Chen-Zhu Xie 谢尘竹

Portfolio:
Scholar: Γ Γ
Preference:
Contact:
Personality: aries INTP ab

EDUCATION

Nanjing University College of Engineering and Applied Sciences **Nanjing, Jiangsu**

| *Doctor of Philosophy* | *Optical Engineering* | *Q.E. – Top 15%* | Nonlinear Fourier Optics | – 2025.06 |

Dissertation: "Analytic 3D vector linear non-uniform & nonlinear Fourier crystal optics in arbitrary $\bar{\bar{\varepsilon}}, \bar{\bar{\chi}}$ dielectrics"

| *Master's Studies* | *Quantum Electronics* | *Courses Score – 93.5* | THz OAM Source | – 2022.06 |

Northeastern University School of Physics, **College** of Science **Shenyang, Liaoning**

| *Bachelor of Science* | *Applied Physics* | *GPA Rank – 1/400* | DDTank Aimbots | – 2020.06 |

Thesis: "Research & design of nonlinear holography based on lithium niobate 3D nonlinear photonic crystal"

| *Freshman in College* | *Science* | *Sichuan Prov. – Top 2%* | 3 e-books with C++ | 2016.09 – |

RESEARCH PROJECTS

3D Vector Nonlinear Fourier Crystal Optics

Solving $\left[(\boldsymbol{\nabla}\times)^2 - k_0^2\bar{\bar{\varepsilon}}\cdot\right]\boldsymbol{E}(\boldsymbol{r}) = k_0^2\bar{\bar{\chi}}:\mathcal{F}_\omega^{-1}\left[\widetilde{\boldsymbol{E}}_{\mathrm{p}}\widetilde{\boldsymbol{E}}_{\mathrm{p}}\right](\boldsymbol{r})$ **analytically**   2023.05 –

- The first & fastest white box solver ever for this inhomogeneous wave equation
  - or other similar equations, with unprecedented efficiency-accuracy product
- No competitors for the time being: other methods or software including
  - k-space RK4, pseudo-spectral, SSF, Green's Function methods, FDTD, COMSOL...
- Reproduced well-known papers, all of which provide either zero or wrong theory:
  - Nat.Photo. #proven theoratically wrong by this project #femtosecond pump
  - O.E. #Bloembergen's legacy2 #experiment | O.M.E. #z-component
  - O.E. | Q.E. #high N.A. #$\bar{\bar{\chi}}$ anisotropy   PPT 1 2 3 ...

Complex Vector Linear Fourier Crystal Optics

Analytic solution $\boldsymbol{E}(\boldsymbol{r})$ to $\left[(\boldsymbol{\nabla}\times)^2 - k_0^2\bar{\bar{\varepsilon}}\cdot\right]\boldsymbol{E}(\boldsymbol{r}) = \boldsymbol{0}$ **where** $\varepsilon_{ij} \in \mathbb{C}$ 2023.02 –

- Drawing insights from PRS.A. #M.V.Berry's legacy | A.O.P. | A.P.B. | J.QSRT.
- The next generation of this project will come really close to the exact solution
- Reproduced well-known papers, some are purely experimental (too hard to model):
  - J.O.S.A. #Bloembergen's legacy1 | J.O. | O.M. | O.M. | J.O. | L.P.R.
  - JOSA.A. | O.E. #tightly focus #$\bar{\bar{\varepsilon}}$ anisotropy | Light.Sci.App. | O.E.   PPT 1 2 3 ...

Real Scalar Nonlinear Fourier Crystal Optics

Closed-form $E_3(\boldsymbol{r})$ **in** $\left[\boldsymbol{\nabla}^2 + k_3^2\right]E_3(\boldsymbol{r}) = -k_{03}^2\chi(\boldsymbol{r})E_1(\boldsymbol{r})E_2(\boldsymbol{r})$ 2022.02 –

- Solving this multivariable/field nonlinear convolution equation on my own
- Strong alternative to Green's Function, pseudo-spectral, split-step Fourier methods
- Reproduced well-known papers & models with maximum accuracy & efficiency:
  - P.R.L. #Green | P.R.L. #experiment #quantum | P.R.L. #experiment #scatter | P.R.L.
  - L.P.R. #SSF #quantum | Matlab #RCWA | A.P.L. #femtosecond pump
  - O.L. | P.R.A.   PPT 1 2 3 4 ...

Scientific Activities

1. **The 4th Nanjing University Doctoral Interdisciplinary Innovation Forum**   **Nanjing, Jiangsu**
   "Analytic vector linear & nonlinear Fourier crystal optics in arbitrary $\bar{\bar{\varepsilon}}, \bar{\bar{\chi}}$ dielectrics" | Oral [PPT]   2024.05.29

2. **2023 CSOE-NJU Book Club Meeting & Sharing Session**   **Nanjing, Jiangsu**
   "A guided tour to Ray & Wave Optics Simulation" | Oral [PPT]   2023.12.09

3. **Academic Café Salon of the Research Group**   **Nanjing, Jiangsu**
   "Bi-directional notes on Nonlinear Optics in a roam-like app: RoamEdit" | Oral [PDF]   2021.05.21

