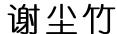
Chen-Zhu Xie



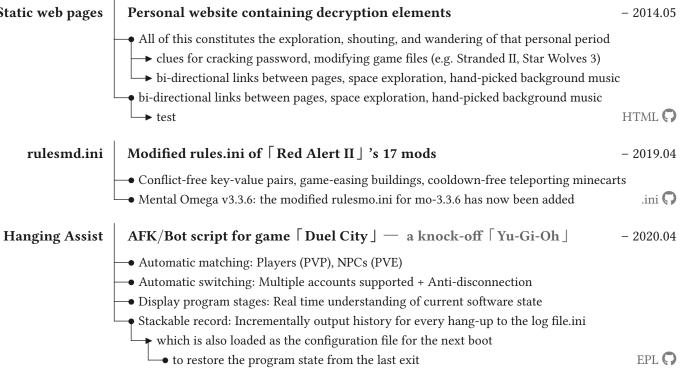
Portfolio: 🗘 🔼 in Scholar: Γ

Preference: 6
Contact: X

Personality: aries INTP ab

Education

Nanjing University	College of	f Engineering and Applied Sci	ences Nan	ijing, Jiangsu			
Doctor of Philosophy	Optical Engineering	Q.E. – Top 15%	Nonlinear Fourier Option	- 2025.06			
Dissertation: "Analy	tic 3D vector linear non-unit	form & nonlinear Fourier crys	tal optics in arbitrary $ar{ar{arepsilon}},ar{ar{ar{ar{\chi}}}}$ o	lielectrics"			
Master 's Studies	Quantum Electronics	Courses Score – 93.5 🞧	THz OAM Source	- 2022.06			
Northeastern University School of Physics, College of Science Shenyang, Liao							
Bachelor of Science	Applied Physics	GPA Rank – 1/400 🜎	DDTank Aimbots	- 2020.06			
Thesis: "Research &	& design of nonlinear hologi	caphy based on lithium niobate	e 3D nonlinear photonic cry	vstal"			
Freshman in College	Science	Sichuan Prov. – Top 2%	3 e-books with C++	2016.09 -			
Personal Project	ts						
Static web pages	Personal website conta	aining decryption elemen	nts	- 2014.05			



