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Summary of Accomplishments

Research Productivity	
Funding Record	
External	Total funds = $21.330,671. Laraoui's share: **$1,613,614** Total pending = $3,305,630. Laraoui's share: **$980,326**
Internal	Total funds = $4,320,000. Laraoui's share: **$380,766**
Publications / Presentations	
Publications	38 peer-reviewed journal papers published (10 under review/revision/submission), 8 conference proceedings published.
Presentations	Presented 62 oral talks (22 invited at Gordon conference, SPIE Photonic West, MMM, MRS Spring Meeting…). Presented 41 posters.
Advised Students	
PhD students/Postdocs	5 ongoing students: one graduated in April of 2024, one will graduate in December of 2024, one will graduate in May of 2025. Supervised one postdoc for two years (now Advanced R&D Scientist at Honeywell).
Undergraduate/high school students	Supervised 13 undergraduate students and one high school student. They presented 7 posters on their research projects.
Teaching and Service	
Courses Taught	MATL 260/360 (required undergraduate course) MATL 262 (required undergraduate lab) MATL 492/982 (new, Spring 2021)
Instructor rating	4.23 average over 5.
Service	Served as a reviewer for NSF (2021, 2024) and DOE (2023); Organized 2024 NRIC conference on diamond quantum sensing; chaired many sessions at APS March Meeting and at International Conference on Magnetism; Reviewed 58 papers (NPG, AIP, APS, Wiley, Elsevier, etc.)

Section 1 Education and Employment History

Section 1.1 Education

- Doctorate (Ph.D.) of Physics, 10/2007, University of Strasbourg Louis Pasteur, France. **Thesis title:** Magnetization dynamics of magnetic nanostructures: Studies performed with femtosecond magneto-optical microscopy, Thesis. Advisor: Dr. Jean-Yves Bigot.
- Master's degree in Condensed Matter Physics, 6/2003, University of Upper Alsace, Mulhouse, France and Institute of Physics and Chemistry of Materials of Strasbourg, Strasbourg, France. **Thesis title:** Elaboration and characterization of magnetic nanoparticles. Advisors: Dr. Jean-Yves Bigot and Dr. Claude Estournès.

Section 1.2 Employment History

- University of Nebraska-Lincoln (UNL), Lincoln, NE
  Assistant Professor at Department of Mechanical & Materials Engineering, 8/2019- Present.
  Associate Faculty at Nebraska Center for Materials & Nanoscience, 8/2019- Present.
  Courtesy Faculty Member, Department of Physics and Astronomy, 2/2022- Present.
- University of New Mexico, Albuquerque, NM
  Research Assistant Professor, Center for High Technology Materials and School of Engineering, 9/2016-7/2019.
- CUNY City College of New York, New York, NY
  Research Associate, 4/2009-7/2016, Group of Prof. Carlos Meriles.
- University of Kaiserslautern of Technology, Kaiserslautern, Germany
  Marie Curie Postdoctoral Fellow, 10/2007-3/2009, Group of Prof. Burkard Hillebrands.

Section 2 Research Accomplishments

Section 2.1 Publication Record

The following subscripts indicate students/trainees under my direct supervision at UNL.
1: Undergraduate. 1": high school student.
3: Ph.D. student. 3" Visiting Ph.D. student.
4: Postdoctoral researcher.
**: Equal contributions.*
&: corresponding author.

Section 2.1.1 Peer reviewed journal publications in reverse chronological order.

1. Adam Erickson,[3,*] Qihan Zhang,[*] Hamed Vakilitaleghani,[*] Suvechhya Lamichhane,[3] Ilja Fescenko, Edward Schwartz, Alexey Kovalev, Sy-Hwang Liou, Jingshen Chen, and **Abdelghani Laraoui**.[&] Direct imaging of room temperature magnetic skyrmions in gradient-DMI engineered CoPt single layers, under review, submitted in February of 2024. A preprint is posted on arXiv. DOI: https://doi.org/10.48550/arXiv.2405.09632.

2. Mohammadjavad Dowran,[4,*] Ufuk Kilic,[*] Suvechhya Lamichhane,[3] Adam Erickson,[3] Joshua Barker,[1] Mathias Schubert, Sy-Hwang Liou, Christos Argyropoulos, and **Abdelghani Laraou**i.[&] Plasmonic Nanocavity to Boost Single Photon Emission from Defects in Thin Hexagonal Boron Nitride, ***Laser & Photonics Reviews*** **(IF = 11)**, under second review, submitted on December 18, 2023. A preprint is posted on arXiv. DOI: https://doi.org/10.48550/arXiv.2405.09683.

3. Adam Erickson,[3] Ather Mahmood, Syed Qamar Abbas Shah, Pratyush Buragohain, Ilja Fescenko, Alexei Gruverman, Christian Binek, **Abdelghani Laraoui**.[&] Imaging Local Effects of Voltage and Boron Doping on Spin Reversal in Antiferromagnetic Magnetoelectric Cr_2O_3 Thin Films and Devices, under review, ***Advanced Functional Materials*** **(IF = 19)**.

4. Suvechhya Lamichhane,[3] Evelyn Carreto Guevara, Ilja Fescenko, Sy-Hwang Liou, Rebecca Y. Lai, and Abdelghani Laraoui.[&] Magnetic Relaxometry of Hemoglobin by Widefield Nitrogen-Vacancy Microscopy, ***APL Photonics*** **(IF = 6)**, under review. A preprint is posted on arXiv. DOI: https://doi.org/10.48550/arXiv.2405.08227.

5. Rupak Timalsina,[3] Bharat Giri, Haohan Haohan, Adam Erickson,[3], Suchit Sarin, Suvechhya Lamichhane,[3] Sy-Hwang Liou, Jeffrey Shield, Xiaoshan Xu, **Abdelghani Laraoui**.[&] Effect of substrate and thickness on spin-wave propagation properties in ferrimagnetic thulium iron garnet thin films, under submission, ***Advanced Electronic Materials*** (**IF = 7.65**). A preprint is posted on arXiv.

6. Bharat Giri, Ahsan Ullah, Suvechhya Lamichhane,[3] Jing Li, Adam Erickson,[3] **Abdelghani Laraoui**, Sy-Hwang Liou, Xiaoshan Xu. Giant topological Hall effect as evidence of small skyrmions above room temperature in $Pt/NiCo_2O_4$ heterostructure, under submission.

7. Thitinun Gas-osoth,[3",*] Yifei Wang,[3",*] Raman Kumar, Tom Delord, Adam Erickson,[3] Tianlin Li, Cory Cress, Jose Fonseca-Vega, Xia Hong, Toshu An, Suvechhya Lamichhane,[3] Sy-Hwang Liou, Carlos Meriles,[&] and **Abdelghani Laraoui**.[&] Ferromagnetism and magnetic edge effects in Fe-implanted WS_2 layers, under preparation, ***Physical Review Materials*** **(IF = 3.4)**.