Publications

1. S. Petridis, J. Shen, **D. Cetin** and M. Pantic, "Visual-Only Recognition of Normal, Whispered And Silent Speech", *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), April 2018*

Academic Focus

Next generation high N.A. 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics ⬤ 2024.06 –

!Paraxial k_0^ω **High N.A.** 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics ⬤ 2024.03 –

Emphasizing G_{xyz}^ω **3D** vector non-uniform analytic linear & nonlinear Fourier crystal optics ⬤ 2023.12 –

Involving $\bar{\bar{\chi}}_\omega^{(2)}$ anisotropy   **Vector** non-uniform analytic linear & nonlinear Fourier crystal optics ⬤ 2023.06 –

!Unitary $G_\omega^\pm \Leftarrow$!Hermitian $\bar{\bar{\varepsilon}}_{\mathrm{r}}^\omega \Rightarrow$ **Non-uniform** analytic linear & nonlinear Fourier crystal optics ⬤ 2023.03 –

Solution $E_\omega^\pm$ to $\left(\nabla^2 + k_{\omega\pm}^2\right)E_\omega^\pm \propto P_{\omega\pm}^{(2)}$ **Analytic** linear & nonlinear Fourier crystal optics ⬤ 2022.09 –

Solution $\mathcal{F}[E_3] = \mathcal{F}\left[f\left(\mathcal{F}^{-1}[\cdot]\right)\right]$ to the Eq. below   **Nonlinear** angular spectrum theory for SFG ⬤ 2022.06 –

Solution $\mathcal{F}[E_3] = \iiiint$ to $\left(\nabla^2 + k_3^2\right)E_3(r) \propto P_3^{(2)}(r)$ **Nonlinear** convolution solution to SFG ⬤ 2022.03 –

⬤ Nonlinear THz LiNbO$_3$-based metasurface   **Quit THz project formally** | COMSOL – 2022.01

⬤ BWOPO + THz optical parametric amplification   Mathematica | BookxNote Pro – 2021.12

⬤ THz backward optical parametric oscillator (BWOPO)   Mathematica | VBA Excel – 2021.11

⬤ Multi-cycle THz orbital angular momentum (OAM) source   RoamEdit | Blender – 2021.11

⬤ Narrow-band THz OAM source via Optical Rectification (OR)   Python | Blender – 2021.10

⬤ Electricity $\xrightarrow{\text{produce}}$ Acoustics $\xrightarrow{\text{modulate}}$ Optics   RoamEdit | VBA Excel – 2021.07

⬤ Visible Photons $\xrightarrow{\text{SPDC}}$ THz Spectroscopy   BookxNote Pro | GeoGebra | VBA Excel – 2021.06

⬤ Cavity Phase Matching = Sheet OPO   Paint 3D | RoamEdit | GeoGebra | VBA Excel – 2021.05

⬤ THz Holography via Optical Rectification   Matlab | GeoGebra | VBA Excel – 2021.01

⬤ Femtosecond laser $\xrightarrow{\text{Optical Rectification}}$ Terahertz (THz)   GeoGebra | VBA Excel – 2020.12

⬤ Multicycle THz pulse generation by OR in LiNbO$_3$ ... crystals   VBA PowerPoinT – 2020.10

Skills

- **Skill Group:** List of technologies
- **Skill Group:** List of technologies
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Languages

- **Language:** language proficiency level
- – **EXAM:** details
- **Language:** language proficiency level
- **Language:** language proficiency level

Honors & Awards

Category	Item	Result	Rank	Institution	Date
Academia	Doctor's Qualification Exam (Oral) ▶	Excellent 🌐	*Top 15%*	Nanjing U.	2024.01
	Bachelar Dissertation 🔘 & Defense ▶	Excellent 🔘	*1/90*	Northeastern U.	2020.06
Competition	Three Provinces Achievement Expo 🌐	Exhibition 🔘	*Leader*	Three Prov.	2019.10
	"Challenge Cup" Tech Competition 🌐	Grand prize 🔘	*Leader*	Liaoning Prov.	2019.06
Scholarships & Fellowships	Academic Fellowship	1st class	¥40,000	Nanjing U.	2020-24
	"Jinchuan" Scholarship	1st place 🔘	¥5,000	Northeastern U.	2019.04
	Academic Scholarship	1st place 🔘	¥2,000	Northeastern U.	2018.06
	Entrance Scholarship	3rd place	¥5,000	Leshan No.1 H.S.	2013.09
Honors & Titles	Graduation with Honor 🌐	Outstanding		Northeastern U.	2020.07
	League Member 🌐	Excellent 🔘		Northeastern U.	2019.11
	Undergraduate Student	Excellent 🔘		Northeastern U.	2018.12
Memberships	Chinese Society for Optical Engineering	Member 🔘		Nanjing U.	2021-25
	"Qian Sanqiang" Talent Class	Head 🌐		I.H.E.P. 🌐	2017-20

Extracurricular Activities

- Member at Some Club — 2017–Current
  Detailed explanation of what you do at this club
- Member at Some Club — 2016–2017
  Detailed explanation of what you do at this club
- Volunteer at Some Event — Fall 2019
  Detailed explanation of what you do in this event
- Volunteer at Some Event — Winter 2015
  Detailed explanation of what you do in this event