CURRICULUM VITAE

# PERSONAL INFORMATION:

Name: Xinhang Xu

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# EDUCATION:

# Postdoc Researcher, University of California, Davis, California (03/2024 – present)

* [Fusion Plasma Diagnotics] Design and develop the far infrared tangential interferometer/polarimeter diagnostic(FIReTIP) and Terahertz high-k scattering system on the National Spherical Torus Experiment-Upgrade (NSTX-U), Princeton Plasma Physics Laboratory

**Ph.D. degree (2016 - 2023) , University of Science and Technology of China, Hefei, China**

* [Computational Plasma Modeling] Numerical study of the kinetic evolution of non-thermal electrons in Tokamak and its influence on cyclotron radiation
* [Fusion Plasma Diagnostics] Operate and upgrade millimeter-wave diagnostics (Electron Cyclotron Emission Imaging) on the Experimental Advanced Superconducting Tokamak (EAST), Hefei city, Anhui, China

Bachelor’s degree (2012 – 2016), **Anhui University of Science and Technology (AUST), Huainan, China**

* [Computational] Dynamics of a Particle Moving Along a Curvilinear Path

**RESEARCH ACTIVITIES:**

* + Fusion plasma diagnostics [Laser-aided diagnostics, millimeter-wave, terahertz]

**As a research scientist in non-invasive fusion plasma diagnostics, I possess extensive expertise in the end-to-end design and development of systems including laser-aided scattering, laser/millimeter-wave interferometry, and terahertz/millimeter-wave spectroscopy, with over 9 years’ experience. My research activity focuses on demonstrated by spearheading the development and implementation of the NSTX-U High-k Collective Scattering System at PPPL for measuring electron density fluctuations and contributing significantly to the NSTX-U Far-Infrared Tangential Interferometry and Polarimetry (FIReTIP) System for density measurement and feedback control. Furthermore, I bring 7 years of advanced experience in millimeter-wave/terahertz spectroscopy, highlighted by the design and deployment of Electron Cyclotron Emission Imaging (ECEI) systems on the DIII-D and EAST tokamaks.**

**This hands-on project work has cultivated a deep mastery of diagnostic principles, from the performance evaluation of key components to the development of custom devices. My proficiency encompasses optical ray-tracing simulation (Code V), custom circuit design and debugging (KiCad), automation and control programming (LabVIEW combined with Python), and 3D modeling (CATIA), supported by extensive experience in experimental installation, commissioning, and application. With seven years of direct tokamak experimental experience on EAST and formal fusion safety training, I am adept at leading experimental campaigns and excel in collaboration, effectively making the bridge between physicists and engineers to achieve project goals.**

**My work extends into data analysis and physics research, where I have led the development of custom data interpretation programs in MATLAB and Python for diagnostic calibration, physics studies, and theoretical model validation. I have also applied my skills to the thermal management of diagnostic equipment, performing heat dissipation simulation and analysis using COMSOL Multiphysics.**

Software: Code V, Catia, KiCad. HFSS, COMSOL Multiphysics, LabVIEW, Python, MATLAB

* + Computational plasma modeling [kinetic dynamics modeling, synthetic diagnostics modeling]

**I developed a novel kinetic simulation program that synergistically combines the computational efficiency of the spectral method (from the CODE program) with the modular, object-oriented architecture of the NORSE program. This hybrid solver is designed to compute the full temporal evolution of the electron distribution function in 0D2P (z**ero spatial dimensions and two momentum dimensions**) phase space under time-varying background parameters, such as plasma density and loop voltage. It self-consistently incorporates key physical processes—including electric field acceleration, test-particle collisions, synchrotron radiation damping, and the complete runaway electron avalanche source term—enabling the investigation of non-thermal electron dynamics in evolving discharge conditions. By moving beyond the limitations of previous steady-state solvers, this algorithm achieves significant gains in computational performance while maintaining high accuracy. The object-oriented framework ensures the code is both extensible and adaptable, facilitating the future integration of additional physics or its application to more complex scenarios.**

# RESEARCH EXPERIENCE:

# Hardware design and installation

* Mechanical design for EAST millimeter-wave imaging diagnostics’ optics housing and shielding crates,2021-2022

# Design and install the platform for two big microwave diagnostic system (EAST and MIR) in the EAST hall,2020-2021

# Design the frequency selective surface for millimeter-wave imaging diagnostics on EAST tokamak, Quasi-optical anti-reflection surface,2022