8. Suvechhya Lamichhane,[3] Rupak Timalsina,[3] Cody Schultz, Ilja Fescenko, Kapildeb Ambal, Sy-Hwang Liou, Rebecca Y. Lai, and **Abdelghani Laraoui**.[&] Nitrogen-Vacancy Magnetic Relaxometry of Nanoclustered Cytochrome C Proteins, ***Nano Letters*** **(IF = 10.8)** 24, 3, 873–880 (2024). DOI: https://doi.org/10.1021/acs.nanolett.3c03843.

9. Rupak Timalsina,[3] Haohan Wang, Bharat Giri, Adam Erickson,[3] Xiaoshan Xu, and **Abdelghani Laraoui**.[&] Mapping of Spin-Wave Transport in Thulium Iron Garnet Thin Films Using Diamond Quantum Microscopy, ***Advanced Electronic Materials*** **(IF = 7.63)**, 2300648, 2023). DOI: https://doi.org/10.1002/aelm.202300648.

10. L. Khosravi Khorashad, A. Reicks, A. Erickson,[3] J. E. Shield, D. Alexander, **A. Laraoui**, G. Gogos, C. Zuhlke, and C. Argyropoulos.[&] Unraveling the formation dynamics of metallic femtosecond laser induced periodic surface structures, ***Optics & Laser Technology*** **(IF = 4.94)**, 171, 110410 (2024). DOI: https://doi.org/10.1016/j.optlastec.2023.110410.

11. Suvechhya Lamichhane,[3] Kayleigh A McElveen, Adam Erickson,[3] Ilja Fescenko, Shuo Sun, Rupak Timalsina,[3] Yinsheng Guo, Sy-Hwang Liou, Rebecca Y. Lai, and **Abdelghani Laraoui**.[&] Nitrogen-vacancy magnetometry of individual Fe-triazole spin crossover nanorods, ***ACS Nano*** **(IF = 17.1)** 17, 9, 8694–8704, 2023.
DOI: https://doi.org/10.1021/acsnano.3c01819. In the News: Nebraska Today, Physics Today.

12. Mohammadjavad Dowran,[4] Andrew Butler, Suvechhya Lamichhane,[3] Adam Erickson,[3] Ufuk Kilic, Sy-Hwang Liou, Christos Argyropoulos, and **Abdelghani Laraoui**.[&] Plasmon Enhanced Single Photon Emitters with Hybrid Hexagonal Boron Nitride Silver Nanocube Systems, ***Advanced Optical Materials* (IF = 9)** 2300392, 2023.
DOI: https://doi.org/10.1002/adom.202300392. In the News: Nebraska Today, Physics Today, and Nebraska EPSCoR. Selected for back outside cover at *Advanced Optical Materials*.

13. Prem Bahadur Karki,[*] Rupak Timalsina,[3,*] Mohammadjavad Dowran,[4] Ayodimeji E. Aregbesola, **Abdelghani Laraoui**,[&] and Kapildeb Ambal.[&] An efficient method to create high-density nitrogen-vacancy centers in CVD diamond for sensing applications, ***Diamond and Related Materials* (IF = 4.1)**, Volume 140, Part B, 110472, 2023. DOI: https://doi.org/10.1016/j.diamond.2023.110472.

14. Adam Erickson,[3] Syed Qamar Abbas Shah, Ather Mahmood, Ilja Fescenko, Rupak Timalsina,[3] Christian Binek,[&] **Abdelghani Laraoui**.[&] Nanoscale imaging of antiferromagnetic domains in epitaxial films of Cr_2O_3 *via* scanning diamond magnetic probe microscopy, ***RSC Advances* (IF = 4)** 13 (1), 178-185, 2023. DOI: https://doi.org/10.1039/D2RA06440E.

15. **Abdelghani Laraoui**[&] and Kapildeb Ambal. Opportunities for nitrogen-vacancy-assisted magnetometry to study magnetism in 2D van der Waals magnets, ***Applied Physics Letters* (IF = 4)** *121, 060502* (2022). DOI: https://doi.org/10.1063/5.0091931.

16. J. Smits, J. Damron, P. Kehayias, N. Mosavian, I. Fescenko, A. McDowell, **A. Laraoui**, A. Jarmola, V. M. Acosta.[&] Sub-Hertz two dimensional NMR spectroscopy of molecules using Nitrogen Vacancy centers in diamond, ***Science Advances*** 5 eaaw7895, 2019. DOI: https://doi.org/10.1126/sciadv.aaw7895. 10% of my contribution.

17. I. Fescenko, **A. Laraoui**, J. Smits, N. Mosavian, P. Kehayias, J. Seto, L. Bougas, A. Jarmola, V. M. Acosta.[&] Diamond magnetic microscopy of malarial hemozoin nanocrystals, ***Physics Review Applied*** *11, 034029*, 2019. DOI: https://doi.org/10.1103/PhysRevApplied.11.034029.

18. D. Kikuchi, D. Prananto, K. Hayashi, **A. Laraoui**, N. Mizuochi, M. Hatano, E. Saitoh, Y. Kim, C.A. Meriles, T. An.[&] Long-distance excitation of nitrogen-vacancy centers in diamond via surface spin waves, ***Applied Physics Express***, 10 103004, 2017. DOI: https://doi.org/10.7567/APEX.10.103004.

19. P. Kehayias, A. Jarmola, N. Mosavian, I. Fescenko, F. M. Benito, **A. Laraoui**, J. Smits, L. Bougas, D. Budker, A. Neumann, S. R. J. Brueck, V. M. Acosta.[&] Solution nuclear magnetic resonance spectroscopy on a nanostructured diamond chip, ***Nature Communications*** 8, 108, 2017. DOI: https://doi.org/10.1038/s41467-017-00266-4.

20. H. Jayakumar, J. Henshaw, S. Dhomkar, D. Pagliero, **A. Laraoui**, N. Manson, R. Albu, M. W. Doherty, C. A. Meriles.[&] Optical patterning of trapped charge in nitrogen-doped diamond, ***Nature Communications*** 7, 12660, 2016. DOI: https://doi.org/10.1038/ncomms12660.

21. **A. Laraoui**, H. Aycock-Rizzo, X. Lu, Y. Gao, E. Riedo, C. A. Meriles.[&] Imaging thermal conductivity with nanoscale resolution using a scanning spin probe, ***Nature Communications*** 6, 8954, 2015. DOI: https://doi.org/10.1038/ncomms9954.

