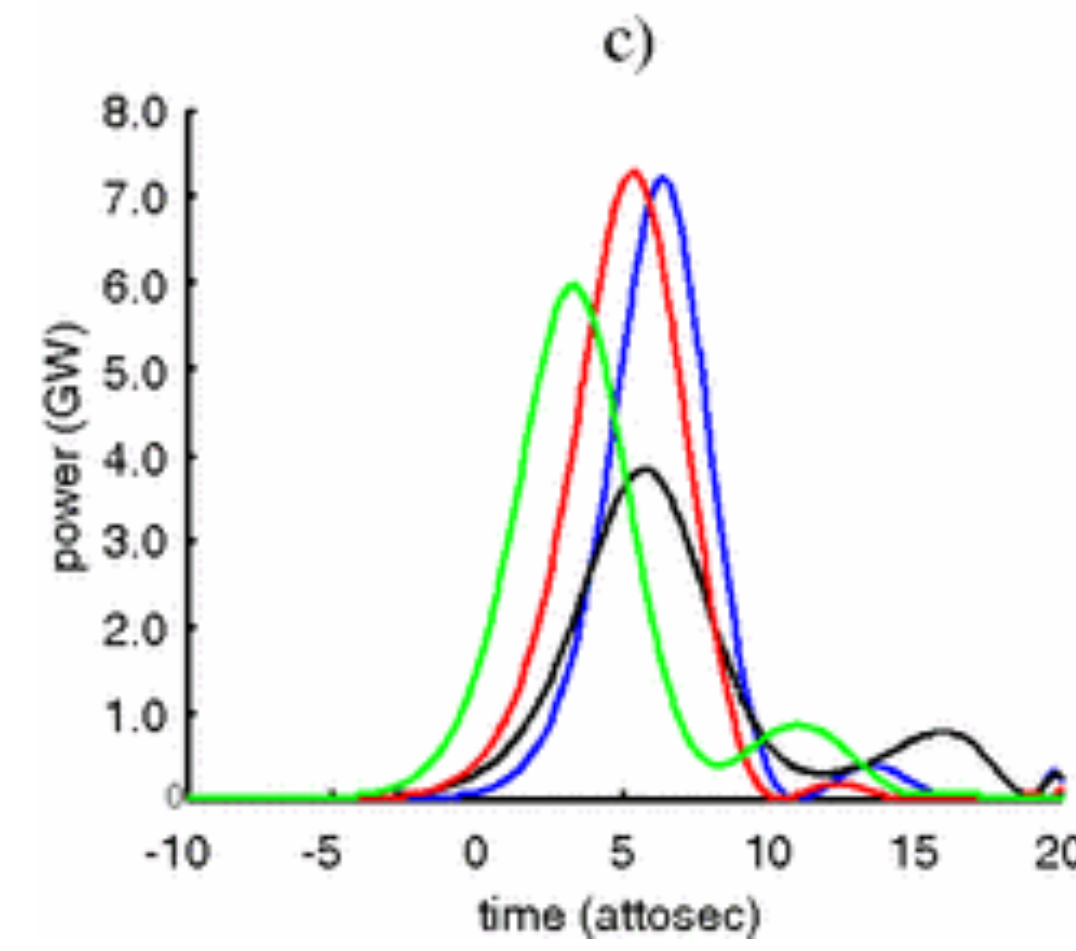
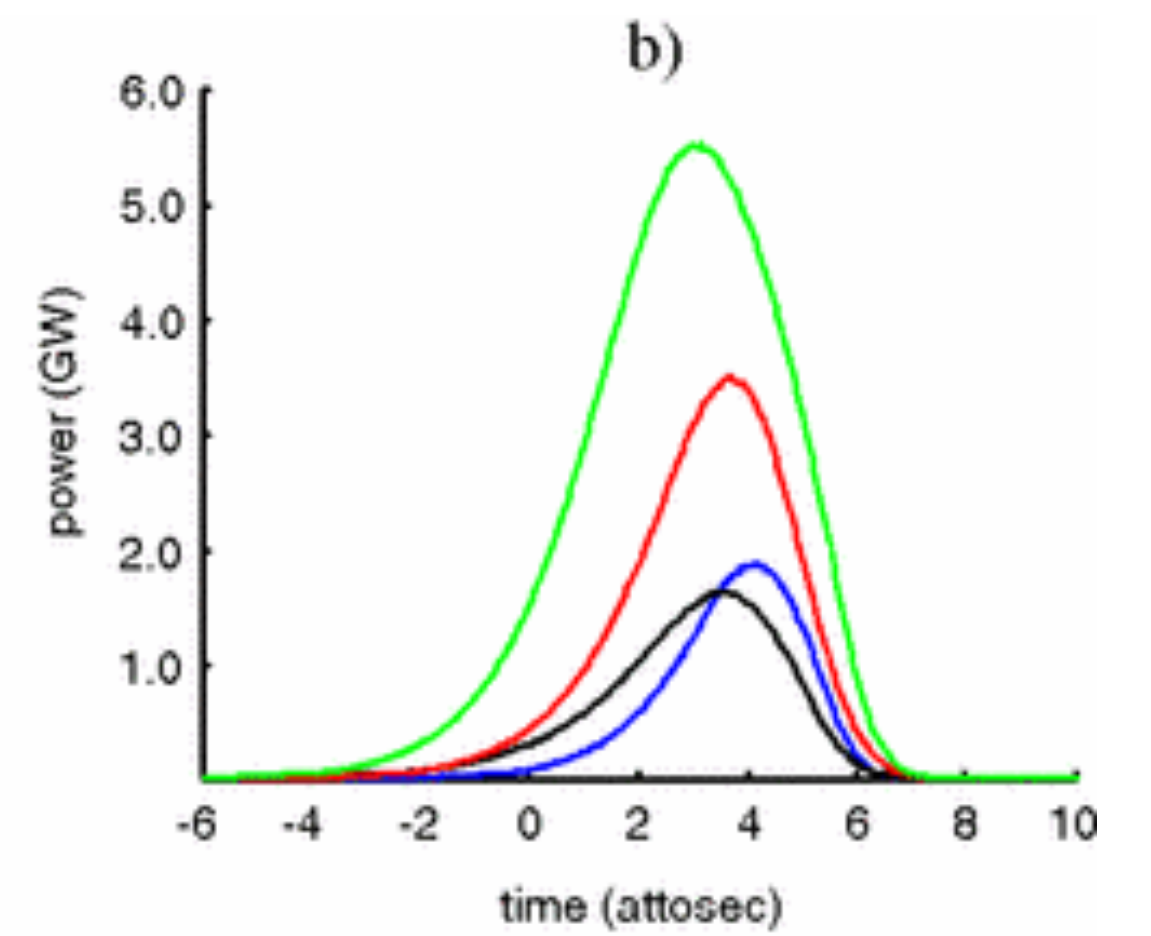
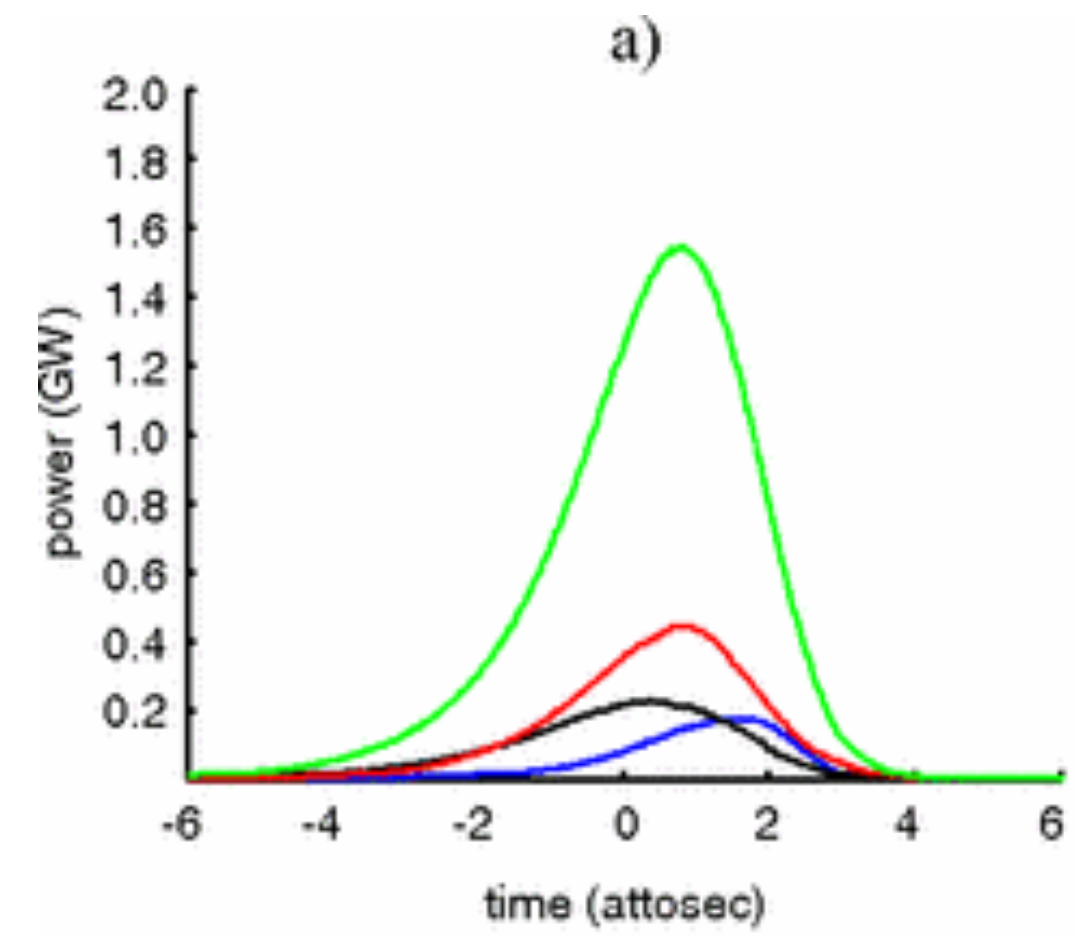
