

Z. ALPHONSE MARRA, PH.D.

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EXPERIENCE

**NRC Research Associate, Air Force Research Laboratory,
Wright-Patterson Air Force Base**

Jun 2025 – *Present*

- Lead development of advanced mid-infrared laser systems for defense-relevant technologies.

Postdoctoral Researcher, University of Ottawa

Aug 2024 – Jun 2025

- Launched a project for generating the world's highest peak-power (>1 TW) laser in the mid-infrared, continuing prior work on cryogenically cooled Fe:ZnSe.

Graduate Research Assistant, University of Central Florida

Aug 2019 – Aug 2024

Zenghu Chang Attosecond Science Research Group

- Developed a novel 4- μm femtosecond driving laser based on chirped pulse amplification of cryogenically cooled Fe:ZnSe, seeded by an optical parametric amplifier; achieved a repetition rate and average power 33x and 44x higher, respectively, than prior systems in its class.
- Operated and supported the laser for collaborative experiments with visiting researchers, including The Ohio State University, as part of the LaserNetUS network.
- Led an ongoing project to enable keV-level attosecond transient absorption spectroscopy.
- Secured grants from multiple agencies (AFOSR, DTRA, ARO, DARPA, NSF); established a new optics lab and mentored two undergraduate researchers.

Undergraduate Research Assistant, University of Wisconsin-Madison

Jan 2017 – Aug 2019

Mark Saffman Quantum Computing Research Group

- Contributed to the Atomic Qubit Array (AQuA) experiment: designed and built an acousto-optic-deflector system for trapping cesium atoms in a blue-detuned lattice, a cesium far-off-resonance trap (FORT), and an apparatus for calibrating laser frequencies via saturated absorption spectroscopy.

EDUCATION

University of Central Florida

Aug 2020 – Aug 2024

Ph.D. in Physics (Advisor: Zenghu Chang)

Orlando, FL

- Dissertation: *An Ultrafast, Mid-Wave Infrared Source for Driving High-Order Harmonics Beyond the Water Window.*
- Recipient of the National Defense Science and Engineering Graduate (NDSEG) Fellowship (5% acceptance rate among top U.S. Ph.D. students).

University of Wisconsin-Madison

Aug 2014 – May 2019

B.A. in Physics & Certificate in Entrepreneurship

Madison, WI

- Exchange study at The University of Hong Kong (Spring 2018).

PUBLICATIONS

- Z. A. Marra**, Y. Wu, F. Zhou, and Z. Chang, “Cryogenically cooled Fe:ZnSe-based chirped pulse amplifier at 4.07 μm ,” *Opt. Express* 31, 13447–13454 (2023).
- Z. Alphonse Marra**, Y. Wu, N. Belden, and Z. Chang, “Few-cycle, mJ-level, mid-wave infrared pulses generated via post-compression of a chirped pulse amplifier,” *Opt. Lett.* 49, 3170–3173 (2024).
- C. Kuz, J. Twardowski, E. DeAngelis, M. Eder, **Z. A. Marra**, Z. Chang, Y. Wu, and E. Chowdhury, “Harmonic generation and linear absorption of BK7 in the mid-infrared,” *Optica Open* (2026), preprint, doi:10.1364/opticaopen.31334149.
- F. Zhou, Y. Wu, **Z. A. Marra**, S.-W. Bahk, and Z. Chang, “Efficient generation of femtosecond multi-mJ pulses at 3 μm ,” *SPIE LASE* (SPIE, 2023), Vol. 12405.
- Z. Chang, L. Fang, V. Fedorov, C. Geiger, S. Ghimire, C. Heide, N. Ishii, J. Itatani, C. Joshi, Y. Kobayashi, P. Kumar, **A. Marra**, S. Mirov, I. Petrushina, M. Polyanskiy, D. Reis, S. Tochitsky, S. Vasilyev, L. Wang, Y. Wu, and F. Zhou, “Intense infrared lasers for strong-field science,” *Advances in Optics and Photonics* (2022).
- F. Zhou, Y. Wu, **A. Marra**, and Z. Chang, “Efficient generation of femtosecond millijoule pulses at 3.1 μm ,” *Opt. Lett.* 47, 6057–6060 (2022).
- Y. Wu, E. Witting Larsen, F. Zhou, L. Wang, **A. Marra**, D. Schade, J. Li, and Z. Chang, “Transition metal doped zinc selenide infrared lasers for ultrafast and intense field science,” in *Emerging Laser Technologies for High-Power and Ultrafast Science* (IOP Publishing, 2021), pp. 3-1–3-23.
- T. M. Graham, Y. Song, J. Scott, C. Poole, L. Phuttitarn, K. Jooya, P. Eichler, X. Jiang, **A. Marra**, B. Grinkemeyer, M. Kwon, M. Ebert, J. Cherek, M. T. Lichtman, M. Gillette, J. Gilbert, D. Bowman, T. Balance, C. Campbell, E. D. Dahl, O. Crawford, N. S. Blunt, B. Rogers, T. Noel, and M. Saffman, “Multi-qubit entanglement and algorithms on a neutral-atom quantum computer,” *Nature* 604, 457–462 (2022).
- T. M. Graham, M. Kwon, B. Grinkemeyer, **Z. Marra**, X. Jiang, M. T. Lichtman, Y. Sun, M. Ebert, and M. Saffman, “Rydberg-Mediated Entanglement in a Two-Dimensional Neutral Atom Qubit Array,” *Physical Review Letters* 123, 230501 (2019).