22. **A. Laraoui**, D. Pagliero, C. A. Meriles.[&] Imaging nuclear spins weakly coupled to a probe paramagnetic center, ***Physical Review B*** 91, 205410, 2015. DOI: https://doi.org/10.1103/PhysRevB.91.205410.

23. D. Pagliero, **A. Laraoui**, J. Henshaw, C. A. Meriles.[&] Recursive polarization of nuclear spins in diamond at arbitrary magnetic fields, ***Applied Physics Letters*** 105, 242402, 2014. DOI: https://doi.org/10.1063/1.4903799.

24. M. E. Trusheim, L. Li, **A. Laraoui**, E.H. Chen, O. Gaathon, H. Bakhru, T. Schroeder, C. A. Meriles, D. Englund.[&] Scalable Fabrication of High Purity Diamond Nanocrystals with Long-Spin-Coherence Nitrogen Vacancy Centers, ***Nano Letters***, 14 (1), 32-36, 2014. DOI: https://doi.org/10.1021/nl402799u. In the News: NanoTechWeb, PhysicsWorld, Nature News Feature.

25. **A. Laraoui**, C. A. Meriles.[&] Approach to dark spin cooling in a diamond nanocrystal, ***ACS Nano*** 7, 3403, 2013. DOI: https://doi.org/10.1021/nn400239n.

26. **A. Laraoui**, F. Dolde, C. Burk, F. Reinhard, J. Wrachtrup, C. A. Meriles.[&] High-Resolution Correlation Spectroscopy of 13C Spins Near a Nitrogen-Vacancy Center in Diamond, ***Nature Communications*** 4, 1651, 2013. DOI: https://doi.org/10.1038/ncomms2685.

27. **A. Laraoui**, J. S. Hodges, C. A. Meriles.[&] Nitrogen-Vacancy-assisted magnetometry of paramagnetic centers in an individual diamond nanocrystal, ***Nano Letters*** 12 (7), 3477–348, 2012. DOI: https://doi.org/10.1021/nl300964g.

28. **A. Laraoui**, C. A. Meriles.[&] Rotating frame spin dynamics of a Nitrogen-Vacancy center in a diamond nanocrystal, ***Physical Review B*** 84, 161403(Rapid Communications), 2011. DOI: https://doi.org/10.1103/PhysRevB.84.161403.

29. **A. Laraoui**, J. S. Hodges, C. Ryan, C. A. Meriles.[&] The diamond nitrogen-vacancy center as a probe of random fluctuations in a spin ensemble, ***Physical Review B*** 84, 104301 (2011). DOI: https://doi.org/10.1103/PhysRevB.84.104301.

30. **A. Laraoui**, J. S. Hodges, C. A. Meriles.[&] Magnetometry of random ac magnetic fields using a single nitrogen-vacancy center in diamond, ***Applied Physics Letters*** 97, 143104, 2010. The Virtual Journal of Nanoscale Science and Technology 22, 16 (October 2010). DOI: https://doi.org/10.1063/1.3497004.

31. H. Schultheiss,[&] X. Janssens, M. van Kampen, F. Ciubotaru, S. J. Hermsdoerfer, B. Obry, **A. Laraoui**,[&] A. A. Serga, L. Lagae, A. N. Slavin, B. Leven, and B. Hillebrands. Direct Current Control of Three Magnon Scattering Processes in Spin-Valve Nanocontacts, ***Physical Review Letters*** 103, 157202, 2009. The Virtual Journal of Nanoscale Science and Technology 20, 16 (October 2009). DOI: https://doi.org/10.1103/PhysRevLett.103.157202.

32. **A. Laraoui**, J. Vénuat, V. Halté, M. Albrecht, E. Beaurepaire, J.-Y. Bigot.[&] Study of individual ferromagnetic discs with femtosecond optical pulses, ***Journal of Applied Physics*** 101, 09C105, 2007. DOI: https://doi.org/10.1063/1.2711609. 60% of my contribution.

33. **A. Laraoui**, M. Albrecht, J.-Y. Bigot.[&] Femtosecond Magneto-optical Kerr Microscopy, ***Optics Letters*** 32, 936, 2007. The Virtual Journal of Ultrafast Science 6, 4 (April 2007). DOI: https://doi.org/10.1364/OL.32.000936.

34. **A. Laraoui**, V. Halté, M. Vomir, J. Vénuat, M. Albrecht, E. Beaurepaire, J.-Y. Bigot.[&] Ultrafast spin dynamics of an individual CoPt3 ferromagnetic dot, ***The European Physical Journal D*** 43, 253, 2007. DOI: https://doi.org/10.1140/epjd/e2007-00120-y.

35. L. H. F. Andrade, **A. Laraoui**, M. Vomir, D. Muller, J.-P. Stoquert, C. Estournès, E. Beaurepaire, J.-Y. Bigot.[&] Damped Precession of the Magnetization Vector of Superparamagnetic Nanoparticles Excited by Femtosecond Optical Pulses, ***Physical Review Letters*** 97, 127401, 2006. The Virtual Journal of Nanoscale Science and Technology 5, 10 (October 2006). DOI: DOI: https://doi.org/10.1103/PhysRevLett.97.127401.

Section 2.1.5 Peer Reviewed Conference Proceedings in reverse chronological order.

1. Prem Bahadur Karki,[*] Rupak Timalsina,[3,*] Mohammadjavad Dowran,[4] Ayodimeji E. Aregbesola, Abdelghani Laraoui,[&] and Kapildeb Ambal.[&] Creation of high-density nitrogen-vacancy centers in CVD diamond for precision magnetometry. ***CLEO Proceeding Conference, Lasers and Electro-Optics***, accepted, 2024. 30% of my contribution.
2. J. Smits,[&] J. Damron, P. Kehayias, A. Mcdowell, N. Mosavian, I. Fescenko, N.Ristoff, **A. Laraoui**, A. Jarmola, V. Acosta. Chemical resolution picolitre NMR with a Nitrogen-Vacancy diamond quantum sensor Symposium Latsis 2019 on ***Diamond Photonics - Physics, Technologies and Applications*** OSA Technical Digest (Optical Society of America), paper 62, 2019. 10% of my contribution.
3. I. Fescenko,[*, &] **A Laraoui**,[*] J Smits, N Mosavian, P Kehayias, J Seto, L Bougas, A. Jarmola, V. M. Acosta. Magnetic imaging of malarial nanocrystals with diamond sensors, Laser Science, JW3A.89 (2019), ***The Optical Society of America***, 2019. 30% of my contribution.
4. J-Y. Bigot, M. Vomir, M. Barthélémy, M. Albrecht, **A. Laraoui**.[&] Nanophotonics devices based on magnetic materials, ***Proc. SPIE*** 8268, 82682U, 2012. 30% of my contribution.
5. J.-Y. Bigot,[&] **A. Laraoui**, M, Vomir, M. Albrecht. Magneto-optical pump probe imaging, ***Proc. IEEE*** in Lasers and Electro-Optics, ISBN: 978-1-55752-859-9 (2008). 40% of my contribution.
6. **A. Laraoui**,[&] V. Halté, L. Andrade, J.-Y. Bigot. Ultrafast magnetization dynamics in cobalt nanoparticles studied with femtosecond laser pulses, ***Proc. IEEE*** in Lasers and Electro-Optics, ISBN: 978-1-55752-859-9 (2008). 50% of my contribution.
7. J.-Y. Bigot, **A. Laraoui**, J. Vénuat, M. Vomir, E. Beaurepaire, Time resolved magneto-optical microscopy of individual ferromagnetic dots, ***Springer Verlag series*** in Chemical Physics 88, 662 (2007). 30% of my contribution.
8. **A. Laraoui**,[&] M. Vomir, E. Beaurepaire, J.-Y. Bigot. Femtosecond imaging of the spin dynamics of CoPt nanostructures, ***Proc. IEEE*** in International Quantum Electronics Conference, ISBN: 978-1-4244-0931-0 (2007). 50% of my contribution.

