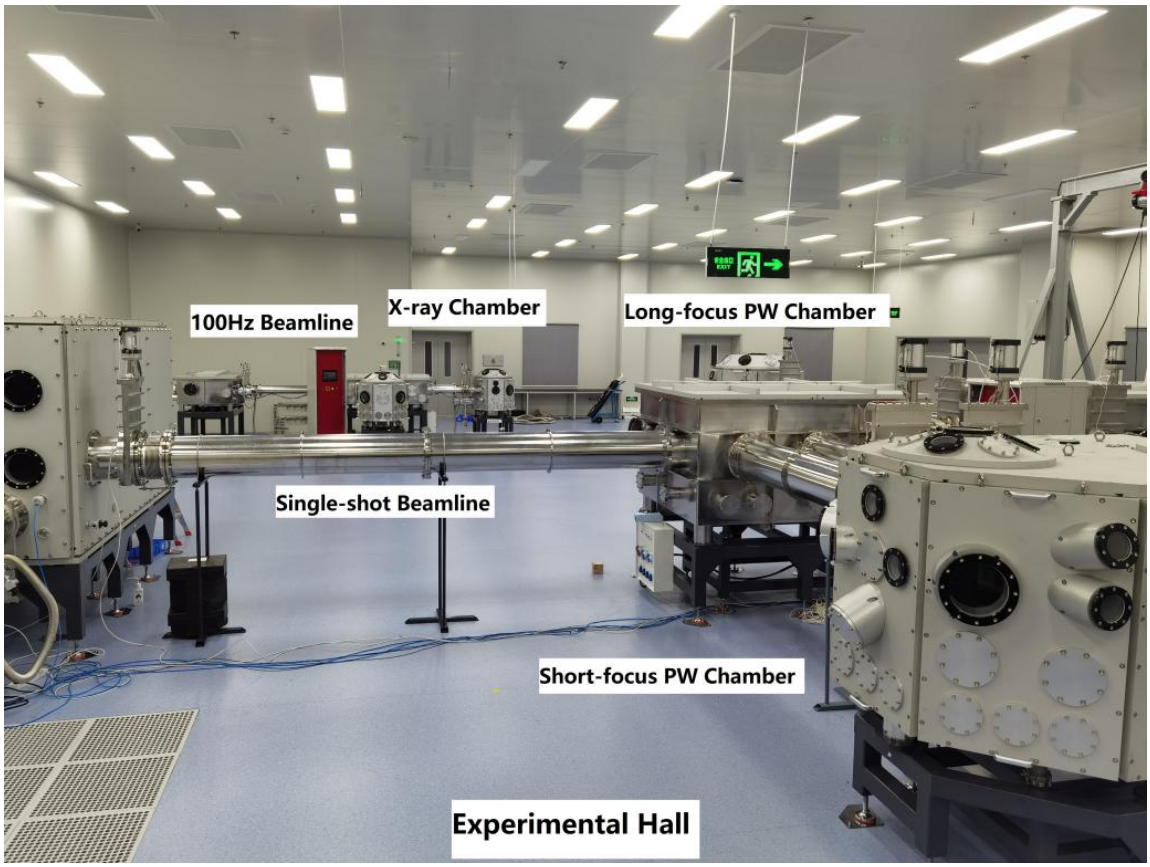
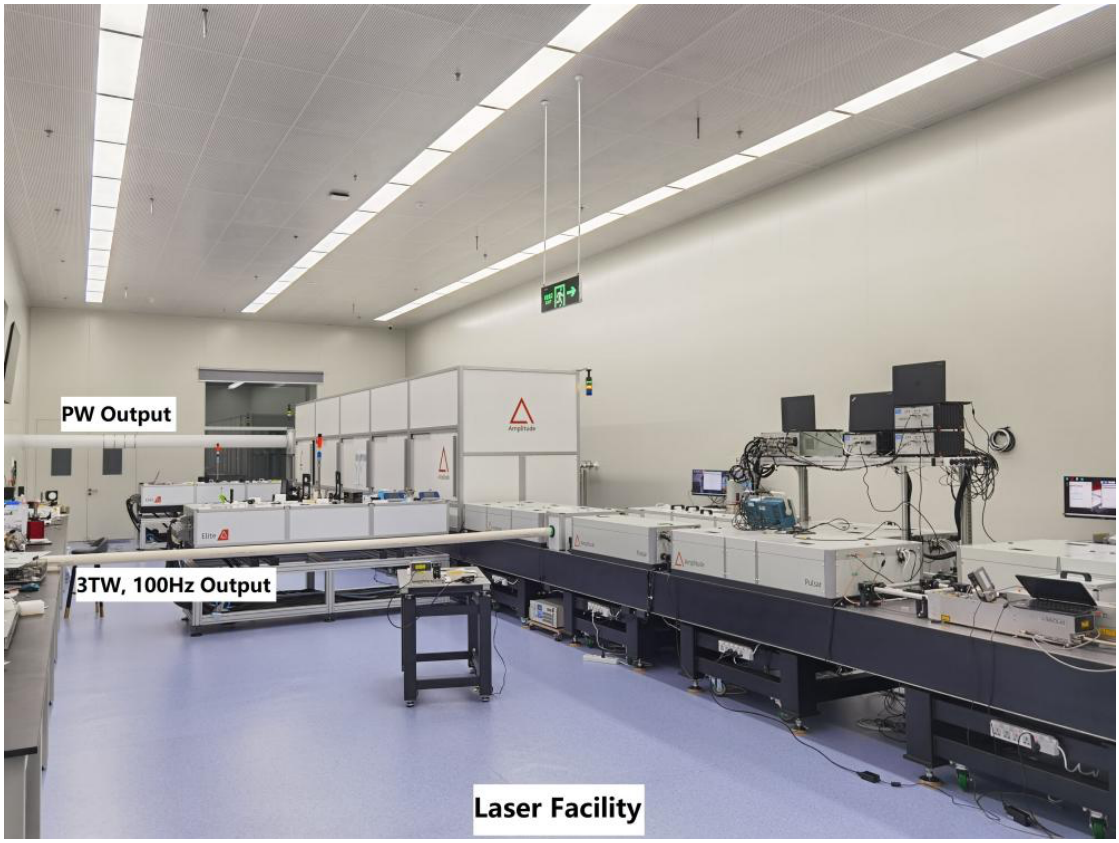
Ultrafast X-ray dynamics experimental station