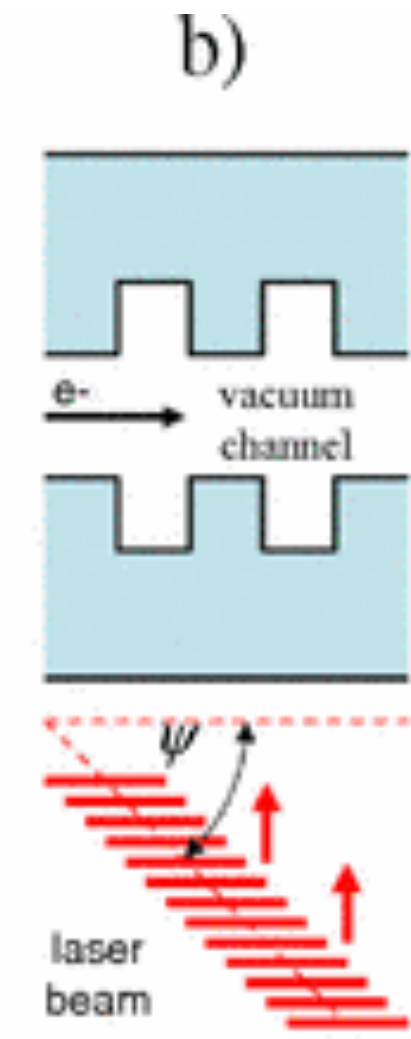
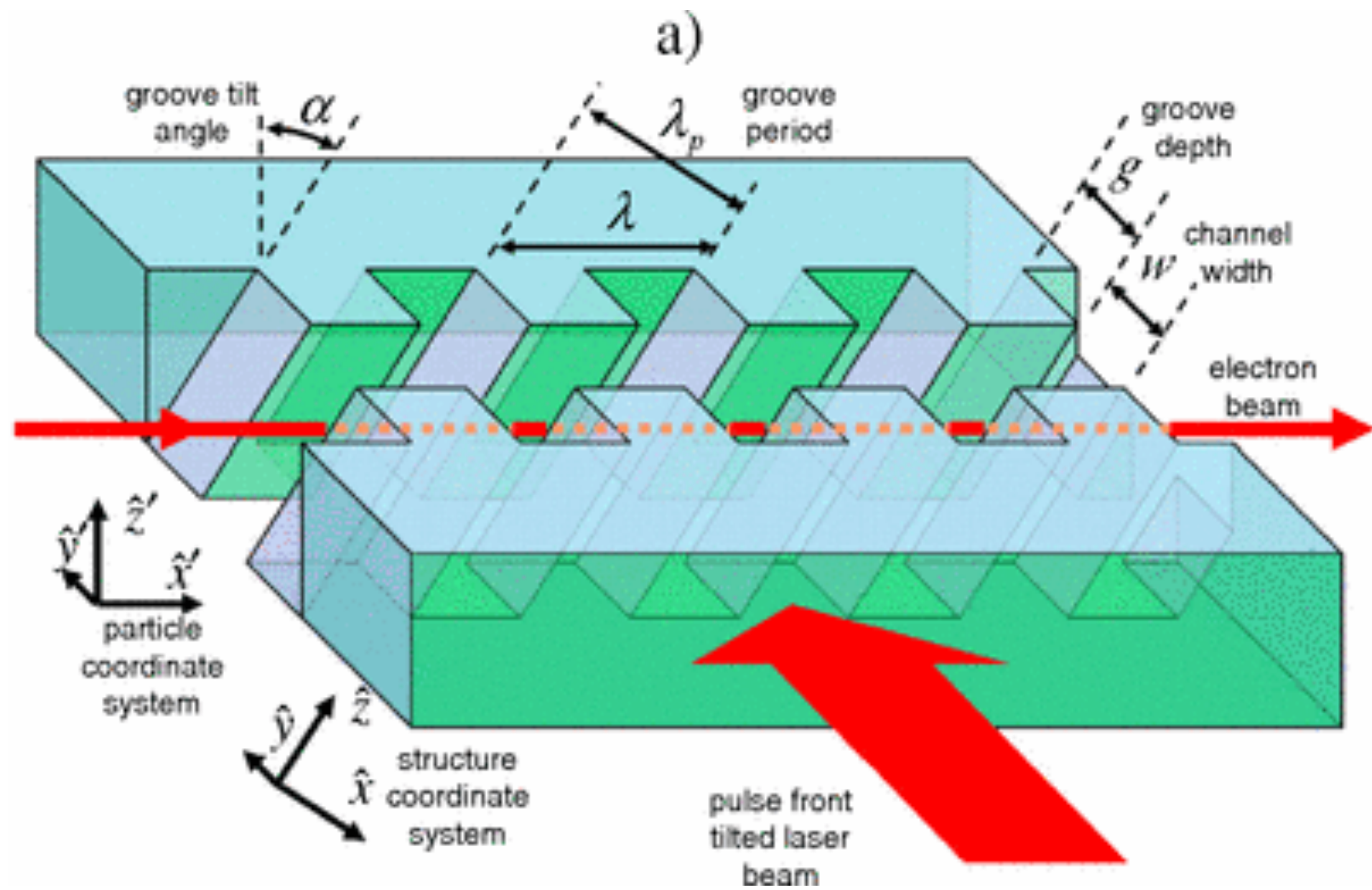