Section 2.1.7 Conference Presentations in reverse chronological order (underlined: the presenter).

1. **Abdelghani Laraoui**, Mohammadjavad Dowran,[4] Ufuk Kilic, Suvechhya Lamichhane,[3] Adam Erickson,[3] Sy-Hwang Liou, Christos Argyropoulos. Enhanced Quantum Properties of Single Photon Emitters in Hexagonal Boron Nitride Flakes Using Plasmonic Nanocavities, 2024 MRS Spring Meeting, April 22-26, 2024, Seattle, WA.
2. Thitinun Gas-osoth,[3",*] Yifei Wang,[3",*] Suvechhya Lamichhane,[3] Raman Kumar, Tianlin Li, Tom Delord, Cory Cress, Jose Fonesca Vega, Xia Hong, Toshu An, Carlos Meriles, and **Abdelghani Laraoui**. Widefield Nitrogen-Vacancy Magnetometry of Pristine and Fe-

implanted WS_2, The 71st Japan Society of Applied Physics (JSAP) Spring Meeting 2024, March 22 – 25 , 2024, Venue Setagaya Campus, Tokyo City University, Japan.

3. Adam Erickson,[3] Ather Mahmood, S.Q.A Shah, Ilja Fescenko, Christian Binek, and **Abdelghani Laraoui**. Studying the effect of boron doping and thickness on antiferromagnetic domains in epitaxial B-Cr_2O_3 films using diamond scanning probe microscopy, APS March Meeting March 3-8, 2024, Minneapolis, MN.
4. Adam Erickson,[3] Qihan Zhang, Hamed Vakili, Ilja Fescenko, Edward Schwartz, Suvechhya Lamichhane,[3] Sy-Hwang Liou, Alexey Kovalev, Jingsheng Chen, and **Abdelghani Laraoui**. Room temperature direct imaging of topological spin textures in gradient-DMI engineered CoPt single layer, APS March Meeting March 3-8, 2024, Minneapolis, MN.
5. Suvechhya Lamichhane,[3] Rupak Timalsina,[3] Cody Schultz, Ilja Fescenko, Kapildeb Ambal, Sy-Hwang Liou, Rebecca Lai, and **Abdelghani Laraoui**. Magnetic relaxometry study of cytochrome C using nitrogen vacancy centers in diamond, APS March Meeting March 3-8, 2024, Minneapolis, MN.
6. Rupak Timalsina,[3] Haohan Wang, Bharat Giri, Adam Erickson,[3] Xiaoshan Xu, and **Abdelghani Laraoui**. Study of spin-wave propagation properties in ferrimagnetic insulator TmIG thin films, APS March Meeting March 3-8, 2024, Minneapolis, MN.
7. **Abdelghani Laraoui**, Thitinun Gas-osoth,[3"] Yifei Wang,[3"] Raman Kumar, Tom Delord, Adam Erickson,[3] Tianlin Li, Cory Cress, Jose Fonseca-Vega, Xia Hong, Toshu An, Carlos Meriles, Suvechhya Lamichhane,[1] Sy-Hwang Liou. Ferromagnetism and magnetic edge effects in Fe-implanted WS2 layers, APS March Meeting March 3-8, 2024, Minneapolis, MN.
8. Suvechhya Lamichhane,[3] Cody Slutz, Rupak Timalsina,[3] Ilja Fescenko, Kapildeb Ambal, Sy-Hwang Liou, Rebecca Y. Lai, and **Abdelghani Laraoui**. Magnetic sensing of iron in Cytochrome C using diamond nitrogen-vacancy magnetometry, SPIE Photonics West 2024, January 29- February 2, 2024, San Francisco, CA.
9. Rupak Timalsina,[3] Haohan Wang, Bharat Giri, Adam Erickson,[3] Xiaoshan Xu, and **Abdelghani Laraoui**. Diamond Magnetic Resonance Imaging of Coherent Spin Waves in Ferrimagnetic TmIG Thin Films. The 68th Annual Conference on Magnetism and Magnetic Materials (MMM), October 30 -November 3, 2023, Dallas, TX.
10. Suvechhya Lamichhane,[3] Kayleigh A McElveen, Adam Erickson,[3] Ilja Fescenko, Shuo Sun, Rupak Timalsina,[3] Yinsheng Guo, Sy-Hwang Liou, Rebecca Y. Lai, and **Abdelghani Laraoui**. Magnetic Imaging of Individual Nanoparticles Using Nitrogen-Vacancy Microscopy. The 68th Annual Conference on Magnetism and Magnetic Materials (MMM), October 30 -November 3, 2023, Dallas, TX.
11. Mohammadjavad Dowran,[4] Suvechhya Lamichhane,[3] Adam Erickson,[3] Andrew Butler, Sy-Hwang Liou, Christos Argyropoulos, **Abdelghani Laraoui**. Plasmon enhanced quantum properties of single photon emitters in hexagonal boron nitride flakes, MRS Spring Meeting, April 10-14, 2023, San Francisco, CA.
12. **Abdelghani Laraoui**, Mohammadjavad Dowran,[4] Suvechhya Lamichhane,[3] Adam Erickson,[3] Andrew Butler, Sy-Hwang Liou, Christos Argyropoulos. Enhancement of Single Photon Emitters in hexagonal boron nitride multilayered flakes Via Plasmonic Resonance in metallic nanostructures, APS March Meeting March 5-10, 2023, Las Vegas, NV.

