Chen-Zhu Xie

谢尘竹

Portfolio: 🕥 🔼 in

Scholar: 📵 🎖

Preference: 6

Contact: **∠** X

Personality: **(INTP)** AB

Education

Nanjing University	College o	College of Engineering and Applied Sciences Nanjing, C					
Doctor of Philosophy	Optical Engineering	Q.E. − Top 15%	Nonlinear Fourier Optics 🕡 – 2025.09				
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				
Northeastern University School of Physics, College of Science Shenyang, Liaoning							
Northeastern Unive	ersity Sch	ool of Physics, College of Scien	snenyang, Liaoning				
Bachelor of Science	Applied Physics	GPA Rank – 1/400	DDTank Aimbots - 2020.06				
Bachelor of Science	Applied Physics	GPA Rank − 1/400 👩	V 0.				

Research Projects

Vector NonlinearFourier Crystal Optics

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

2023.05 -

- First & fastest white box solver ever for this inhomogeneous $\mathbb{C}^3_{\lambda}(\mathbb{R}^3_{\lambda})$ wave equation \circ 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...
- \bullet Reproduced well-known papers, all of which provide either zero or wrong theory:
 - o Nat.Photo. #proven theoratically wrong by this project #femtosecond pump
 - \circ O.E. #Bloembergen's legacy2 #experiment | O.M.E. #z-component
 - \circ O.E. | Q.E. #high N.A. $\#\bar{\chi}$ anisotropy

decks <u>1 2 3</u> ... •

Complex Vector Linear

Analytic
$$E(r) \in \mathbb{C}^3_{\lambda}(\mathbb{R}^3_{\lambda})$$
 to $\left[[(\nabla \times)^2 - k_0^2 \bar{\varepsilon} \cdot] E(r) = \mathbf{0} \right]$ 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.
- ullet Next generation will come really close to the exact solution with highly !hermitian $ar{ar{arepsilon}}$
- \bullet Reproduced well-known papers, some are purely experimental (too hard to model):
 - \circ J.O.S.A. #Bloembergen's legacy1 | J.O. | O.M. | O.M. | J.O. | L.P.R.
 - \circ JOSA.A. | O.E. #tightly focus #\$\bar{e}\$ anisotropy | Light.Sci.App. | O.E.

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Real Scalar Nonlinear

Closed-form
$$E_3(\mathbf{r}) \in \mathbb{C}(\mathbb{R}^3_{\lambda})$$
 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:
 - o P.R.L. #Green | P.R.L. #experiment #quantum | P.R.L. #experiment #scatter | P.R.L.
 - \circ L.P.R. #SSF #quantum | Matlab #RCWA | A.P.L. #femtosecond pump
 - O.L. | P.R.A.

Scientific Activities

Publications

In preparation:

[1] C. Xie and Y. Zhang, Nonlinear angular spectrum theory, (2025)

Journal article:

- [4] **C. Xie** and Y. Zhang, *Analytic 3D vector non-uniform fourier crystal optics in arbitrary* \$\bar{\bar{\varepsilon}}\$\$ *dielectric*, (Dec. 25, 2024) http://arxiv.org/abs/2412.17224 (visited on 01/01/2025), pre-published
- [3] X. Yang, Q. Yu, X. Xu, S. Chen, C. Xie, S. Zhu, M. Xiao, and Y. Zhang, Spontaneous parametric downconversion in a laser-poled lithium niobate nonlinear photonic crystal with nanoscale resolution, Optics Letters 49, 5799–5802 (2024)
- [2] 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)

Software copyright:

- [4] C. Xie, Stardust DDTank charge-mode auxiliary tool.apk, [Ver 1.0], ID. 2019SR0530474, Beijing, China.
- [3] C. Xie, Stardust DDTank drag-mode auxiliary tool.exe, [Ver 1.0], ID. 2019SR0390880, Beijing, China.
- [2] C. Xie, Stardust DDTank-Browser auxiliary tool.exe, [Ver 1.0], ID. 2019SR0435497, Beijing, China.
- [1] C. Xie, Stardust DDTank-mobile auxiliary tool.exe, [Ver 1.0], ID. 2019SR0390310, Beijing, China.

