

RESEARCH HIGHLIGHTS FROM FLASH

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Abstract

The Free electron LASer in Hamburg (FLASH) has started regular user operation in summer 2005, providing XUV radiation pulses with pulse energies in the 10–100 μ J range and pulse durations of 10–50 fs. The science programme at FLASH covers a broad range of novel applications including fundamental studies on atoms, ions, molecules and clusters, creation and characterisation of warm dense matter, diffraction imaging of nanoparticles, spectroscopy of bulk solids and surfaces, investigation of surface reactions and spin dynamics, and the development of advanced photon diagnostics and experimental techniques. So far, 16 science projects have been pursued involving approximately 200 scientists from 11 countries. Some of the research highlights were presented in the talk.

Most of the presented results are presently in the publishing process. Hence the reader is kindly referred to the selection of already published research at FLASH as listed below.

SELECTED PUBLICATIONS ON RESEARCH AT FLASH

1. V. Ayvazyan et al.,
First operation of a Free-Electron Laser generating GW power radiation at 32 nm wavelength,
Eur. Phys. J. D, **37**, 297-303 (2006)
2. S. Düsterer et al.,
Spectroscopic characterization of vacuum ultraviolet free electron laser pulses,
Opt. Lett. **31**, 1750-1752 (2006)
3. A.A. Sorokin et al.,
Multi-photon ionization of molecular nitrogen by femtosecond soft x-ray FEL pulses,
J. Phys. B: At. Mol. Opt. Phys. **39**, L299-L304 (2006)
4. H.N. Chapman et al.,
Femtosecond diffractive imaging with a soft-X-ray free-electron laser,
Nature Physics **2**, 839-843 (2006)
5. M. Meyer et al.,
Two-color photoionization in xuv free-electron and visible laser fields,
Phys. Rev. A **74**, 011401(R) (2006)
6. A.A. Sorokin et al.,
Method based on atomic photoionization for spot-size measurement on focused soft x-ray free-electron laser beams,
Appl. Phys. Lett. **89**, 221114 (2006)
7. N. Stojanovic et al.,
Ablation of solids using a femtosecond extreme ultraviolet free electron laser,
Appl. Phys. Lett. **89**, 241909 (2006)
8. A.R.B. de Castro et al.,
Spectroscopy of rare gas clusters using VUV light from a free-electron-laser,
J. Electron Spectrosc. Relat. Phenom. **156158**, 25-29 (2007)
9. M. Kirm et al.,
Time resolved luminescence of solids excited by femtosecond VUV pulses and synchrotron radiation,
phys. stat. sol. (c) **4**, No. 3, 870876 (2007)
10. S. Cunovic et al.,
Time-to-space mapping in a gas medium for the temporal characterization of vacuum-ultraviolet pulses,
Appl. Phys. Lett. **90**, 121112 (2007)
11. P. Radcliffe et al.,
Single-shot characterization of independent femtosecond extreme ultraviolet free electron and infrared laser pulses,
Appl. Phys. Lett. **90**, 131108 (2007)
12. S.P. Hau-Riege et al.,
Damage threshold of inorganic solids under free-electron laser irradiation at 32.5 nm wavelength,
Appl. Phys. Lett. **90**, 173128 (2007)
13. S.P. Hau-Riege et al.,
Subnanometer-Scale Measurements of the Interaction of Ultrafast Soft X-Ray Free-Electron-Laser Pulses with Matter,
Phys. Rev. Lett. **98**, 145502 (2007)
14. S.W. Epp et al.,
Soft x-ray laser spectroscopy on trapped highly charged ions at FLASH,
Phys. Rev. Lett. **98**, 183001 (2007)
15. J. Chalupský et al.,
Characteristics of focused soft X-ray free-electron laser beam determined by ablation of organic molecular solids,
Optics Express **15**, 6036-6043 (2007)
16. A.A. Sorokin et al.,
X-ray-laser interaction with matter and the role of multiphoton ionization: Free-electron-laser studies on neon and helium,
Phys. Rev. A **75**, 051402(R) (2007)

17. M. Nagasono et al.,
Resonant two-photon absorption of extreme ultraviolet FEL radiation in Helium,
Phys. Rev. A **75**, 051406(R) (2007)
18. R. Moshhammer et al.,
Few-photon Multiple Ionization of Ne and Ar by Strong Free-Electron-Laser Pulses,
Phys. Rev. Lett. **98**, 203001 (2007)
19. H.B. Pedersen et al.,
Crossed Beams Photodissociation Imaging of HeH⁺ with Vacuum Ultraviolet Free Electron Laser Pulses,
Phys. Rev. Lett. **98**, 223202 (2007)
20. W. Ackermann et al.,
Operation of a Free Electron Laser in the Wavelength Range from the Extreme Ultraviolet to the Water Window,
Nature Photonics **1**, 336-342 (2007)
21. A. Föhlisch et al.,
High-brilliance free-electron-laser photoionization of N₂: Ground-state depletion and radiationfield-induced modifications,
Phys. Rev. A **76**, 013411 (2007)
22. H.N. Chapman et al.,
Femtosecond Time-Delay X-ray Holography,
Nature **448**, 676-680 (2007)