13. **Abdelghani Laraoui**, Adam Erickson,[3] Ather Mahmood, Syed Qamar Abbas Shah, Ilja Fescenko, Rupak Timalsina,[3] Christian Binek. Imaging voltage controlled antiferromagnetic domains' switching in B doped Cr_2O_3 epitaxial films using nitrogen-vacancy scanning microscopy, APS March Meeting March 5-10, 2023, Las Vegas, NV.

14. Suvechhya Lamichhane,[3] Kayleigh McElveen, Adam Erickson,[3] Shuo Sun, Rupak Timalsina,[3] Yinsheng Guo, Rebecca Lai, Sy-Hwang Liou, **Abdelghani Laraoui**. Studying spin states of single nano-rods of $[Fe(Htrz)_2(trz)](BF_4)$ spin-crossover molecules using diamond quantum sensing microscopy, APS March Meeting March 5-10, 2023, Las Vegas, NV.

15. Adam Erickson,[3] Ather Mahmood, Syed Qamar Abbas Shah, Ilja Fescenko, Rupak Timalsina,[3] Christian Binek, **Abdelghani Laraoui**. Studying the effect of boron doping and temperature on antiferromagnetic domains in epitaxial Cr_2O_3 films using diamond magnetometry, APS March Meeting March 5-10, 2023, Las Vegas, NV.

16. Rupak Timalsina,[3] HaohanWang, Adam Erickson,[3] Bharat Giri, Xiaoshan Xu, **Abdelghani Laraoui**. Excitation and detection of spin waves in rare-earth garnet insulator TmIG films using diamond nitrogen vacancy magnetometry, APS March Meeting March 5-10, 2023, Las Vegas, NV.

17. **Abdelghani Laraoui**, Rupak Timalsina,[3] Cody M. Schultz, Suvechhya Lamichhane,[3] Adam Erickson,[3] Sy-Hwang Liou, Rebecca Y. Lai. Magnetic imaging of iron in biomolecules using diamond quantum sensors, MRS Spring Meeting, May 23-25, 2022, Honolulu HI.

18. Bryan Richards, Nate Ristoff, Abdelghani Laraoui, Ilja Fescenko, Joshua Damron, Nazanin Mosavian, Janis Smits, Andrey Jarmola, Pauli Kehayias, Maziar Saleh Ziabari, Andrew Mounce, Dale Huber, Victor Acosta. Imaging Néel Relaxation of Superparamagnetic Nanoparticles using Diamond Magnetic Microscopy, March 14–18, 2022; Chicago, IL.

19. Adam Erickson,[3] Ather Mahmood, Syed Qamar Abbas Shah, Rupak Timalsina,[3] Christian Binek, **Abdelghani Laraoui**. Nanoscale imaging of antiferromagnetic domains in epitaxial Cr_2O_3 films using diamond quantum sensing microscopy, March 14–18, 2022; Chicago, IL.

20. Rupak Timalsina,[3] Cody Schultz, Suvechhya Lamichhane,[3] Adam Erickson,[3] Sy-Hwang Liou, Rebecca Lai, **Abdelghani Laraoui**. Magnetic sensing of iron in biomolecules using diamond nitrogen vacancy centers, APS March Meeting, March 14–18, 2022; Chicago, IL.

21. R. Skomski, D. Paudyal, B. Balasubramanian, A. Ullah, **A. Laraoui**, and D. J. Sellmyer, Exchange Interactions in Mixed-Rare-Earth Transition-Metal Compounds, 2022 Joint MMM-Intermag Conference, January 10-14, 2022, New Orleans, LA.

22. A. Erickson,[3] W. K. Chin,[3] R. Timalsina,[3] and **A. Laraoui**. Nitrogen Vacancy Magnetic Microscopy of Spin Textures in Magnetic Nanomaterials, MRS Fall Meeting (virtual), December 6–8, 2021.

23. N. Ristoff, **A. Laraoui**, I. Fescenko, J. Damron, N. Mosavian, J. Smits, A. Jarmola, P. Kehayias, M. Salehziabari, A. Mounce, D. Huber, V.Acosta. Time-resolved diamond magnetic microscopy of superparamagnetic nanoparticles, APS March Meeting, March 2–6, 2020, Denver, CO.

24. **A. Laraoui**, I. Fescenko, J. Smits, N. Mosavian, P. Kehayias, A. Jarmola, V. Acosta. Studying static and dynamic magnetic properties of individual 22.6-nm superparamagnetic

nanoparticles using diamond magnetic microscopy, APS March Meeting, March 4–8, 2019; Boston, MA.

25. J. Smits, A. Jarmola, L. Bougas, N. Mosavian, I. Fescenko, P. Kehayias, **A. Laraoui**, V. Acosta. Microscale nuclear magnetic resonance imaging with diamond chips, APS March Meeting, March 5–9, 2018; Los Angeles, CA.
26. P. Kehayias, A. Jarmola, N. Mosavian, I. Fescenko, F. Benito, **A. Laraoui**, J. Smits, L. Bougas, D. Budker, A. Neumann, S. Brueck, V. Acosta. Picoliter NMR spectroscopy using nitrogen-vacancy centers in nanofabricated diamond, 48th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics, June 5–9, 2017, Sacramento, CA.
27. S. Dhomkar, H. Jayakumar, D. Pagliero, A. Laraoui, R. Albu, N. Manson, M. Doherty, J. Henshaw, C.A. Meriles. Optical patterning of trapped charge in nitrogen-doped diamond, , APS March Meeting March 14–18, 2016; Baltimore, MD.
28. **A. Laraoui**, D. Pagliero, C.A. Meriles. Structure determination of individual electron-nuclear spin complexes in a solid-state matrix, APS March Meeting, March 2–6, 2015; San Antonio, Texas.
29. D. Pagliero, **A. Laraoui**, J. Henshaw, C.A. Meriles. Recursive polarization of nuclear spins in diamond at arbitrary magnetic field APS March Meeting, March 2–6, 2015; San Antonio, Texas.
30. **A. Laraoui**, F. Dolde, C. Burk, J. Wrachtrup, F. Reinhard, C.A. Meriles. High-resolution correlation spectroscopy of ^{13}C spins near a nitrogen-vacancy center in diamond, APS March Meeting, March 18 - 22, 2013, Baltimore, MD.
31. **A Laraoui**, C.A. Meriles. Spin Sensing of Paramagnetic Centers in an Individual Diamond Nanocrystal, MRS Fall meeting, November 25-30, 2012, Boston, MA.
32. C. A. Meriles, **A. Laraoui**, J. S. Hodges. Nitrogen-Vacancy-assisted magnetometry of paramagnetic centers in an individual diamond nanocrystal, 4th Nano-MRI Conference, July 22-27, 2012, Monte Verita, Switzerland.
33. **A Laraoui**, C.A. Meriles. Spin dynamics of Nitrogen-Vacancy centers in a diamond nanocrystal, APS March Meeting, February 27 - March 2, 2012, Boston, MA.
34. H. Schultheiss, **A. Laraoui**, F. Ciubotaru, M. Manfrini, M. van Kampen, L. Lagae, A. N. Slavin, B. Leven, B. Hillebrands. Spin-wave radiation and dc current controlled three-magnon-scattering efficiency in a spin-torque nanocontact device, The first international workshop on Magnetic Single Nano-Objects, November 26-28, 2008, Nancy, France.
35. H. Schultheiss**, A. Laraoui**, F. Ciubotaru, M. Manfrini, M. van Kampen, L. Lagae, A. N. Slavin, B. Leven, B. Hillebrands. DC current controlled three magnons scattering efficiency in spin torque nano-oscillators, Spin momentum transfer workshop, October 3-5, 2008, Krakow, Poland.
36. M. Vomir, **A. Laraoui**, V. Halté, M. Albrecht, E. Beaurepaire, J.-Y. Bigot. Ultrafast magnetization dynamics of magnetic films and nanostructures, Nano science Grand East Meeting: spintronics and nanomagnetism, Oct 2007, Strasbourg, France.