* Develop the millimeter-wave (transmitter/receiver/local oscillator) optics system for Electron Cyclotron Emission Imaging and Microwave Imaging Reflectometer on EAST tokamak,2023

# Physics experiment

# Investigate the non-thermal emission of electron cyclotron emission on EAST,2021-2023

# Investigate the micro-tearing modes instability based on Electron cyclotron emission imaging on EAST tokamak,2023

# Operate millimeter-wave imaging diagnostics on EAST tokamak,2016-2022

* Data interpretation for EAST Electron Cyclotron Emission Imaging experimental result.
* The benchmark and optical testing of High-k scattering and FIReTIP laser system,2024-2025

# CODE Development

* + Build 2D beam tracing simulation program based on Finite Difference Time Domain code,2023
  + Analysis the runaway electron and its emission in tokamak with kinetic equation,2022
  + Auto-control program of high-k scattering and FIReTIP laser system, 2024-2025

# PUBLICATIONS:

1. *Xu Xinhang, et al. "Improvement of transmittance using groove structured surface for microwave imaging diagnostics in tokamak plasmas." 2020 45th International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz). IEEE, 2020.*
2. *Xu, Xinhang, et al. "Analysis of the Anomalous Doppler Effect from Quantum Theory to Classical Dynamics Simulations." Chinese Physics B (2025).*
3. *Gao, BingXi, et al. "Diagnostic capacity of electron cyclotron emission imaging system with continuous large observation area on EAST tokamak." Review of Scientific Instruments 89.9 (2018).*

1. *Liu, Xianzi, et al. "High-wavenumber Collective Scattering Diagnostic System for EAST and NSTX-U Tokamaks and Synthetic Diagnostic System Development." APS Division of Plasma Physics Meeting Abstracts. Vol. 2024. 2024*
2. *Han, Dongqi, et al. "In situ relative self-dependent calibration of electron cyclotron emission imaging via shape* *matching." Review of Scientific Instruments 89.10 (2018).*
3. *Fei-xue, G. A. O., et al. "Evaluation of optical performance of microwave reflection imaging system on EAST tokamak." Nuclear Fusion and Plasma Physics 42.2 (2022): 187.*
4. *Zihan, L. I., et al. "A synthetic diagnostics platform for microwave imaging diagnostics in tokamaks." Plasma Science and Technology 26.3 (2024): 034006.*

## Presentations:

* + Oral presentation: The 8th Graduate Academic Forum on Plasma Physics and Fusion Engineering, University of Science and Technology of China, China (May 2023)
  + Poster: The 45th International Conference on Infrared, Millimeter, and Terahertz Waves

(Nov 2020)

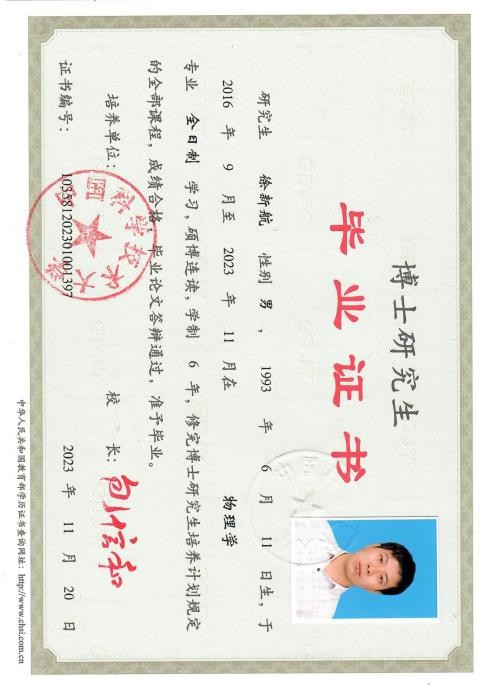
* + Oral presentation: 2023 Plasma Mixture Simulation Workshop, HeFei, China.

(Oct 2023)

**Collaborative Work**

Collaborated with scientists from UC Davis and PPPL on the discussion and analysis of DIII-D ECEI experimental data. Worked with engineering staff to propose equipment improvements based on experimental requirements, supporting the future operation and maintenance of the high-k scattering diagnostic and FIReTIP systems on NSTX-U. Maintained close collaboration with professors and peers from the University of Science and Technology of China in both experimental and theoretical plasma physics research.

**Certification of highest degree**

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