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Nota di contenuto	About the Special Issue Editor -- Preface to "X-Ray Free-Electron Laser" -- The FLASH Facility: Advanced Options for FLASH2 and Future Perspectives -- The Linac Coherent Light Source: Recent Developments and Future Plans -- Status of the SACLAC Facility -- FERMI: Present and Future Challenges -- Construction and Commissioning of PAL-XFEL Facility -- Photon Beam Transport and Scientific Instruments at the European XFEL -- SwissFEL: The Swiss X-ray Free Electron Laser -- Status of the SXFEL Facility -- Ultrashort Free-Electron Laser X-ray Pulses -- A Dispersive Inelastic X-ray Scattering Spectrometer for Use at X-ray Free Electron Lasers -- Split-And-Delay Unit for FEL Interferometry in the XUV Spectral Range -- Terawatt-Isolated Attosecond X-ray Pulse Using a Tapered X-ray Free Electron Laser -- Molecular Dynamics of XFEL-Induced Photo-Dissociation, Revealed by Ion-Ion Coincidence Measurements -- Observing Femtosecond Fragmentation Using Ultrafast X-ray-Induced Auger Spectra -- X-ray Pump-Probe Investigation of Charge and Dissociation Dynamics in Methyl Iodine Molecule -- Application of Matched-Filter Concepts to Unbiased Selection of Data in Pump-Probe Experiments with Free Electron Lasers -- Measurement of the Resonant Magneto-Optical Kerr Effect Using a FreeElectron Laser -- Current Status of Single Particle Imaging with X-ray Laser -- Probing Dynamics in Colloidal Crystals with Pump-Probe Experiments at LCLS: Methodology and Analysis --

Probing Physics in Vacuum Using an X-ray Free-Electron Laser, a High-Power Laser, and a High-Field Magnet -- Algorithm for Reconstruction of 3D Images of Nanorice Particles from Diffraction Patterns of Two Particles in Independent Random Orientations with an X-ray Laser -- Nobel Symposium on Free Electron Laser Research.

Sommario/riassunto

X-ray free electron lasers (XFELs) deliver intense, coherent, femtosecond laser pulses in the X-ray range. The XFELs are opening two new research fields. One is to study ultrafast electronic and structural dynamics in various forms of matter. XFELs can make atoms and electrons in action visible. Another field is to study the non-linear interaction of the unprecedented intense X-ray pulse with matter. XFELs transform matter into its new form in extreme conditions that have never been reached. The present special issue provides an overview of the current status and future direction of the development of XFELs and the research fields opened by XFELs. Featured are reports on the status and plans of all FEL facilities in the world, ie, FLASH in Germany, LCLS in USA, SACLAC in Japan, FERMI in Italy, European XFEL, SwissFEL, PAL-XFEL in Korea, and Shanghai SXFEL in China. Reports are also included on instrumentations and on science at these facilities, as well as on the relevant theory.