37. V. Halté, **A. Laraoui**, L.H.F. Andrade, M. Vomir, J.-Y. Bigot. Damped precession of the magnetization in cobalt nanoparticles induced by femtosecond laser pulses, FCILA 2007, June 4-7, 2007, Lyon, France.
38. **A. Laraoui**, J.-Y. Bigot. Ultrafast magneto-optical Kerr microscopy: Spin dynamics in individual ferromagnetic dots, 11th Louis Néel Colloquium, March 11-16, 2007, Lyon, France.
39. J.-Y. Bigot, **A. Laraoui**, J. Vénuat, M. Vomir, E. Beaurepaire. Time resolved magneto-optical microcopy of individual ferromagnetic dots, 15th International Conference Ultrafast Phenomena, July 30, - August 4, 2006, Pacific Grove/CA.

Section 2.1.7 Posters in reverse chronological order (underlined: the presenter).

1. Adam Erickson,[3] Qihan Zhang, Hamed Vakilitaleghani, Suvechhya Lamichhane,[3] Ilja Fescenko, Edward Schwartz, Alexey Kovalev, Sy-Hwang Liou, Jingshen Chen, and **Abdelghani Laraoui**. Mapping Bloch Skyrmions and Anti-Skyrmion-Skyrmion Pairs in Broken Inversion Symmetry CoPt Gradient Thin Films, NRIC 2024 Conference on diamond quantum sensing: challenge and opportunities, March 14, 2024, Lincoln, NE.

2. Suvechhya Lamichhane,[3] Rupak Timalsina,[3] Cody Schultz, Adam Erickson,[3] Ilja Fescenko, Kapildeb Ambal, Sy-Hwang Liou, Rebecca Lai, and **Abdelghani Laraoui**. Diamond quantum sensing microscopy of cytochrome C molecules, NRIC 2024 Conference on diamond quantum sensing: challenge and opportunities, March 14, 2024, Lincoln, NE.

1. Rupak Timalsina,[3] Haohan Wang, Bharat Giri, Adam Erickson,[3] Xiaoshan Xu, and **Abdelghani Laraoui**. Mapping spin-wave transport in ferrimagnetic insulator TmIG thin films, NRIC 2024 Conference on diamond quantum sensing: challenge and opportunities, March 14, 2024, Lincoln, NE.
2. Rupak Timalsina,[3] Haohan Wang, Adam Erickson,[3] Bharat Giri, Xiaoshan Xu, and **Abdelghani Laraoui**. Study of spin waves in rare-earth garnet TmIG thin films, NRIC 2023 on Topology and Valley-Driven Quantum Phenomena, March 17, 2023, Lincoln, NE.
3. Adam Erickson,[3] Qihan Zhang, Suvechhya Lamichhane,[3] Sy-Hwang Liou, Jingshen Chen, and **Abdelghani Laraoui**. Studying the creation and motion of skyrmions in broken inversion symmetry CoPt gradient single-crystal thin films, NRIC 2023 on Topology and Valley-Driven Quantum Phenomena, March 17, 2023, Lincoln, NE.
4. Ben Hammons,[1"] Rupak Timalsina,[3] and **Abdelghani Laraoui**. Cryogenic Nitrogen Vacancy Widefield Microscopy, Magnetic Resonance Measurements, UNL's Lincoln Summer Research Fair, August 3, 2023.
5. Enrique Stolz,[1] Rupak Timalsina,[3] Ben Hammons,[1"] and **Abdelghani Laraoui**. Application of Nitrogen Vacancy Centers in Spin wave Imaging, UNL's Lincoln Summer Research Fair, August 3, 2023.
6. Mauricio Velasco,[1] Suvechhya Lamichhane,[3] and **Abdelghani Laraoui**. Properties Of Nanoparticles on Hematite and Magnetite, UNL's Lincoln Summer Research Fair, August 3, 2023.