Three e-books

Freely explored math, physics, and programming with raw intellect

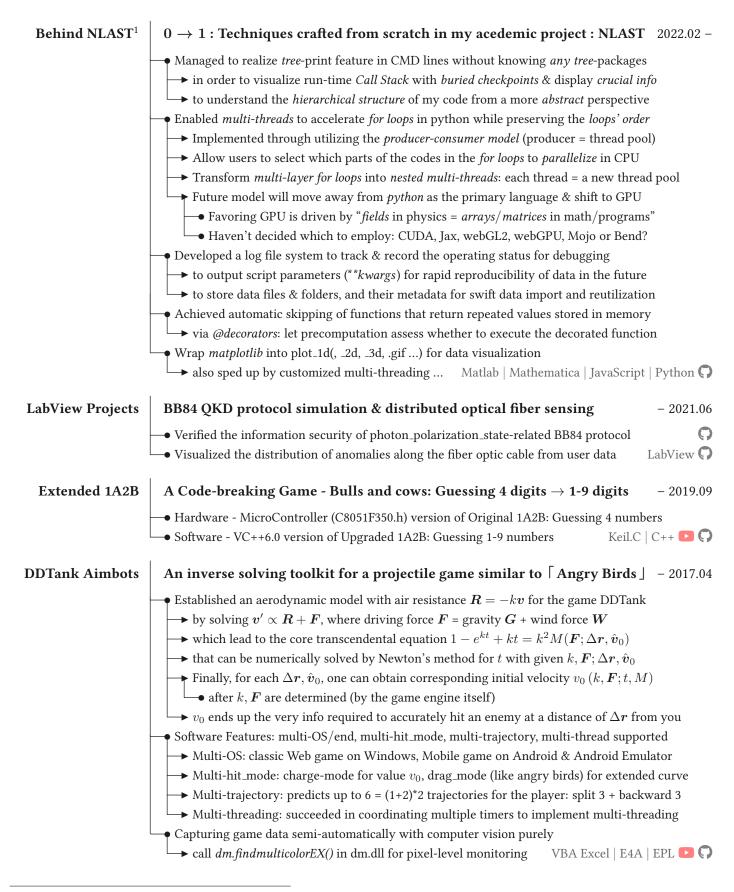
- 2017.08

- Book 1: mainly on mathematics, some intriguing chapters are:
- Multinomial theorem: $(\Sigma_{i=1}^n a_i)^m = \Sigma \frac{m!}{\prod_{i=1}^n b_i!} \prod_{i=1}^n a_i^{b_i}$ over $\{b_i \geq 0\}$, where $\Sigma_{i=1}^n b_i = m$ Strive to get the general formula for the n-th derivatives $f(g(x))^{(n)}$ of a composite function
- → Connection between the sums of certain series and the indefinite integrals of their terms
- ightharpoonup Explaining Euler's formula a+b-c=n through topology
- → Retracing the birth of the determinant calculation rules
- Pook 2: up to 12 programs designed to solve mathematical / physical problems
 - Multinomial theorem \Longrightarrow Microstate count $\Omega_l = \frac{(g_l + a_l 1)!}{(g_l 1)!a_l!}$ of Bose-Einstein systems
 - lacktriangle All solutions $\{b_i\}$ that meet the condition $\Sigma_{i=1}^m i \cdot b_i = m$ of the Faà di Bruno Formula
 - ightharpoonup Deep recursion algorithms for partition number P(n) & all the aforementioned contexts
 - → General solution $\{x_i\}$ of multivariable linear Diophantine equation $\sum_{i=1}^n a_i \cdot x_i = b$
 - ightharpoonup Complete solution $v_{
 m max}, v_{
 m min}$ to the Double Comb/Ruler problem

Minimum integer solution x, y of linear Diophantine equation $a \cdot x + b \cdot y = c$

• Book 3: geometry-related mathematics & physics

- → Spherical trigonometry: from which I designed a non-Euler_angle rotation operator for NLAST
 - ullet which converts direction $heta,\phi$ of a 3D real vector $oldsymbol{v}$ between two coordinate systems
- ➤ Special relativity: Had it been animated (by Manim?), it would have looked stunning



¹ Non-linear Angular Spectrum Theory

- 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
- logging system
 - o J.O.S.A. #Bloembergen's legacy1 | J.O. | O.M. | O.M. | J.O. | L.P.R.
 - o JOSA.A. | O.E. #tightly focus # $\bar{\epsilon}$ anisotropy | Light.Sci.App. | O.E.

PPT <u>1 2 3</u> ... •

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

2022.02 -

- Solving this multivariable/field nonlinear convolution equation on my own
- Strong alternative to Green's Function, pseudo-spectral, split-step Fourier methods
- Developed a log file system to record and output script runtime parameters**kwargs,
 - o P.R.L. #Green | P.R.L. #experiment #quantum | P.R.L. #experiment #scatter | P.R.L.
 - o L.P.R. #SSF #quantum | Matlab #RCWA | A.P.L. #femtosecond pump
 - O.L. | P.R.A.

Scientific Activities

- [0] The 4th Nanjing University Doctoral Interdisciplinary Innovation Forum

 "Analytic vector linear & nonlinear Fourier crystal optics in arbitrary $\bar{\bar{\epsilon}}$, $\bar{\bar{\bar{\chi}}}$ dielectrics" | Oral [PPT] 2024.05.29
- "Analytic vector linear & nonlinear Fourier crystal optics in arbitrary $\bar{\epsilon}$, $\bar{\bar{\chi}}$ dielectrics" | Oral [PPT] 2024.05.29 [-1] 2023 CSOE-NJU² Book Club Meeting & Sharing Session Nanjing, Jiangsu

"A guided tour to Ray & Wave Optics Simulation" | Oral [PPT]

2023.12.09

PPT 1234 ... 😱

[-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 \bigcirc 2024.06 – !Paraxial k_0^{ω} High N.A. 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics \bigcirc 2024.03 – Emphasizing G_{xyz}^{ω} 3D vector non-uniform analytic linear & nonlinear Fourier crystal optics \bigcirc 2023.12 – Involving $\bar{\chi}_{\omega}^{(2)}$ anisotropy Vector non-uniform analytic linear & nonlinear Fourier crystal optics \bigcirc 2023.06 – !Unitary $G_{\omega}^{\pm} \Leftarrow$!Hermitian $\bar{\varepsilon}_{r}^{\omega} \Rightarrow$ Non-uniform analytic linear & nonlinear Fourier crystal optics \bigcirc 2023.03 –

² The Nanjing University student branch of the Chinese Society for Optical Engineering