Academic Focus

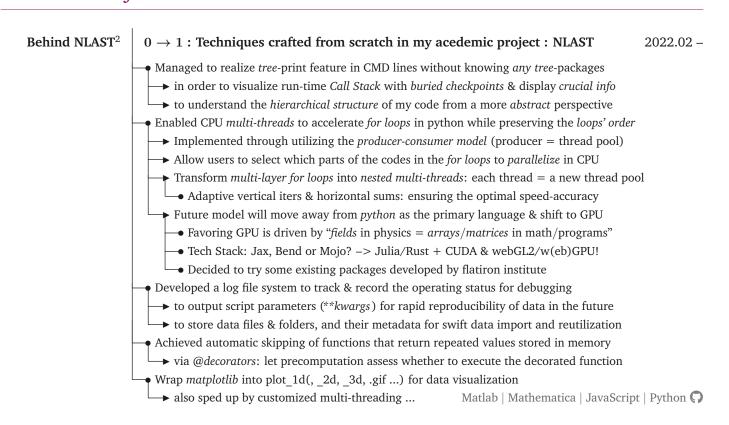
Next generation high N.A. 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics 😱				
!Paraxial k_0^{ω} High N.A. 3D vector non-uniform and	alytic linear & nonlinear Fourier crystal optics 🜎	2024.03 -		
Emphasizing G_{xyz}^{ω} 3D vector non-uniform and	alytic linear & nonlinear Fourier crystal optics 🜎	2023.12 -		
Involving $\bar{\bar{\chi}}_{\omega}^{(2)}$ anisotropy Vector non-uniform and	alytic linear & nonlinear Fourier crystal optics 🜎	2023.06 -		
!Unitary $G^\pm_\omega \Leftarrow$!Hermitian $\bar{\bar{\varepsilon}}^\omega_{\mathrm{r}} \Rightarrow$ Non-uniform and	alytic linear & nonlinear Fourier crystal optics 🜎	2023.03 -		
Solution E^\pm_ω to $(\nabla^2 + k^2_{\omega\pm}) E^\pm_\omega \propto P^{(2)}_{\omega\pm}$	llytic 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 $\mathcal{F}[E_3] = \iiint \cdot \text{to} \left(\nabla^2 + k_3^2\right) E_3(r) \propto P_3^{(2)}(r)$	Nonlinear convolution solution to SFG 😱	2022.03 -		

 $^{^{1}}$ The Nanjing University student branch of the Chinese Society for Optical Engineering