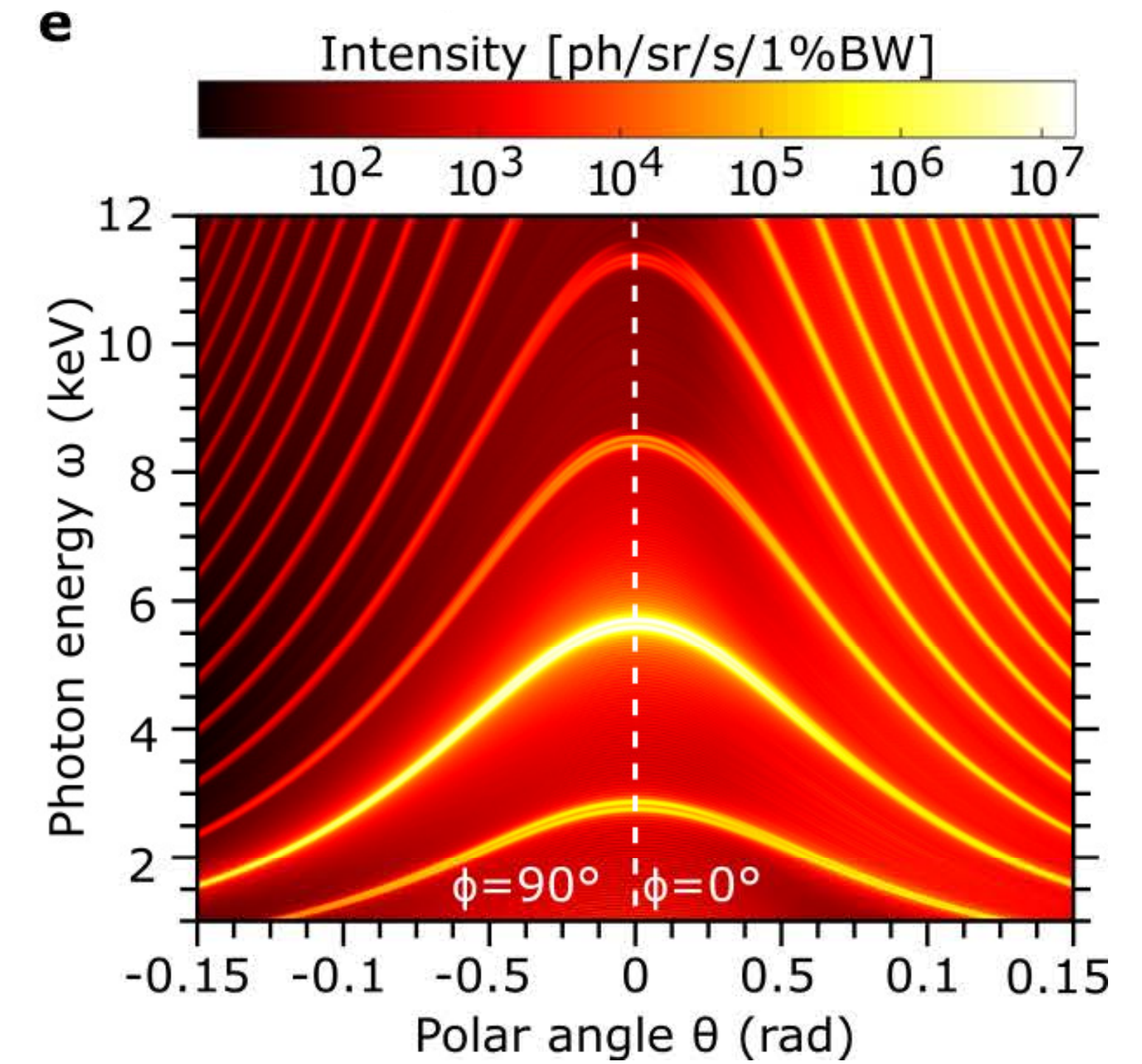
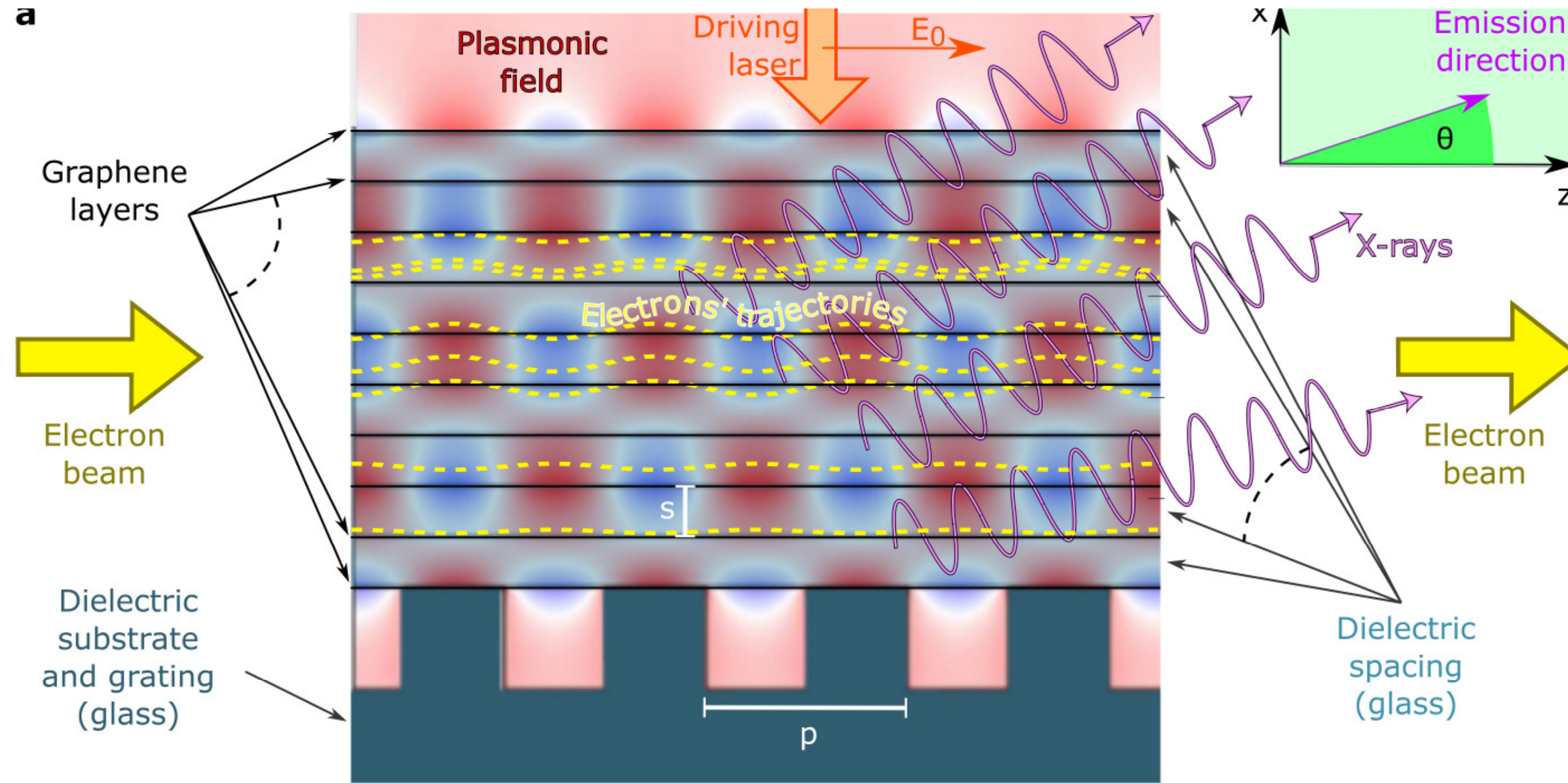
# How Did You Like the Course?



