Friedrich-Alexander-Universität
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Department für Physik

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Free-Electron Lasers and Coherent Synchrotron Radiation

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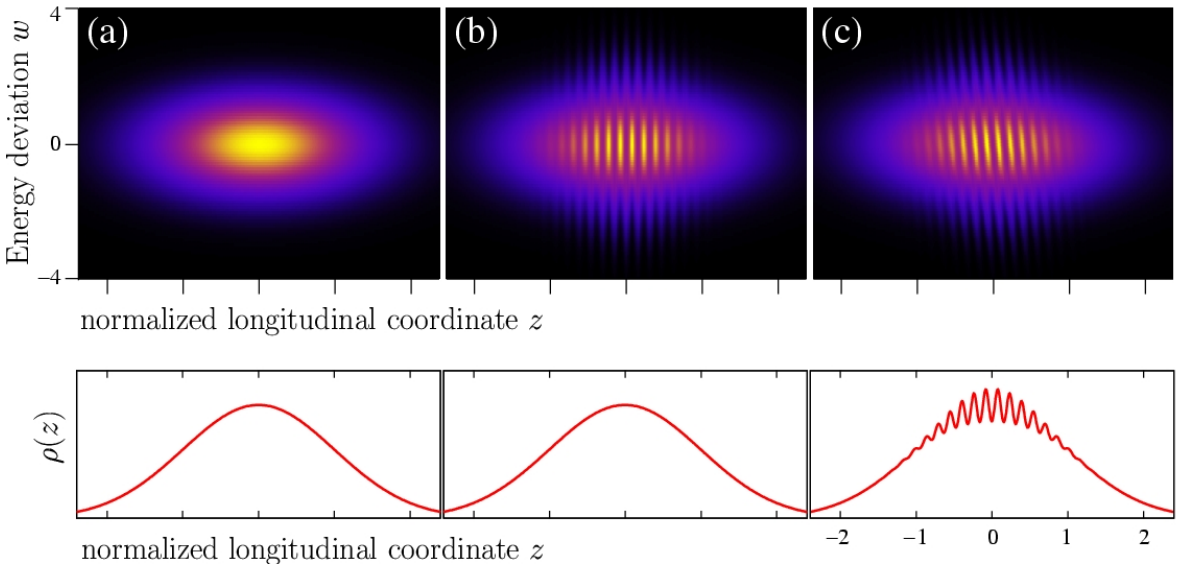

When relativistic electrons are deviated by a magnetic field, Synchrotron Radiation occurs. Most of the emitted light is usually incoherent, however techniques for obtaining a coherent sources from relativistic electrons have been also developed.

Here, we will consider two schemes, for which laser-electron interaction is involved. The first one is the Free-Electron Laser (FEL), for which laser-electron interaction leads to coherent amplification. The second one consists of creating a periodic structure inside a relativistic electron bunch, using an external laser. The principle is that such "shaped electrons bunches" can emit a coherent radiation, typically in the terahertz domain when they are deviated by a bending magnet.

In this talk, we will first introduce the two types of source. We will show that -in spite of the particular physics involved- FELs present many common points with classical lasers, in particular regarding their nonlinear dynamics. In a similar way, Coherent Synchrotron Radiation present striking analogies (as well as differences) with classical nonlinear optics processes. Finally, nonlinear dynamics issues of pulse propagation in UV/X Free-Electron Lasers will also be addressed.

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