INVITED TALKS

- Z. Alphonse Marra**, “An Ultrafast, Mid-Wave Infrared Source for Driving High-Order Harmonics Beyond the Water Window,” IOS Seminar, Institute of Optical Science, The Ohio State University, May 2026.
- Z. Alphonse Marra**, “Cryogenically cooled Fe:ZnSe-based chirped pulse amplifier,” Air Force Institute of Technology (AFIT), December 2023.

PRESENTATIONS & POSTERS

- Z. Alphonse Marra**, M. Drees, D. Fleischmann, F. Xu, C. Geiger, Z. Chang, “Few-cycle, mJ-level, mid-wave infrared pulses generated via post-compression of a chirped pulse amplifier,” *SPIE Photonics West*, 2025 (poster).
- Z. Alphonse Marra**, F. Zhou, Y. Wu, Z. Chang, “A Chirped Pulse Amplifier at 4.05 μm Based on Cryogenically Cooled Fe:ZnSe,” *Conference on Lasers and Electro-Optics (CLEO)*, 2023.
- Z. A. Marra**, A. Banner, Z. Chang, “A 4.1 μm Fe:ZnSe-based CPA for driving high-order harmonics beyond the water window,” *8th International Conference on Attosecond Science and Technology (ATTO)*, 2022.
- Z. A. Marra**, A. Banner, F. Zhou, Y. Wu, Z. Chang, “A 4.1 μm Fe:ZnSe-based chirped pulse amplifier for driving high-order harmonics beyond the water window,” *Siegman International School on Lasers*, 2022.

Z. A. Marra, J. Li, D. Smerina, F. Zhou, Y. Wu, Z. Chang, “An optical parametric amplifier for seeding femtosecond Fe:ZnSe lasers at 4.1 μm ,” Conference on Lasers and Electro-Optics (CLEO), 2021.

T. Graham, M. Kwon, C. Poole, X. Jiang, **A. Marra**, B. Grinkemeyer, J. Cherek, M. Ebert, M. Saffman, “Quantum gates and algorithms in a 2D neutral atom array,” APS Division of Atomic, Molecular and Optical Physics (DAMOP), 2020.

T. Graham, C. Poole, X. Jiang, **A. Marra**, B. Grinkemeyer, G. Hickman, J. Cherek, M. Ebert, M. Saffman, “A reconfigurable, blue-detuned lattice for neutral atom quantum computing,” 50th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), 2019.

M. Ebert, G. Hickman, **A. Marra**, X. Jiang, T. Graham, M. Saffman, “Dual species Rydberg and collisional interactions in an optical dipole trap,” APS DAMOP, 2018.

PATENT

Z. A. Marra et al., “Mid-Infrared Chirped Pulse Amplifier,” U.S. Patent Application No. 18/646,498, filed April 25, 2024 (patent pending).

PROFESSIONAL SERVICE

Peer reviewer for Optica Publishing Group journals.

TECHNICAL SKILLS

Laboratory	Laser Engineering, Optical Design, Vacuum & Cryogenics, Machining (mill, lathe)
Software/Programming	Python, MATLAB, SolidWorks, Zemax, LabVIEW, COMSOL