7. Ben Hammons,[1"] Rupak Timalsina,[3] and **Abdelghani Laraoui**. Wire Bonding Thin Films for Ferromagnetic Resonance and Optically Detected, Magnetic Resonance Measurements, UNL's Lincoln Summer Research Fair, August 5, 2022.
8. Patrick Osborn,[1] Rupak Timalsina,[3] and **Abdelghani Laraoui**. Automating A Ferromagnetic Resonance Spectroscopy Setup, UNL's Lincoln Summer Research Fair, August 5, 2022.
9. John Kunkee,[1] Mohammadjavad Dowran,[4] and **Abdelghani Laraoui**. Studying Hexagonal Boron Flakes by Using Atomic Force Microscopy for Quantum Photonics, UNL's Lincoln Summer Research Fair, August 5, 2022.
10. Adam Erickson,[3] Rupak Timalsina,[3] Syed Qamar Abbas, Ather Mahmood, Christian Binek, and **Abdelghani Laraoui**. Imaging and Control of Antiferromagnetic Domains in Cr_2O_3, 2022 NRIC Workshop, Commercializing Quantum Technologies in Nebraska: From Research to Licensing, April 14, 2022, Lincoln, NE.
11. Suvechhya Lamichhane,[3] Rupak Timalsina,[3] Cody M. Schultz, Adam Erickson,[3] Sy-Hwang Liou, Rebecca Y. Lai, and **Abdelghani Laraoui**. T_1 relaxometry of Fe Contained Biomolecules Using Nitrogen Vacancy Centers in Diamond, 2022 NRIC Workshop, Commercializing Quantum Technologies in Nebraska: From Research to Licensing, April 14, 2022, Lincoln, NE.
12. **Abdelghani Laraoui** and Victor M. Acosta. Time resolved diamond magnetic microscopy of single transition metal magnetic nanoparticles, APS March Meeting 2020, March 2–6, 2020, Denver, CO.
13. **A. Laraoui**, I. Fescenko, J. Smits, N. Mosavian, P. Kehayias, A. Jarmola, V. Acosta, Gordon conference, Time resolved diamond microscopy of magnetic nanostructures, Quantum Sensing Applications in Metrology and Imaging, June 2 - 7, 2019, Hong Kong, China.
14. N. Arnold, **A. Laraoui**, I. Fescenko, J. Smits, V. Acosta, Diamond Magnetic Microscopy of Individual Superparamagnetic Nanoparticles, 2018 Annual Meeting of the APS Four Corners Section, October 12–13, 2018; University of Utah, Salt Lake City, UT.
15. I. Fescenko, **A. Laraoui**, J. Smits, N. Mosavian, P. Kehayias, J. Seto, L. Bougas, A. Jarmola, V. Acosta, Diamond magnetic imaging of single paramagnetic biocrystals, Southwest Quantum Information and Technology Workshop, February 22-24, 2018. Santa Fe, N September 2017, CINT Sandia-LANL meeting, Santa Fe, NM.
16. **A. Laraoui**, N. Mosavian, J. Smits, I. Fescenko, V. Acosta, Imaging individual 25-nm superparamagnetic nanoparticles using diamond magnetic microscopy, Southwest Quantum Information and Technology Workshop, February 22-24, 2018. Santa Fe, N September 2017, CINT Sandia-LANL meeting, Santa Fe, NM.
17. **A. Laraoui**, H. Aycock-Rizzo, X. Lu, E. Riedo, C. A. Meriles. Nanoscale thermal conductivity imaging using scanning spin probe, 5th annual NanoMRI Conference, July 27-31, 2015, Waterloo, Canada.
18. T. An, **A. Laraoui**, C.A. Meriles. Broadening of ODMR Signal of NV center in Nanodiamond by Domain Wall Motion, 5th annual NanoMRI Conference, July 27-31, 2015, Waterloo, Canada.

19. **A. Laraoui**, H. Aycock-Rizzo, X. Lu, E. Riedo, C.A. Meriles. Imaging Thermal Conductivity with Nanoscale Resolution via a Scanning Spin Probe, NanoscienceNY meeting, February 19th, 2015, New York, NY.
20. **A. Laraoui**, C.A. Meriles. Exploring the Nitrogen Vacancy center as a high-resolution magnetic sensor in bulk and nanostructured diamond crystals, APS March Meeting, February 27 - March 2, 2012, Boston, MA.
21. **A. Laraoui**, J. S. Hodges, C. Ryan, C. A. Meriles. Exploring the Nitrogen Vacancy center as a high-resolution magnetic sensor, Gordon Research Conferences, Magnetic resonance, June 12-17, 2011, University of New England, Biddeford, ME.
22. C. A. Meriles, **A. Laraoui**, J. S. Hodges. T_1-limited Nitrogen-Vacancy magnetometry of fluctuating AC magnetic fields, *APS* March Meeting 2011, March 21-25, 2011, Dallas, Texas.
23. A**. Laraoui**, J. S. Hodges, C. A. Meriles. T_1-limited Nitrogen Vacancy magnetometry of fluctuating AC magnetic fields, Artificial atoms in diamond Workshop, November 11-13, 2010, Harvard University, Cambridge, MA.
24. **A. Laraoui**, J. S. Hodges, C. A. Meriles. Characterization of random AC magnetic fields using a single Nitrogen-Vacancy center, 3rd nano-MRI research conference: Exploring the Frontiers of Magnetic Resonance Imaging, July 12-16, 2010, Le Tremblay sur Mauldre, France.
25. F. Ciubotaru, H. Schultheiss, **A. Laraoui**, A. Serga, X. Janssens, M. van Kampen, L. Lagae, A.N. Slavin, B. Leven, B. Hillebrands. Oersted field influence on three-magnon-scattering processes in nano-point contact spin-valves, SPINSWITCH Summer School: Spin torque transfer and domain wall dynamics, September 14-18, 2009, Iaşi, Romania.
26. **A. Laraoui**, M. Albrecht, M. Vomir, J.-Y. Bigot. Magneto-optical pump probe Imaging of CoPt nanostructures, 20th International Colloquium on Magnetic Films and Surfaces, July 20–24, 2009, Berlin, Germany.
27. H. Schultheiss, F. Ciubotaru, **A. Laraoui**, A. Serga, X. Janssens, M. van Kampen, L. Lagae, A. N. Slavin, B. Leven, B. Hillebrands. Current controlled three-magnon-scattering in spin-torque nanocontact devices, 20th International Colloquium on Magnetic Films and Surfaces, July 20–24 2009, Berlin, Germany.
28. **A. Laraoui**, F. Ciubotaru, H. Schultheiss, A. Serga, S. Hermsdörfer, M. van Kampen, L. Lagae, B. Leven, A. N. Slavin, B. Hillebrands. Effect of a DC current on the magnetization dynamics in spin-valve nanocontacts, German Physical Society (DPG) spring meeting, March 22-27, 2009, Dresden, Germany.
29. H. Schultheiss, F. Ciubotaru, **A. Laraoui**, M. Manfrini, M. van Kampen, L. Lagae, A. N. Slavin, B. Leven, B. Hillebrands. Nonlinear spin-wave radiation in spin-torque nanocontact devices, Spin momentum transfer workshop, October 3 -5, 2008, Krakow, Poland.
30. H. Schultheiss, X. Janssens, M. van Kampen, S. Cornelissen, F. Ciubotaru, **A. Laraoui**, B. Leven, A. N. Slavin, L. Lagae, B. Hillebrands. Investigation of spin-wave radiation and current controlled three-magnon-scattering in spin-torque nanocontact devices, INTERMAG 2008, Madrid, Spain, May 4-8, 2008.