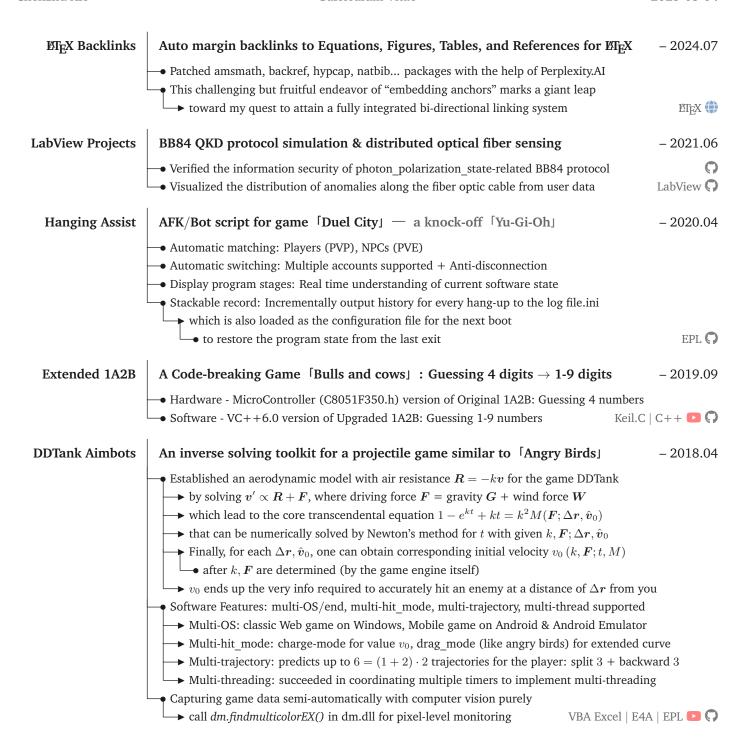
Honors & Awards

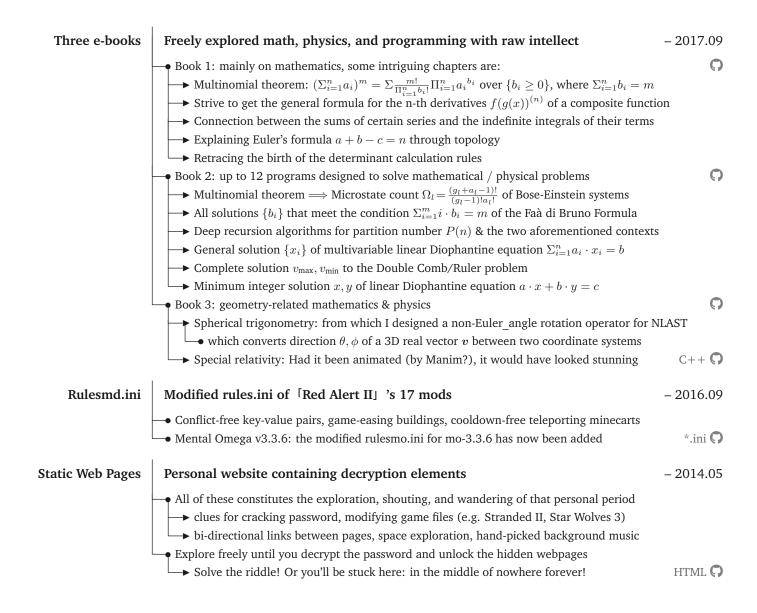
	- 1- 11-11 (0.1	15	0 1 1		*** 000			
	Doctoral Interdisciplinary Forum (Oral)		2nd place		¥1,000	Nanjing	U.	2024.05
Academia	Doctor's Qualification Exam (Oral)		Excellent	(<i>Top 15%</i>	Nanjing	U.	2024.01
	Bachelar Thesis 🕠 & Defense		Excellent	0	1/90	Northeastern	U.	2020.06
	NJU 1st Most Beautiful Notes Comp.	(2nd place	0	¥500	Nanjing	U.	2024.09
Competition	Three Provinces Achievement Expo	(Exhibition		Leader	Three I	Prov.	2019.10
	"Challenge Cup" Tech Competition	(Grand prize		Leader	Liaoning I	Prov.	2019.06
Scholarships	Academic Fellowship		1st class		¥56,000	Nanjing	U.	2020-25
&	"Jinchuan" Scholarship		1st place		¥5,000	Northeastern	U.	2019.04
	Academic Scholarship		1st place		¥2,000	Northeastern	U.	2018.06
Fellowships	Entrance Scholarship		3rd place		¥5,000	Leshan No.1	H.S.	2013.09
Honors	Graduation with Honor	(Outstanding	3		Northeastern	U.	2020.07
&	League Member	(Excellent	0		Northeastern	U.	2019.11
Titles	Undergraduate Student		Excellent	0		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

Personal Projects



²Non-linear Angular Spectrum Theory (= Nonlinear Fourier Optics in Research Projects)





Historical Details

Doctoral -	Activities Academia	•- 24 - 27 ③	2022.09 – 2025.06
Postgraduate -•	Activities Courses Academia	•- 22 - 24 (•)	2020.09 - 2022.06
Undergraduate -•	Activities Courses C	•- 18 - 22 ⓑ	2016.09 – 2020.06
Senior-high-school -	Activities 😱	•- 15 - 18 🕐	2013.09 – 2016.06