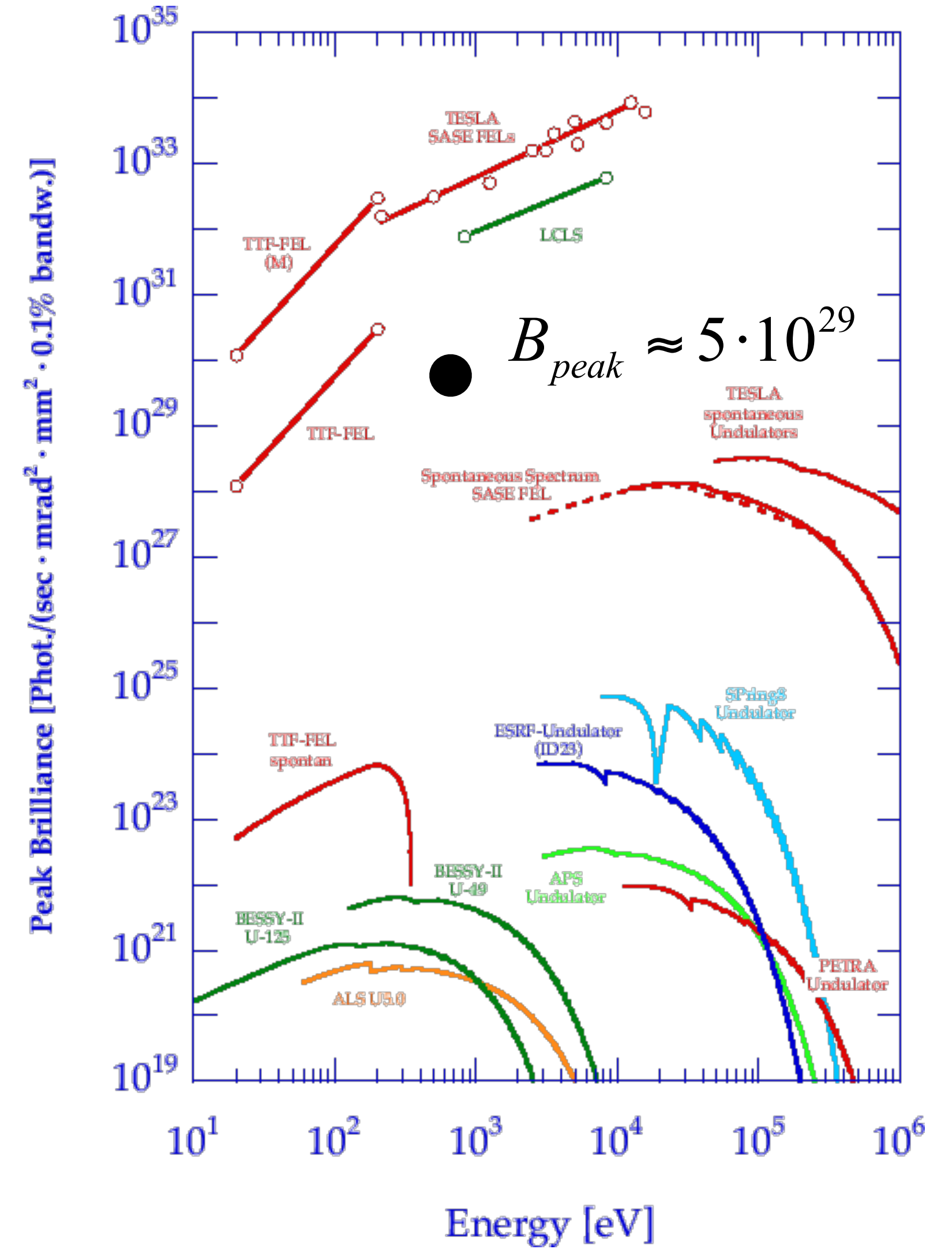
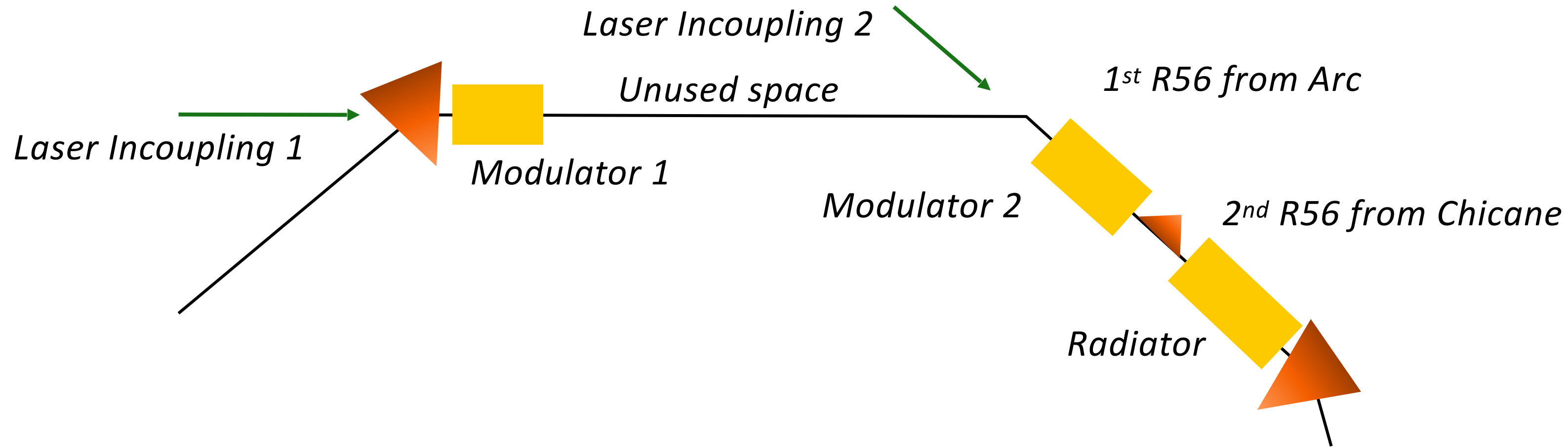




