

KE LIN

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RESEARCH INTEREST

Key words: Nonlinear optics, Photonic crystal, Nano-photonics, Quantum and optical chaos

Disordered system and its application in modeling the flow of light in Photonics.

Novel topological states in optical system, interplay between periodic system and disorder

EXPERIMENT SKILLS

Experimental Observation of Branched Flow

- Create isotropic and anisotropic gaussian-correlated random lattice both in 2D and 3D using optical induction based on a photorefractive SBN:61 crystal
- Record the light intensity pattern using a charge-coupled device (CCD) at different facet of the crystal

Measurement of plasmon wavelength on graphene surfaces

- Use Atomic Force Microscopy (AFM) to measure the thickness of graphene
- Use Scattering-type Scanning Near-field Optical Microscope (SNOM) to measure the wavelength of graphene surface plasmon resonance

Measuring forces with the optical trap (2018 Nobel Prize, Arthur Ashkin, optical tweezers)

- DIY an optical tweezers and assemble the self-designed optical trap
- Use 5mW Nd: YAG 532nm laser to trap beads and measure the maximum force it generates

Publications

(*: equal contribution)

- **K. Lin**, Z. Y. Liu, J. W. Qin, Q. D. Fu, P. Wang, F. W. Ye, “[Observation of two-dimensional branched flow of light](#)”, *Phys. Rev. Lett.* (Submitted 15 May 2023, now under review)

Note: Click the link to see draft.

- Z. P. Fu*, Z. W. Zhang*, **K. Lin***, D. Wu, J. Zhang, “**Stopping power of high-density alpha-particle clusters in warm dense deuterium-tritium fuels**”, *Physics of Plasmas* 1 July 2023; 30 (7): 072708. <https://doi.org/10.1063/5.0156388> (Featured as cover, Editor’s pick)

EDUCATION

Massachusetts Institute of Technology (MIT), MA, USA

Spring 2023

Department of Physics

Major: Physics

Main course and scores:

8.292 [U, 12 units] Fluid Physics by Prof. Lydia Bourouiba: A

8.422 [G, 12 units] Atomic and Optical Physics II by Prof. Martin Zwierlein: A

8.431 [G, 12 units] Nonlinear Optics by Prof. James Fujimoto: B

Shanghai Jiao Tong University (SJTU), Shanghai, China

Sep.2020-Jun.2024 (expected)

School of Physics and Astronomy

Major: Physics (**Zhiyuan Honor Program, Talented Student Program in SJTU, Top 10%**)

• GPA: 3.92/4.30 Average Score: 90.38/100 RANK: 3/31

Main course and scores

Atomic Physics: 98.6 (Best score in class)

Electromagnetics: 90 (Best score in class)

Quantum Mechanics: 90

Classical Mechanics: 91

Numerical Analysis and Programming: 95

Computational Physics: 98

Application of Calculation Software: 97

Mathematical Analyses (Honor) I/ II: 96/96

Methods in Mathematical Physics: 91

Research topic in Plasma Physics: 96.5

Research topic in Optical Physics: 96.5

RESEARCH EXPERIENCE

Dynamic tunneling effect of superwire

Mar.2023-Now

Instructor: Professor Eric. J. Heller (Harvard Physics & Chemistry, Member of American Academy of Art and Science, Email: eheller@fas.harvard.edu)

- Extend study of superwire to three dimension using split-operator method
- Figure out the difference between superwire and supercollimation beam in Photonics Crystal
- Find breathing parallel superwire and its analogy with Gaussian wave packet in a harmonic well
- Add deformation potential in superlattice and find disorder-free superwire
- Construct band structure of square lattice with Fermi potential and find corresponding flat band in high index band (High Brillouin Zone)

Branched flow of the light (Zhiyuan Scholar Program, CN\$100,000)

Sept.2021-Mar.2023

Instructor: Professor Fangwei Ye (SJTU, Email: fangweiye@sjtu.edu.cn)

Part 1: (1+1)D and (2+1)D experimental realization

- Use Split-Step FFT to simulate branch flow of light in both 2D & 3D random potential field (weak disorder)
- Construct 2D & 3D, isotropic & anisotropic Gaussian-correlated random potential in a photorefractive SBN:61 crystal
- Observe both (1+1)D and (2+1)D branched flow in a photorefractive SBN:61 crystal

