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Theoretical studies on narrow-band hard-x-ray lasing

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Since the advent of x-ray free-electron lasers (XFELs), considerable efforts have been devoted to achieve x-ray pulses with better temporal coherence. Here, we put forward a scheme to generate fully coherent x-ray lasers (XRLs) based on population inversion in highly charged ions, created by fast inner-shell photoionization using XFEL pulses in a laser-produced plasma. Numerical simulations show that one can obtain high-intensity, femtosecond x-ray pulses of relative bandwidths $/ = 10^{-5}$ 10^{-7} by orders of magnitude narrower than in XFEL pulses for discrete wavelengths down to the sub-ångström regime.

Primary author: Mr LYU, Chunhai (Max Planck Institute for Nuclear Physics)

Co-authors: Dr CAVALETTO, Stefano M. (Max Planck Institute for Nuclear Physics); Prof. KEITEL , Christoph H. (Max Planck Institute for Nuclear Physics); Dr HARMAN, Zoltán (Max Planck Institute for Nuclear Physics)

Presenter: Mr LYU, Chunhai (Max Planck Institute for Nuclear Physics)

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