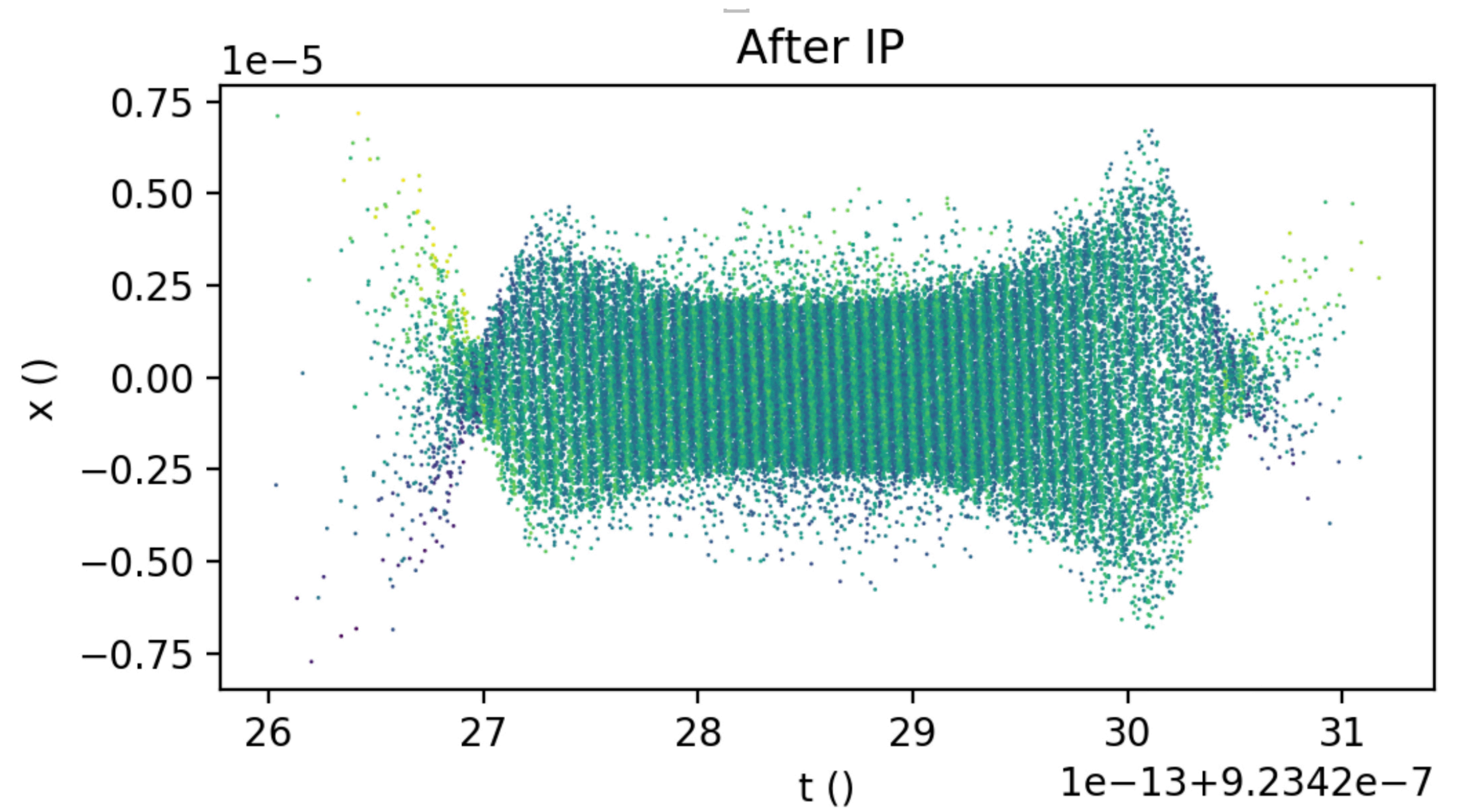








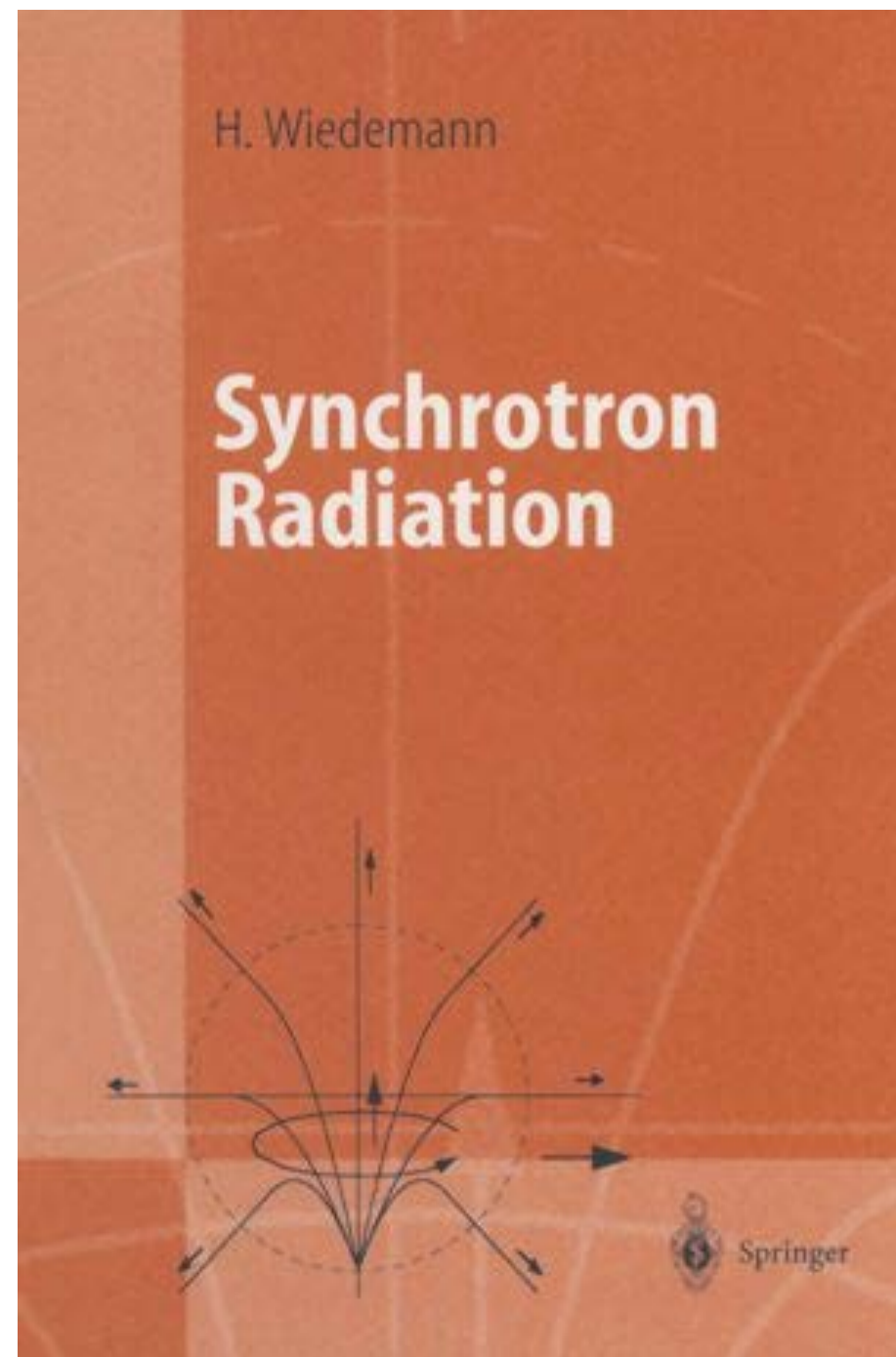






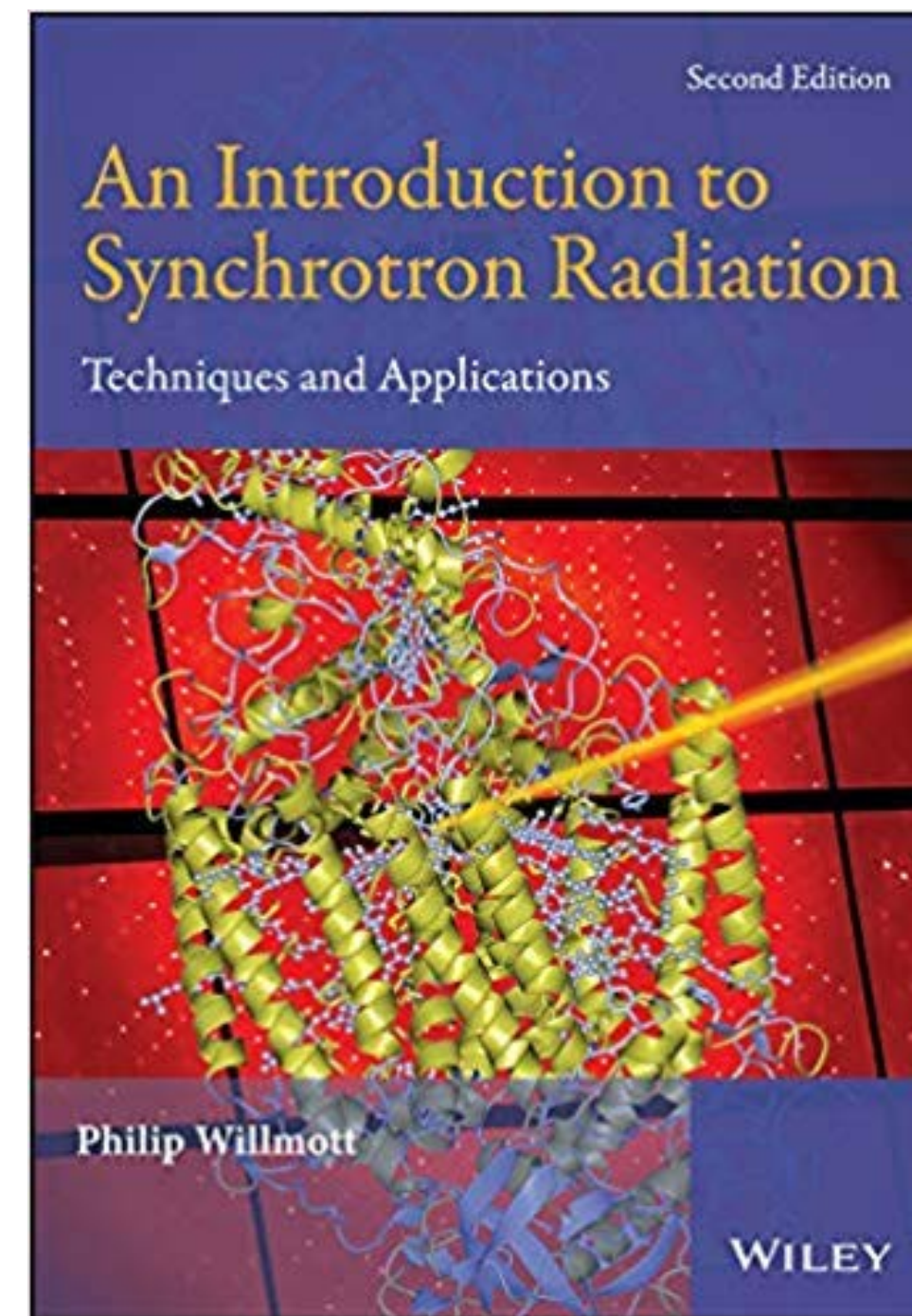
## Books on synchrotrons

- Accelerator side:



Helmut Wiedemann  
Synchrotron Radiation  
[3-642-07777-3; 3-662-05312-8]