Part 2: Theoretical study of nonlinear branched flow

- Use Fokker-Planck approach to explain the formation of caustics and branched flow

- Explain the influence of the non-linear self-trap effect on the characteristics of the branch flow
- Use 8th Gaussian beam to create initial effective refractive index to verify the non-linear effect
- Discover smartly non-linear self-routing of soliton propagating in weak disorder random potential

Publication: K. Lin, Z. Y. Liu, J. W. Qin, Q. D. Fu, P. Wang, F. W. Ye, “[Observation of Stable Branched Flow of Light in Photorefractive Crystals](#),” *Phys. Rev. Lett.* (under review)

Nonlinear topological Thouless pumping in optical lattice

Jun.2022-Aug.2022

Instructor: Professor Fangwei Ye (SJTU, Email: fangweiye@sjtu.edu.cn)

- Mastered the theory of topological insulator, topological photonics and photonics band gap material
- Stimulate the wave packet transportation in Thouless pumping with different nonlinear amplitude
- Use MATLAB code calculating band structure for Thouless pumping in one and two dimensions

Measuring forces with magnetic field homopolar motor

May.2021-Sept.2021

Instructor: Professor Wei Pan (SJTU, Email: wtushelswill@sjtu.edu.cn)

- Assemble the stable self-designed homopolar motor using batteries and button magnets
- Model the motion of homopolar motor on a circular aluminum foil with classical electrodynamics

SELECTED COURSE PROJECT & RESEARCH

Measuring forces with the optical trap

2020 Fall

Instructor: Professor Dan Czajkowsky (SJTU, Email: dczaj@sjtu.edu.cn)

- Measure the laser's power-dependent force on water droplets
- Assemble the self-designed optical trap, use it to capture glass beads and control their motion
- Use optical trap to measure the twisting force that the bacterial motor (*E. coli*) generates

Study of stopping power of α -clusters in warm dense hydrogen

2022 Fall

Instructor:

Prof. Dong Wu (SJTU, Email: dwu.phys@sjtu.edu.cn), Prof. Jie Zhang (SJTU, CAS, Email: jzhang@iphy.ac.cn)

- Use Tianhe-2 supercomputer to simulate alpha-cluster propagation in Warm Dense Matter (WDM)
- Explain the influence of alpha-clusters by the interference of wake field

Publication: Z. P. Fu*, Z. W. Zhang*, K. Lin*, D. Wu, J. Zhang, “Stopping power of high-density alpha-particle clusters in warm dense deuterium-tritium fuels”, *Physics of Plasmas* 1 July 2023; 30 (7): 072708. <https://doi.org/10.1063/5.0156388> (Featured as cover, Editor's pick)

SEMINARS

Summer School of Theoretical Physics, Peking University

2022 Summer

- Write a research review on topological matter and topological state (Nobel Prize 2016)

- Listen to all the lectures on the frontiers of theoretical physics, including cosmology, dark matter and dark energy, topological phase transition, quantum computing, string theory, etc.

Joint TDLI and INPAC Summer School in Particle Physics 2021

2021 Summer

- Discuss the frontier research topics on Muon physics and listen to all the lectures on the frontiers of particle physics

AWARDS & HONORS

- Rongchang Scholarship of Science Innovation (Best 10 undergraduates in SJTU, CN\$30,000) 2022
- A-Level Scholarship, Shanghai Jiao Tong University (Top 1%) 2021&2022
- Bronze medal in The University Physics Competition 2022
- Hanyingjuhua Scholarship (Best 15 undergraduates in Zhiyuan Collage, CN\$15,000) 2022
- Merit Student, Shanghai Jiao Tong University 2021
- National Scholarship, China (CN\$8,000) 2021
- 1st Prize in China Undergraduate Physics academic Tournament (CUPT, Chinese IYPT) 2021
 - * As a leader of the team on behalf of SJTU, won 1st Prize for the first time
- Meritorious winners in Mathematical Contest in Modeling (MCM) 2021
- Zhiyuan Honor Scholarship, Shanghai Jiao Tong University (CN\$20,000) 2020&2021&2022&2023

ADDITIONS

- Programming Skills: C/C++, Python, MATLAB, Mathematica, COMSOL
- Presenting Tools: LaTeX, Markdown, Slidev on VSCode
- Leadership: President of the Student Union, Zhiyuan College, SJTU
- Volunteer in the 2021 & 2022 Graduation Ceremony in School of Physics