

# PHYSICS COLLOQUIA 2018



> The discovery of X-rays in 1895 allowed the determination of the atomic structure of matter, the spatial arrangement of atoms in molecules and solids, and the science community demanded more and more brilliant X-ray sources.

It was recognized since the 1960's that electron accelerators and storage rings, thanks to the phenomenon of synchrotron radiation, are the most powerful X-ray sources on earth. In recent years, a further step was taken by sources based on linear accelerators, the Free-Electron Lasers, producing X-ray pulses with peak brilliance exceeding that of synchrotron beams by up to 9 orders of magnitude, with ultra-short duration,  $\sim 10$  fs ( $10^{-14}$ s), and with a high (laser-like) degree of transverse coherence.

The latest addition to the handful of existing X-ray Free-Electron Lasers (XFEL's), the European XFEL, resulting from the collaboration of 12 countries including Italy, and now operating in Hamburg, will be described.

Examples of applications of the new sources to time-resolved studies in the sub-ps range ("molecular movies") of chemical reactions, biochemical processes such as photosynthesis, and technologically relevant solid-state processes will be briefly discussed, together with possible future developments.

22

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> **Science with X-ray free electron lasers**



**UNIVERSITÀ DEGLI STUDI DI MILANO**  
DOTTORATO DI RICERCA IN FISICA  
ASTROFISICA E FISICA APPLICATA

Gli incontri si terranno alle **ore 14:30**  
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