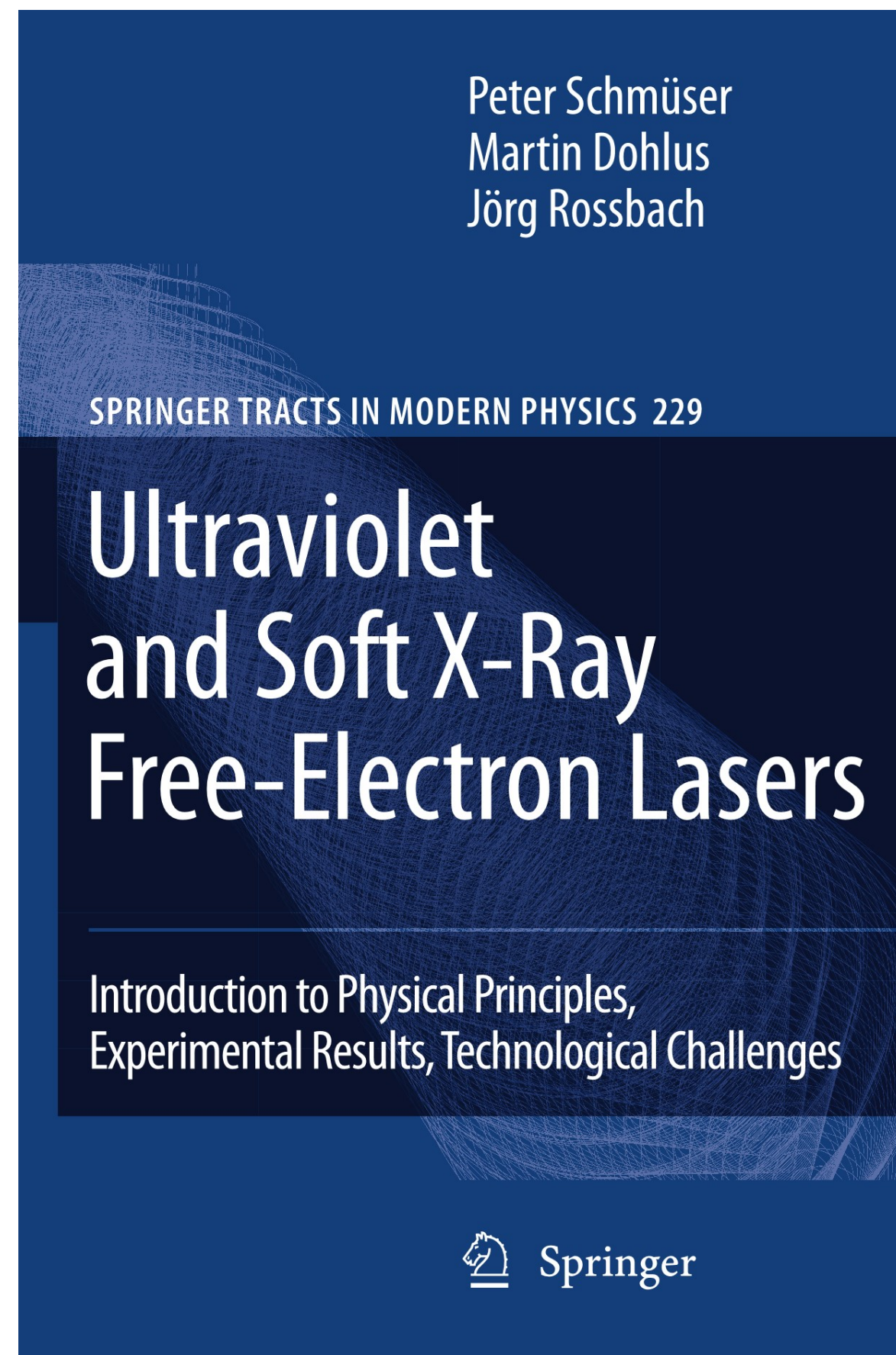
- User side:



Philip Willmott  
An Introduction to Synchrotron Radiation  
[1119280397]

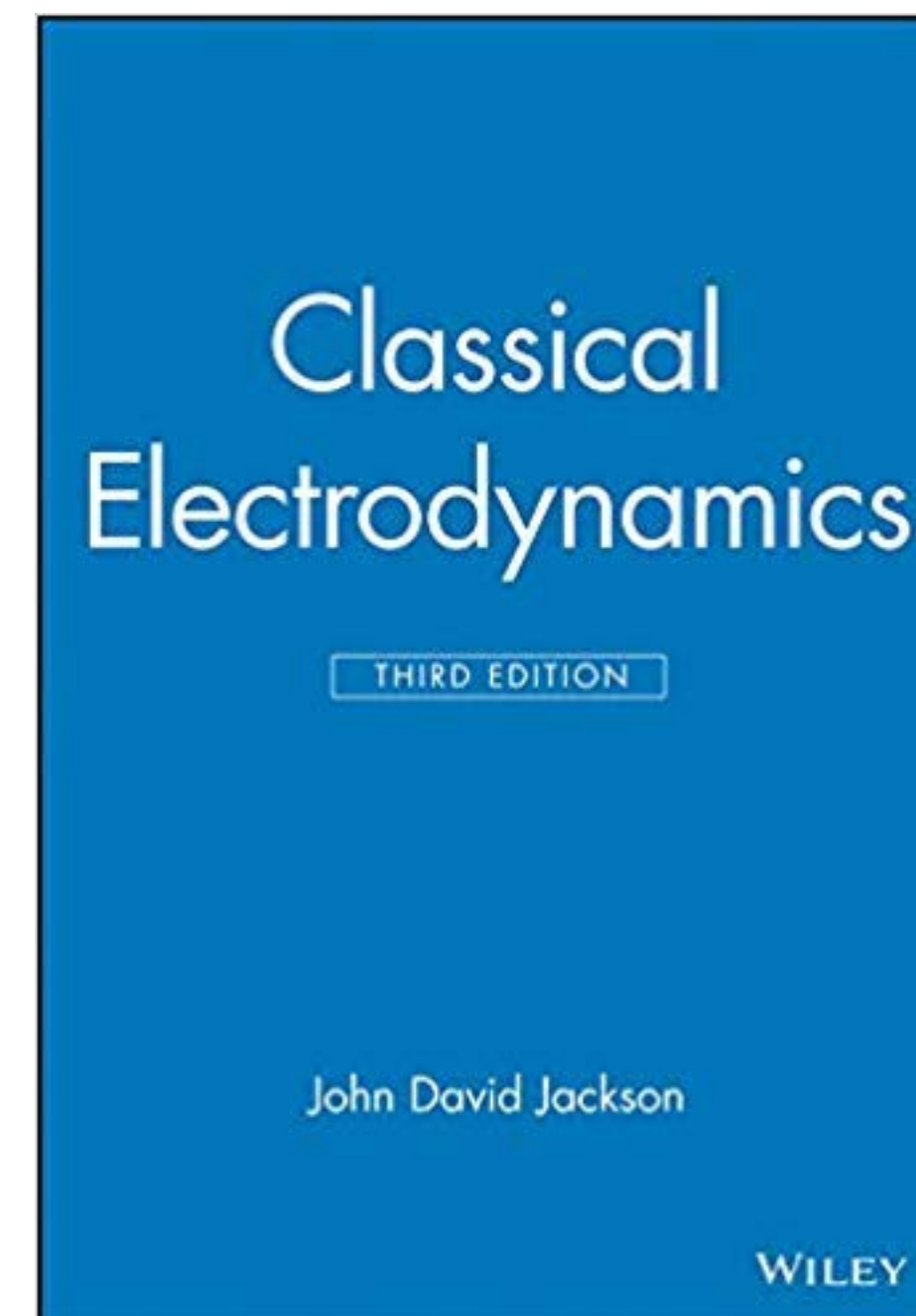


- A book on FELs



Schmüser, Dohlus & Rossbach  
Ultraviolet and Soft X-Ray Free-Electron Lasers  
[978-3-540-79571-1]

- Derivation of synchrotron radiation from Maxwell's Equations



John David Jackson  
Classical Electrodynamics  
[978-0471309321]

*“Undergraduate E&M is about solving the simple problems exactly. Jackson E&M is about learning to approximate reliably. The entire book, with few exceptions, is a mathematical discussion on finding way to solve only 4 equations for different boundary conditions.” (Davon Ferrara)*



henke.lbl.gov/optical\_constants/

**Tell us what else you wish this tool could do!** [SHARE MY IDEAS](#)

We want to make this tool even more capable and useful to you so let us know how it can be improved.

