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**X-ray Free Electron Lasers and Ultra-Fast Science**

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This lesson will provide a basic introduction to X-ray Free Electron Lasers (XFELs) and highlight the new scientific opportunities that open up with these relatively new user facilities.

The lesson is divided into two parts. In Part 1, I will introduce the characteristics of XFEL radiation, highlighting differences with respect to synchrotron radiation. An overview of operating XFEL facilities worldwide will be given, while the European XFEL will be described in more detail. In Part 2, I will illustrate examples of XFEL scientific applications in ultrafast science, investigation of bio-objects and studies of extreme states of matter. I will conclude with an outlook towards the future and the impact XFELs may have in contributing to solve major societal challenges.