

# Hao Zhang

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## Education

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### The University of Tennessee

*Knoxville, TN*

Ph.D. in Physics

Aug. 12, 2016 - Aug. 13, 2022

- Dissertation supervisor: Cristian Batista
- Dissertation title: *Semi-classical theories of quantum magnets*
- GPA: 3.98/4.00

### Sichuan University

*Chengdu, China*

B.S. in Physics

Sep. 1, 2012 - Jun. 30, 2016

- GPA: 3.70/4.00

## Employment

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### The University of Tennessee

*Knoxville, TN*

Postdoctoral Researcher

Aug. 15, 2022 - Now

### The University of Tennessee

*Knoxville, TN*

Graduate Research Assistant

Aug. 13, 2017 - Aug. 13, 2022

### The University of Tennessee

*Knoxville, TN*

Graduate Teaching Assistant

Aug. 13, 2016 - Aug. 12 2017

## Fellowships and Awards

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Graduate Fellowships (Topoffs) (University of Tennessee) ..... Aug. 2016-Aug. 2020

Shull Wollan Center Graduate Research Fellowship (University of Tennessee/Oak Ridge National Laboratory) ..... Jan. 2021-Jun. 2022

Graduate Advancement Training and Education Program Fellowship (The Science Alliance, University of Tennessee) .. Aug. 2021-Aug. 2022

Paul H. Stelson Fellowships of Professional Promise (Depart. of Physics & Astronomy, University of Tennessee) .... 2021 Department honors

## Research Interests

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Spin dynamics in frustrated magnets:  $SU(N)$  Landau-Lifshitz dynamics; Generalized spin wave theory; Topology in spin systems; Non-perturbative approaches in spin dynamics; Magnetic skyrmions.

## Programming Skills & Software Contributions

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**Programming Languages:** Julia, Python, Mathematica

**Sunny . j1 projects**      Contributing  $SU(N)$  spin-wave theory, work in progress

## Publications

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**HZ\*** indicates contribute equally

- [1] D. Dahlbom, C. Miles, **HZ**, C. D. Batista, and K. Barros, “Langevin dynamics of generalized spins as  $SU(N)$  coherent states,” *arXiv*, 2209.01265, (2022). [\[Link\]](#)
- [2] A. O. Scheie, Y. Kamiya, **HZ**, S. Lee, “Non-linear magnons in the  $1/3$  magnetization plateau of a proximate quantum spin liquid,” *arXiv*, 2207.14785, (2022). [\[Link\]](#)
- [3] S-H. Do\*, **HZ**\*, D. Dahlbom, T. J. Williams, et al. “Understanding temperature-dependent  $SU(3)$  spin dynamics in the antiferromagnet  $Ba_2FeSi_2O_7$ ,” *arXiv*, 2205.11770, (2022). [\[Link\]](#)
- [4] **HZ**, Z. Wang, D. Dahlbom, K. Barros, and C. D. Batista. “ $CP^2$  Skyrmions and Skyrmion Crystals in Realistic Quantum Magnets,” *arXiv*, 2203.15248, (2022). [\[Link\]](#)
- [5] D. Dahlbom, **HZ**, C. Miles, X. Bai, C. D. Batista, and K. Barros. “Geometric integration of classical spin dynamics via a mean-field Schrödinger equation,” *Phys. Rev. B*, 106, 054423, (2022). [\[Link\]](#)
- [6] X. Bai, S-S. Zhang, **HZ**, Z. Dun, W. A. Phelan, V. O. Garlea, M. Mourigal, and C. D. Batista. “Instabilities of heavy magnons in an anisotropic magnet,” *arXiv*, 2107.05694, (2021). [\[Link\]](#)
- [7] **HZ**, and C. D. Batista. “Classical spin dynamics based on  $SU(N)$  coherent states,” *Phys. Rev. B*, 104, 104409, (2021). [\[Link\]](#)
- [8] S-H. Do\*, **HZ**\*, T. J. Williams, T. Hong, et al. “Decay and renormalization of a longitudinal mode in a quasi-two-dimensional antiferromagnet,” *Nat. Commun.*, 12, 5331, (2021). [\[Link\]](#)
- [9] A. Legros, S-S. Zhang, X. Bai, **HZ**, et al. “Observation of 4- and 6-Magnon Bound States in the Spin-Anisotropic Frustrated Antiferromagnet  $FeI_2$ ,” *Phys. Rev. Lett.*, 127, 267201, (2021). [\[Link\]](#)
- [10] X. Bai, S-S. Zhang, Z. Dun, **HZ**, et al. “Hybridized quadrupolar excitations in the spin-anisotropic frustrated magnet  $FeI_2$ ,” *Nat. Phys.*, 17, 467–472 (2021). [\[Link\]](#)
- [11] Y. Ishii, G. Sala, M. B. Stone, V. O. Garlea, S. Calder, J. Chen, H. K. Yoshida, S. Fukuoka, J. Yan, C. Cruz, M-H. Du, D. S. Parker, **HZ**, C. D. Batista, K. Yamaura, and A. D. Christianson. “Magnetic properties of the Shastry-Sutherland lattice material  $BaNd_2ZnO_5$ ,” *Phys. Rev. Materials*, 5, 064418, (2021). [\[Link\]](#)
- [12] A. D. King, C. D. Batista, J. Raymond, T. Lanting, I. Ozfidan, G. Poulin-Lamarre, **HZ**, and M. H. Amin. “Quantum Annealing Simulation of Out-of-Equilibrium Magnetization in a Spin-Chain Compound,” *PRX Quantum*, 2, 030317, (2021). [\[Link\]](#)
- [13] S-S. Zhang, H. Ishizuka, **HZ**, G. B. Halász, and C. D. Batista. “Real-space Berry curvature of itinerant electron systems with spin-orbit interaction,” *Phys. Rev. B*, 101, 024420, (2020). [\[Link\]](#)
- [14] M. Vogl, P. Laurell, **HZ**, S. Okamoto, and G. A. Fiete. “Resummation of the Holstein-Primakoff expansion and differential equation approach to operator square roots,” *Phys. Rev. Research*, 2, 043243, (2020). [\[Link\]](#)

## Presentations

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### Spin-wave workshop at Oak Ridge National Laboratory

–20 min invited talk. *SU(3) Spin Dynamics in The  $S = 1$  Antiferromagnet  $Ba_2FeSi_2O_7$*

Oak Ridge, TN

Sep. 2022

### Seminar at T-4 group, Los Alamos Laboratory

–45 min invited talk.  *$CP^2$  Skyrmion and Skyrmion Crystals in Realistic Quantum Magnets*

Los Alamos, NM

Aug. 2022

### APS March Meeting

–10 min contributed talk. *Classical Spin Dynamics Based on  $SU(N)$  Coherent States*

Virtual

Mar. 2022

### APS March Meeting

–10 min contributed talk. *Decay and Renormalization in  $S = 1$  Antiferromagnet  $Ba_2FeSi_2O_7$*

Virtual

Mar. 2021

### Condensed Matter Seminar at University of Tennessee

–45 min invited talk. *Semiclassical Expansion Based on  $SU(3)$  Coherent States*

Virtual

Feb. 2021

### Mini March Meeting at Oak Ridge National Laboratory

–10 min contributed talk. *Generalized  $SU(3)$  Spin Wave Theory on  $S = 1$  Frustrated Triangular Magnets  $FeI_2$*

Oak Ridge, Tennessee

Mar. 2020