

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 $\bar{\epsilon}$, $\bar{\chi}$ 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 –


PERSONAL PROJECTS

Behind NLAST

• Some techniques behind my academic project

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 theoretically wrong by this project #femtosecond pump
 - [O.E.](#) #Bloembergen's legacy2 #experiment | [O.M.E.](#) #z-component
 - [O.E.](#) | [Q.E.](#) #high N.A. # $\bar{\chi}$ anisotropy

PPT [1](#) [2](#) [3](#) ... 


DDTank Aimbots

Analytic solution $\mathbf{E}(\mathbf{r})$ to $\left[(\nabla \times)^2 - k_0^2 \bar{\epsilon} \cdot \right] \mathbf{E}(\mathbf{r}) = \mathbf{0}$ where $\epsilon_{ij} \in \mathbb{C}$ 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 # $\bar{\epsilon}$ anisotropy | [Light.Sci.App.](#) | [O.E.](#)

PPT [1](#) [2](#) [3](#) ... Real Scalar Nonlinear
Fourier Crystal OpticsClosed-form $E_3(\mathbf{r})$ in $\left[\nabla^2 + k_3^2 \right] E_3(\mathbf{r}) = -k_{03}^2 \chi(\mathbf{r}) E_1(\mathbf{r}) E_2(\mathbf{r})$ 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

- [0] **The 4th Nanjing University Doctoral Interdisciplinary Innovation Forum** Nanjing, Jiangsu
“Analytic vector linear & nonlinear Fourier crystal optics in arbitrary $\bar{\epsilon}, \bar{\chi}$ dielectrics” | Oral [PPT] 2024.05.29
- [-1] **2023 CSOE-NJU¹ Book Club Meeting & Sharing Session** Nanjing, Jiangsu
“A guided tour to Ray & Wave Optics Simulation” | Oral [PPT] 2023.12.09
- [-2] **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

- [0] P. Chen, X. Xu, T. Wang, C. Zhou, D. Wei, J. Ma, J. Guo, X. Cui, X. Cheng, **C. Xie**, S. Zhang, S. Zhu, M. Xiao, and Y. Zhang, *Laser nanoprinting of 3D nonlinear holograms beyond 25000 pixels-per-inch for inter-wavelength-band information processing*, Nature Communications **14**, 5523 (2023)
- [-1] J. Guo, Y. Zhang, H. Ye, L. Wang, P. Chen, D. Mao, **C. Xie**, Z. Chen, X. Wu, M. Xiao, and Y. Zhang, *Spatially Structured-Mode Multiplexing Holography for High-Capacity Security Encryption*, ACS Photonics **10**, 757–763 (2023)

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 $\bar{\chi}_\omega^{(2)}$ anisotropy **Vector** non-uniform analytic linear & nonlinear Fourier crystal optics 2023.06 –
!Unitary $G_\omega^\pm \Leftarrow$!Hermitian $\bar{\epsilon}_r^\omega \Rightarrow$ **Non-uniform** analytic linear & nonlinear Fourier crystal optics 2023.03 –
Solution E_ω^\pm to $(\nabla^2 + k_{\omega\pm}^2) E_\omega^\pm \propto P_{\omega\pm}^{(2)}$ **Analytic** linear & nonlinear Fourier crystal optics 2022.09 –
Solution $\mathcal{F}[E_3] = \mathcal{F}[f(\mathcal{F}^{-1}[\cdot])]$ to the Eq. below **Nonlinear** angular spectrum theory for SFG 2022.06 –
Solution $\mathcal{F}[E_3] = \iiint \text{to } (\nabla^2 + k_3^2) E_3(r) \propto P_3^{(2)}(r)$ **Nonlinear** convolution solution to SFG 2022.03 –
Nonlinear THz LiNbO₃-based metasurface **Quit THz project formally** | COMSOL – 2022.01
BWOP + THz optical parametric amplification Mathematica | BookxNote Pro – 2021.12
THz backward optical parametric oscillator (BWOP) 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 LiNbO₃ ... crystals VBA PowerPoinT – 2020.10

¹ The Nanjing University student branch of the Chinese Society for Optical Engineering

HONORS & AWARDS

Academia	Doctor's Qualification Exam (Oral)		Excellent		Top 15%	Nanjing	U.	2024.01
	Bachelor Thesis & 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

RESEARCH PROJECTS

3D Vector Nonlinear Fourier Crystal Optics	Solving $\left[(\nabla \times)^2 - k_0^2 \bar{\epsilon} \cdot \right] \mathbf{E}(\mathbf{r}) = k_0^2 \bar{\chi} : \mathcal{F}_\omega^{-1} \left[\tilde{\mathbf{E}}_p \tilde{\mathbf{E}}_p \right] (\mathbf{r})$ analytically 2023.05 – <ul style="list-style-type: none">• The first & fastest white box solver ever for this inhomogeneous wave equation<ul style="list-style-type: none">◦ or other similar equations, with unprecedented efficiency-accuracy product• No competitors for the time being: other methods or software including<ul style="list-style-type: none">◦ 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:<ul style="list-style-type: none">◦ Nat.Photo. #proven theoretically wrong by this project #femtosecond pump◦ O.E. #Bloembergen's legacy2 #experiment O.M.E. #z-component◦ O.E. Q.E. #high N.A. #$\bar{\chi}$ anisotropy PPT 1 2 3 ...
Complex Vector Linear Fourier Crystal Optics	Analytic solution $\mathbf{E}(\mathbf{r})$ to $\left[(\nabla \times)^2 - k_0^2 \bar{\epsilon} \cdot \right] \mathbf{E}(\mathbf{r}) = \mathbf{0}$ where $\epsilon_{ij} \in \mathbb{C}$ 2023.02 – <ul style="list-style-type: none">• 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):<ul style="list-style-type: none">◦ J.O.S.A. #Bloembergen's legacy1 J.O. O.M. O.M. J.O. L.P.R.◦ JOSA.A. O.E. #tightly focus #$\bar{\epsilon}$ anisotropy Light.Sci.App. O.E. PPT 1 2 3 ...
Real Scalar Nonlinear Fourier Crystal Optics	Closed-form $E_3(\mathbf{r})$ in $\left[\nabla^2 + k_3^2 \right] E_3(\mathbf{r}) = -k_{03}^2 \chi(\mathbf{r}) E_1(\mathbf{r}) E_2(\mathbf{r})$ 2022.02 – <ul style="list-style-type: none">• 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:<ul style="list-style-type: none">◦ 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 ...

EXTRACURRICULAR ACTIVITIES

- | | |
|--|--------------|
| • Member at Some Club | 2017–Current |
| <i>Detailed explanation of what you do at this club</i> | |
| • Member at Some Club | 2016–2017 |
| <i>Detailed explanation of what you do at this club</i> | |
| • Volunteer at Some Event | Fall 2019 |
| <i>Detailed explanation of what you do in this event</i> | |
| • Volunteer at Some Event | Winter 2015 |
| <i>Detailed explanation of what you do in this event</i> | |

SKILLS

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

LANGUAGES

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