Cheng-Qi Zhang

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Laser–plasma interactions | Fusion diagnostics | Computational plasma physics

Education

Beijing Normal University Sep 2024 – Jun 2027 (expected)
M.Sc. in Physics (Laser–Plasma Physics and Ion-Acceleration Simulation) Beijing, China

- Class rank: **2/33**. Selected coursework: The Physics of Laser Plasma Interactions (95/100), Introduction to Nuclear and Particle Physics (92/100).

Chengdu University of Technology Sep 2020 – Jun 2024
B.Eng. in Radiation Protection and Nuclear Safety Chengdu, China

- Class rank: **1/36**. Selected coursework: Nuclear Electronics (96/100), Radiation Monitoring Data Processing Practice (95/100), Calculation Method and Programming Practice (95/100).

Research and Professional Experience

Beijing Normal University Sep 2024 – Present
Graduate Researcher, Laser–Plasma Interactions Beijing, China

- Performed 2D/3D particle-in-cell (**EPOCH/PIC**) studies of laser-driven proton acceleration, including target-normal-sheath acceleration (TNSA) and near-critical-density plasma targets.
- Investigated how microstructured target geometry affects proton energy spectra and beam divergence. Used **Bayesian optimization** for double-pulse timing and energy partition at fixed total laser energy and for multi-parameter target design.
- Developed data-driven surrogate models for proton spectra and participated in research on attosecond electron bunch generation using high-order-harmonic pulses.

ENN Group Oct 2026 – Present
Fusion Diagnostics Intern Beijing, China

- Modelled photoneutron production and transport for an EXL-50U gamma-ray diagnostic using Monte Carlo simulations to inform EHL-2 shielding design. Compared high-density polyethylene and boron carbide-loaded polyethylene in a simplified model with a lead collimator and $LaBr_3$ detector. In a benchmark with a 20 MeV ring photon source, adding a thin inner layer increased the simulated neutron fluence reduction from 61.3% to 76.5%, with relative statistical uncertainty within 2%.
- Reproduced the EXL-50U soft X-ray analysis workflow. Decoded raw events from SQLite, calibrated event energies, reconstructed spectra, corrected for detector efficiency and fitted the continuum to estimate electron temperature. Checked data completeness across discharges and channels and screened event continuity in 20 ms windows to identify intervals for further analysis.

International Atomic Energy Agency (IAEA) Oct 2025 – Oct 2026
Fusion Intern, Nuclear Power Technology Development Section Vienna, Austria

- Supported technical and consultancy meetings, technical publications, and fusion technology knowledge-sharing for IAEA Member States. Helped prepare meetings on remote handling and maintenance in challenging environments and on fusion workforce development.
- Led content development for fusion technology modules on **IAEA FUSE CONNECT**, an IAEA fusion knowledge platform. Helped build a fusion-device database covering machine parameters and fuel-cycle information.
- Developed an AI-assisted *Publication Review Assistant* to check editorial and formatting issues against the IAEA Style Manual, with structured, verifiable review suggestions.
- Analyzed *Fusion Cohesion* training data for fusion workforce development; contributed to materials on tritium breeding, remote handling, and codes and standards.

Technical Skills

- **Simulation methods and software:** Particle-in-cell (PIC) simulation — EPOCH (2D/3D); Monte Carlo radiation transport — MCNP, OpenMC; molecular dynamics (MD) — LAMMPS.
- **Computing:** Python, MATLAB, Bayesian optimization, machine-learning surrogate models, LaTeX.
- **Languages:** Mandarin (native); English (IELTS 7.0); Japanese (basic).

Publications and Manuscripts

Published Articles and Accepted Manuscripts

1. **C.-Q. Zhang**, Y. He, M. A. Bake, and B.-S. Xie. “Enhancement of proton acceleration via geometric confinement in near critical density plasma-filled targets.” *Plasma Physics and Controlled Fusion* **68**(7), 075023 (2026). doi:10.1088/1361-6587/ae81e4. **(First author; published)**

2. **C.-Q. Zhang**, Y. He, M. A. Bake, and B.-S. Xie. “Bayesian optimization of double-pulse temporal shaping for enhanced target-normal-sheath proton acceleration under fixed laser energy.” *Plasma Science and Technology*, accepted manuscript (online, 2026). doi:10.1088/2058-6272/ae9fbd. **(First author; accepted)**

3. Y. He, **C.-Q. Zhang**, M. A. Bake, and B.-S. Xie. “Attosecond electron bunch generation by an intense high-order harmonic pulse interacting with a thin target.” *Plasma Physics and Controlled Fusion* **68**(7), 075017 (2026). doi:10.1088/1361-6587/ae8574. **(Second author; published)**

Manuscripts Under Review or Revision

4. **C.-Q. Zhang**, Y. He, M. A. Bake, and B.-S. Xie. “Neutron-source fidelity for laser-driven D–D lithium-blanket tritium-breeding tests.” *Fusion Engineering and Design*, under revision (2026). arXiv:2607.13585.

5. **C.-Q. Zhang**, Y. He, M. A. Bake, and B.-S. Xie. “Multi-objective Bayesian optimisation of a double-layer target for quasi-monoenergetic TNSA protons.” Under review (2026). arXiv:2606.23224.

6. **C.-Q. Zhang**, Y. He, M. A. Bake, X. Wang, and B.-S. Xie. “A surrogate model for proton spectrum prediction to map transitions in laser-ion acceleration.” *Physical Review Applied*, under review (2026). arXiv:2606.06210.

Selected Research Projects and Training

ICTP Fusion Energy School — May 2026
Participant and Poster Presenter — Trieste, Italy

- Studied MHD, neutronics, transport, and magnetic/inertial fusion concepts; presented a poster on machine-learning prediction of laser-accelerated proton spectra.

IAEA–ICTP Workshop on SMR Physics and Thermal Hydraulics — Apr 2026
Participant and Poster Presenter — Trieste, Italy

- Studied reactor physics and thermal hydraulics; presented on Chinese HTGR/SMR progress and potential relevance of pebble-bed experience to fusion breeder blankets.

Irradiation Collision Cascades in Molybdenum — Jan – Jun 2024
Undergraduate Research Project Lead — Chengdu, China

- Used LAMMPS to study primary-knock-on-atom energy dependence of vacancy/interstitial formation in irradiation cascades, with relevance to fusion-facing materials.

Monte Carlo Whole-Body Counter Design — Apr – Jul 2023
Undergraduate Project Lead — Chengdu, China

- Modeled photon transport in a digital human phantom using MCNP and examined detector geometry and shielding parameters.

Selected Honors and Academic Service

- China Scholarship Council (CSC) funding (ID CSC202506040219); First-Class Academic Scholarship; National College Computer Design Competition (Second Prize); National Nuclear+X Competition (Merit Award); Kaggle 2025 Optimization Challenge (Silver Medal, top 4%).
- Co-organizing member of the International Fusion Energy Young Group (IFEYG). Member, CTBT Young Leaders (CYL). Science-outreach and physics-teaching volunteer.

Additional Internship Experience

Beixin Health Technology — AI Research Intern (Beijing; AI-guided wellness design) — Dec 2024–Jul 2025
IKEA (China) — HR Intern (Chengdu; onboarding and staff training) — Dec 2023–Sep 2024
Apple — Specialist Intern (Chengdu; customer support and device data transfer) — Aug 2020–Oct 2022