Solution $m{E}_{\omega}^{\pm}$ to $\left(m{\nabla}^2+k_{\omega\pm}^2 ight)m{E}_{\omega}^{\pm}\!\propto\!m{P}_{\omega\pm}^{(2)}$	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 $\mathcal{F}[E_3] = \iiint \cdot to\left(\nabla^2 + k_3^2\right) E_3(r) \propto P_3^{(2)}(r)$	Nonlinear convolution solution to SFG 😱	2022.03 -
\square 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 (BWOPC	Mathematica VBA Excel	- 2021.11
Multi-cycle THz orbital angular momentum (OAM) s	source RoamEdit Blender	- 2021.11
Narrow-band THz OAM source via Optical Rectification	tion (OR) Python Blender	- 2021.10
\bigcirc Electricity $\xrightarrow{\text{produce}}$ Acoustics $\xrightarrow{\text{modulate}}$ Optics	RoamEdit VBA Excel	- 2021.07
\bigcirc 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
\bigcirc Femtosecond laser $\xrightarrow{\text{Optical Rectification}}$ Terahertz (THz)	GeoGebra VBA Excel	- 2020.12
\square Multicycle THz pulse generation by OR in LiNbO ₃	. crystals VBA PowerPoinT	- 2020.10

Honors & Awards

Academia	Doctor's Qualification Exam (Oral)		Excellent	(<i>Top 15%</i>	Nanjing	U.	2024.01	
	Bachelar Thesis 😱 & Defense		Excellent	(7)	1/90	Northeaster	n U.	2020.06	
Competition	Three Provinces Achievement Expo	(Exhibition		Leader	Three	Prov.	2019.10	
	"Challenge Cup" Tech Competition	(Grand prize	e 😱	Leader	Liaoning	Prov.	2019.06	
Scholarships & Fellowships	Academic Fellowship		1st class		¥40,000	Nanjing	U.	2020-24	
	"Jinchuan" Scholarship		1st place		¥5,000	Northeaster	n U.	2019.04	
	Academic Scholarship		1st place		¥2,000	Northeaster	n U.	2018.06	
	Entrance Scholarship		3rd place		¥5,000	Leshan No.1	H.S.	2013.09	
Hor	iors	Graduation with Honor		Outstandin	ıg		Northeaster	n U.	2020.07
8	ķ	League Member		Excellent			Northeaster	n U.	2019.11
Tit	les	Undergraduate Student		Excellent	(7)		Northeaster	n U.	2018.12
Memberships	Chinese Society for Optical Engineer	ing	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
$$\left[\left[(\nabla \times)^2 - k_0^2 \bar{\bar{\varepsilon}} \cdot \right] \underline{\boldsymbol{E}}(\boldsymbol{r}) = k_0^2 \bar{\bar{\chi}} : \mathcal{F}_{\omega}^{-1} \left[\widetilde{\boldsymbol{E}}_{\mathrm{p}} \widetilde{\boldsymbol{E}}_{\mathrm{p}} \right] (\boldsymbol{r}) \right]$$
 analytically 2023.05 –

- First & fastest white box solver ever for this inhomogeneous wave equation o 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:
 - o Nat.Photo. #proven theoratically wrong by this project #femtosecond pump
 - O.E. #Bloembergen's legacy2 #experiment | O.M.E. #z-component
 - \circ O.E. | Q.E. #high N.A. # $\bar{\bar{\chi}}$ anisotropy

Complex Vector Linear

Fourier Crystal Optics

Analytic solution
$$E(r)$$
 to $\left[(\nabla \times)^2 - k_0^2 \bar{\bar{\varepsilon}} \cdot \right] E(r) = 0$ 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.
- Next generation of this project will come really close to the exact solution
- \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.
 - o JOSA.A. | O.E. #tightly focus # $\bar{\epsilon}$ anisotropy | Light.Sci.App. | O.E.

PPT <u>123</u> ... 😱

PPT 123 ... 😱

Real Scalar NonlinearFourier Crystal Optics

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

- Solving this multivariable/field nonlinear convolution equation on my own
- Strong alternative to Green's Function, pseudo-spectral, split-step Fourier methods
- \bullet 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 1234 ... (7)

Extracurricular Activities

Detailed explanation of what you do at this club

- Member at Some Club

 Detailed explanation of what you do at this club
- Member at Some Club 2016–2017
- Volunteer at Some Event

 Detailed explanation of what you do in this event

 Fall 2019
- Volunteer at Some Event

 Detailed explanation of what you do in this event

 Winter 2015

Skills

Languages

- Skill Group: List of technologies

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