The main function of the Ultrafast X-ray dynamics experimental station is to use the ultra-fast X-ray pulse generated by the interaction of femtosecond intense laser and target as the probe light, combined with the naturally synchronized driving laser as the pump light, to carry out ultra-fast time-resolved laser pumping X-ray detection research on material samples, which can provide four-dimensional ultra-fast research capabilities for photosynthesis, Auger process, lattice vibration process, etc. The main part of the station consists of an ultra-clean laboratory, an ultra-short and ultra-intense femtosecond laser, a vacuum chamber assembly and X-ray sources. The ultrashort and ultra-intense laser driver can provide two levels of output, corresponding to different X-ray beam modes respectively: the front level is 100 Hz, 3 TW output, used for X-ray beam lines in repetitive mode; The rear stage is 1 PW single shot output, which is used for ultra-strong X-ray beam in single shot mode.





Photos of the experimental station

Specification of ultrafast X-ray dynamics experimental station

Parameters	Values
100 Hz beamline X-ray yield	Photon energy 1-60 keV, yield 10^8/shot
Single-shot beamline X-ray yield	Photon energy 3-20 keV, yield 10^{11}/shot
100 Hz beamline driven laser	Peak power 3 TW, Pulse width<30 fs; Central wavelength 800 nm; Repetition rate 100 Hz
Single-shot beamline driven laser	Peak power 1 PW; Pulse width<30 fs; Central wavelength 800 nm; 1 shot per minute

A detailed introduction to ultrafast X-ray dynamics experimental station:

1. The 100 Hz X-ray output unit uses a 100 Hz main laser to focus on the surface of disk, tape solid targets or liquid metal targets through short focus OAP to generate

Kα X ray radiation. The generated X-rays are collected, collimated or focused and then provided to users for ultrafast X-ray diffraction, imaging and other research. The target material can be copper, silver, molybdenum, indium, tantalum and other metals according to the user's needs to generate Kα radiation of different wavelengths.

2. The single shot X-ray output unit uses PW laser to interact with the gas target to generate high-flux single shot X-ray pulse. The beamline is equipped with two interaction target chambers: short focus and long focus chambers. The short focus target chamber uses a parabolic mirror with a f-number about 4 to focus the PW laser pulse on argon, krypton and other gas nozzles to generate Kα X ray radiation. It can also be used for the research of inverse Compton scattering X-ray sources and other high energy density physical problems requiring ultra-high light intensity. The main function of the long focus target chamber is to focus the PW laser pulse on the gas or cluster target with a paraboloid mirror with a f-number about 40 to generate broad spectrum and directional Betatron radiation for X-ray absorption spectroscopy, ultrafast imaging and other studies, and also for the study of other new particle acceleration and radiation mechanisms.
3. The driving laser source of the 100 Hz beam line and the single beam line can also be provided to users to carry out the physical property research under the interaction with ultra-fast intense laser, as well as the research in the field of high field and high energy density physics.
4. Through further upgrading and Cooperation with other experimental stations, we will be able to conduct ultrafast physical property research under extreme conditions such as high pressure, strong magnetic field and extremely low temperature.

Contact Information:

Dr. Lu, E-mail: luxin@iphy.ac.cn.