**CXRO**  
THE CENTER FOR X-RAY OPTICS

- X-Ray Database
- Nanomagnetism
- X-Ray Microscopy
- EUV Lithography
- EUV Mask Imaging
- Reflectometry
- Zoneplate Lenses
- Coherent Optics
- Nanofabrication
- Optical Coatings
- Engineering
- Education
- Publications
- Contact

**BERKELEY LAB**

The Center for X-Ray Optics is a multi-disciplined research group within Lawrence Berkeley National Laboratory's (LBNL) Materials Sciences Division

## X-Ray Interactions With Matter

### Introduction

Access the [atomic scattering factor](#) files.  
 Look up [x-ray properties of the elements](#).  
 The [index of refraction](#) for a compound material.  
 The x-ray [attenuation length](#) of a solid.

X-ray transmission

- Of a [solid](#).
- Of a [gas](#).

X-ray reflectivity

- Of a [thick mirror](#).
- Of a [single layer](#).
- Of a [bilayer](#).
- Of a [multilayer](#).

The diffraction efficiency of a [transmission grating](#).

Related calculations:

- Synchrotron [bend magnet radiation](#).

[Other x-ray web resources.](#)  
[X-ray Data Booklet](#)

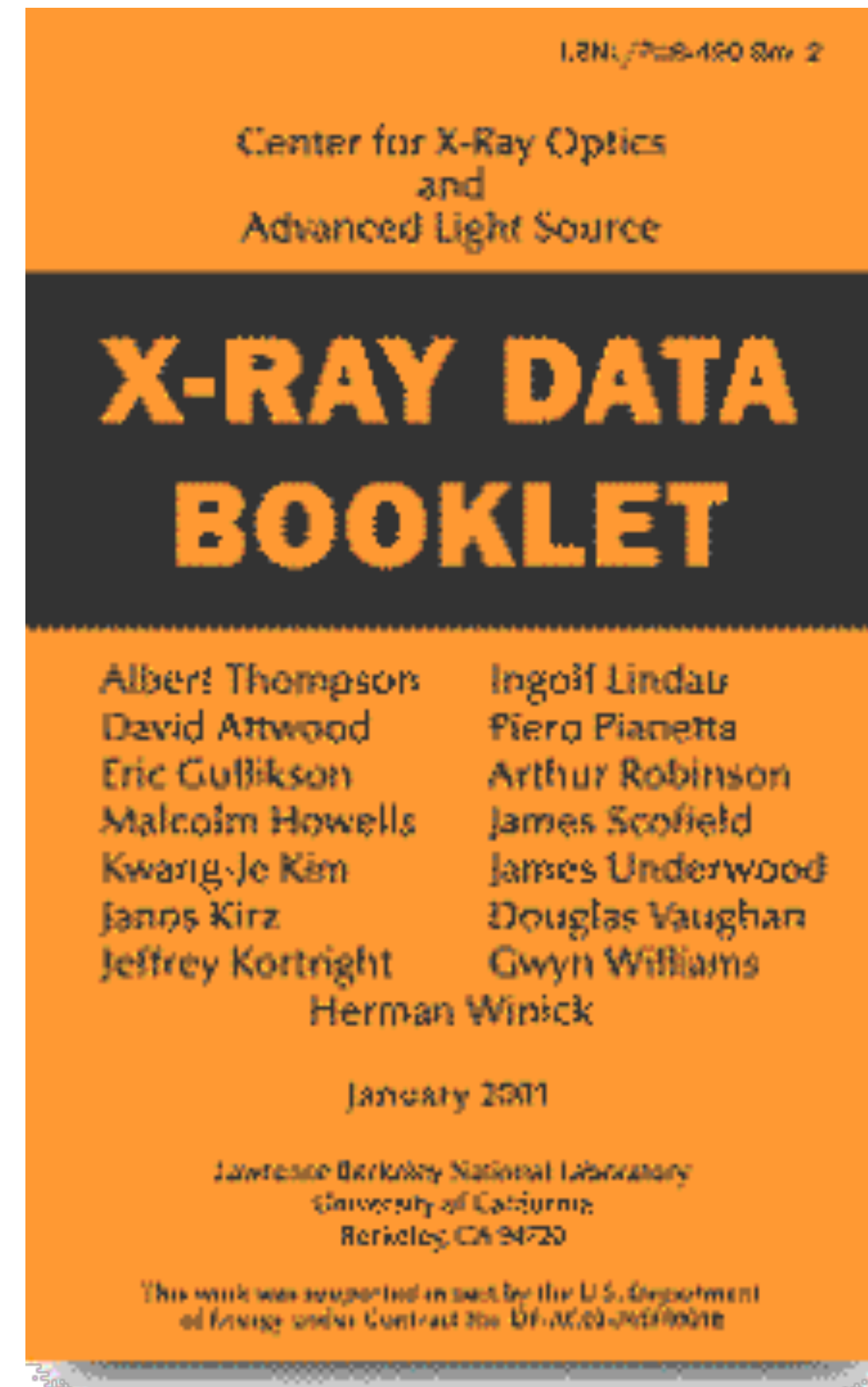


The screenshot shows a web browser window with the URL `courses.edx.org/dashboard`. The page features the edX logo and navigation tabs for **Courses**, **Programs**, **Profile**, **Help**, and a user profile for **ischebeck**. The main content area is titled **My Courses** and displays a course card for **Synchrotrons and X-Ray Free Electron Lasers**, which is an EPFLx - SynchrotronsX course that ended on May 15, 2018. The card includes social media icons for settings, Twitter, and Facebook, and a **View Archived Course** button. To the right, a promotional box encourages users to **Explore New Courses** with a search icon. The footer contains the edX logo, navigation links for **edX** (About, edX for Business, Affiliates, Open edX), **Legal** (Terms of Service & Honor Code, Privacy Policy, Accessibility Policy), **Connect** (Blog, Contact Us, Help Center, Media Kit), and social media icons for Facebook, Twitter, YouTube, LinkedIn, Google+, and Reddit. It also features **Download on the App Store** and **GET IT ON Google play** buttons.



# The X-Ray Data Booklet

- On-line: <http://xdb.lbl.gov/xdb-new.pdf>





- The exam will be an open-book exam.
- You are permitted to use all the course materials, as well as your notes.
- Please bring a calculator, install a calculator app on your computer/tablet, or use Python/Matlab/Mathematica. (Make sure your application runs without an online connection.)
- Please download all lecture material to your computer/tablet.
- In addition, please download from the Indico site:
  - The X-Ray Data Booklet
  - The sheet with natural constants
- The exam will differ somewhat from last year's exam:  
there will be questions on the uses of synchrotron radiation.  
The problems will be similar to the ones in this year's exercises.
- **Mobile phones are not permitted. Only your laptop/tablet is allowed.**
- **On-line connections during the exams are not permitted.**
- **Turn your Wi-Fi off, switch your tablet to airplane mode, and deposit your mobile phone with the instructors.**





# Any More Questions...

- e-mail: [rasmus.ischebeck@psi.ch](mailto:rasmus.ischebeck@psi.ch)
- web page: <https://ischebeck.net>
- see (some of) you at PSI!