Chen-Zhu Xie 谢尘竹

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

- The first and 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:
  - N.P. #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

Complex Vector Linear Fourier Crystal Optics

Analytic solution $\boldsymbol{E}(\boldsymbol{r})$ to $\left[(\nabla\times)^2 - k_0^2\bar{\bar{\varepsilon}}\cdot\right]\boldsymbol{E}(\boldsymbol{r}) = \boldsymbol{0}$ **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.

Real Scalar Nonlinear Fourier Crystal Optics

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

- Solving multivariable/field nonlinear convolution equations directly on my own
- Strong alternative to Green's Function, pseudo-spectral, split-step Fourier methods
- Reproduced well-known papers & models with higher both 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.

Scientific Activities

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Academic Focus

	Next generation high N.A. 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics	2024.06 –
!Paraxial $\boldsymbol{k}_0^\omega$	**High N.A.** 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics	2024.03 –
Emphasizing $\boldsymbol{G}_{\mathrm{xyz}}^\omega$	**3D** vector non-uniform analytic linear & nonlinear Fourier crystal optics	2023.12 –
Involving $\bar{\bar{\boldsymbol{\chi}}}_\omega^{(2)}$ anisotropy	**Vector** non-uniform analytic linear & nonlinear Fourier crystal optics	2023.06 –
!Unitary $\boldsymbol{G}_\omega^\pm \Leftarrow$!Hermitian $\bar{\bar{\varepsilon}}_{\mathrm{r}}^\omega \Rightarrow$	**Non-uniform** analytic linear & nonlinear Fourier crystal optics	2023.03 –
Solution $\boldsymbol{E}_\omega^\pm$ to $(\boldsymbol{\nabla}^2 + k_{\omega\pm}^2)\boldsymbol{E}_\omega^\pm \propto \boldsymbol{P}_{\omega\pm}^{(2)}$	**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 $\mathcal{F}[E_3] = \iiint$ to $(\boldsymbol{\nabla}^2 + k_3^2)E_3(\boldsymbol{r}) \propto P_3^{(2)}(\boldsymbol{r})$	**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
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Languages

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

Honors & Awards

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