31. **A. Laraoui**, M. Vomir, M. Albrecht, J.-Y. Bigot. Magnetization dynamics of ferromagnetic dots: Studies with a femtosecond magneto-optical microscope, 11th France condensed matter meeting, August 25-29, 2008, Strasbourg, France.
32. V. Halté, L.H.F. Andrade, **A. Laraoui**, M. Vomir, J.-Y. Bigot. Magnetization precession of magnetic nanoparticles induced with femtosecond laser pulses, 11th France condensed matter meeting, August 25-29, 2008, Strasbourg, France.
33. **A. Laraoui**, V. Halté, M. Vomir, J. Vénuat, M. Albrecht, E. Beaurepaire, J.-Y. Bigot. Femtosecond spin dynamics of an individual, School on Nanomaterials for magnetism and spintronics, February 18-23, 2008, Strasbourg, France.
34. **A. Laraoui**, M. Albrecht, M. Vomir, E. Beaurepaire, J.-Y. Bigot. Time-resolved magneto-optical imaging of magnetic domains written in CoPt films with femtosecond laser pulses, Optics Grenoble 2007, July 2-5, 2007, Grenoble, France.
35. **A. Laraoui**, V. Halté, M. Vomir, E. Beaurepaire, J.-Y. Bigot. Time resolved magneto-optical imaging of magnetic domains written in CoPt films with femtosecond laser pulses, International Symposium on Spin Waves, June 16-21, 2007, Saint Petersburg, Russia.
36. **A. Laraoui**, J. Vénuat, V. Halté, M. Albrecht, M. Vomir, E. Beaurepaire, J.-Y. Bigot. Study of individual ferromagnetic dots with femtosecond optical pulses, 10th Joint MMM/Intermag Conference, January 7-11, 2007, Baltimore, Maryland.
37. **A. Laraoui**, V. Halté, M. Vomir, J. Vénuat, M. Albrecht, E. Beaurepaire, J.-Y. Bigot. Ultrafast spin dynamics of individual ferromagnetic dots, 3rd TMN (Trends in Materials and Nanosciences) Conference, November 5, 2006, Strasbourg, France.
38. **A. Laraoui**, V. Halté, M. Vomir, J. Vénuat, M. Albrecht, E. Beaurepaire, J.-Y. Bigot. Femtosecond spin dynamics of a single $CoPt_3$ dot, 13th ISSPIC Conference, July 23- 28, 2006, Goteborg, Sweden.
39. M. Vomir, L. Andrade, E. Beaurepaire, **A. Laraoui**, J.-Y. Bigot. Magnetization trajectory induced with femtosecond laser pulses: tridimensional study of magnetic anisotropy effects. 7th meeting on ultrafast phenomena, December 5-7, 2005, Lille, France.

Section 2.1.8 Invited talks or Keynote Speeches in reverse chronological order (underlined: the presenter).

1. Christos Argyropoulos, Mohammadjavad Dowran,[4] Ufuk Kilic, Andrew Butler, Suvechhya Lamichhane,[3] Adam Erickson,[3] Sy-Hwang Liou, and **Abdelghani Laraoui**. Efficient Single Photon Emission with Quantum Plasmonic Nanocavities, 2024 IEEE International Symposium on Antennas and Propagation and ITNC-USNC-URSI, Special session; Quantum Technology Related to Electromagnetics, July 14-19, 2024, Florence, Italy.
2. **Abdelghani Laraoui**. Direct imaging of room temperature magnetic skyrmions in composition gradient CoPt single layer, invited seminar at Online Spintronics Seminar, February 9, 2024.
3. Suvechhya Lamichhane,[3] Cody Slutz, Rupak Timalsina,[3] Ilja Fescenko, Kapildeb Ambal, Sy-Hwang Liou, Rebecca Y. Lai, and **Abdelghani Laraoui**. Magnetic sensing of iron in Cytochrome C using diamond nitrogen-vacancy magnetometry, 2024 MRS Spring Meeting, April 22-26, 2024, Seattle, WA.

4. Mohammadjavad Dowran,[4] Ufuk Kilic, Andrew Butler, Suvechhya Lamichhane,[3] Adam Erickson,[3] Sy-Hwang Liou, Christos Argyropoulos, and **Abdelghani Laraoui**. Plasmonic Nanocavity Enhanced Quantum Properties of Single Photon Emitters in Hexagonal Boron Nitride, SPIE Photonics West 2024, January 29- February 2, 2024, San Francisco, CA.
5. Adam Erickson,[3] Ather Mahmood, S.Q.A. Shah, Rupak Timalsina,[3] Ilja Fescenko, Christian Binek, and **Abdelghani. Laraoui**. Nitrogen-Vacancy Microscopy of Antiferromagnetic Domains in Undoped and Boron Doped Cr_2O_3 Thin Films. **Invited Talk** at The 68th Annual Conference on Magnetism and Magnetic Materials (MMM), October 30 -November 3, 2023, Dallas, TX.
6. **Abdelghani Laraoui**. Diamond quantum sensing microscopy of Fe-triazole spin crossover molecules/Fe-containing biomolecules, **Invited Virtual Talk** at Big Quantum Biology Meetings, October 26, 2023.
7. **Abdelghani Laraoui**. Diamond magnetometry of spin textures in thin magnetic films, **Invited Talk**, Gordon Research Conference, Frontiers of Sensing in the Quantum Regime with Atomic, Solid-State and Photonic Systems, July 23 – 28, 2023, Les Diablerets, Switzerland.
8. **Abdelghani Laraoui**. Probing Nanoscale Magnetic Phenomena Using Diamond Quantum Sensing Microscopy, **Invited Lecture**, Virtual Lecture Series on Nanodiamond, January 19, 2023.
9. **Abdelghani Laraoui**. Quantum Sensing, UNL's Grand Challenges 2025 vision, **Invited Talk**, workshop on Quantum Science and Engineering, October 19-20, 2021, Lincoln, NE.
10. **Abdelghani Laraoui**. Quantum Sensing and Technologies, **Invited Talk**, EPSCoR workshop on Emergent quantum materials and Technologies (EQUATE), March 26-27, 2021, Lincoln, NE.
11. **Abdelghani Laraoui**. Diamond quantum sensing, **Invited Lecture**, Quantum Information Science biweekly seminar series, April 5th,2020, Ames Laboratory-Iowa State University, Ames, IA.
12. **Abdelghani Laraoui**. Nanoscale Magnetic Resonance Spectroscopy using Nitrogen Vacancy Centers in Diamond, **Keynote Lecture**, 2017 NMR^2, April 15, 2017, Albuquerque, NM.
13. **A. Laraoui**, I. Fescenko, N. Mosavian A. Jarmola, P. Kehayias, V. Acosta. Solution NMR and EPR on a diamond chip, **Invited Talk**, The 20th Meeting of the International Society of Magnetic Resonance (ISMAR 2017), July 23-28, 2017, Québec City, Canada. Sponsor: NSF.
14. **A. Laraoui**, H. Aycock-Rizzo, Y. Gao, E. Riedo, C. A. Meriles. Nanoscale thermal imaging using a scanning spin probe, APS March Meeting March 14–18, 2016, Baltimore, MD.
15. **A. Laraoui**, H. Aycock-Rizzo, X. Lu, E. Riedo, C. A. Meriles. Nanoscale Imaging of Thermal Conductivity Using Nitrogen Vacancy Center in Nanodiamond, **Invited Talk** META'15, the 6th International Conference on Metamaterials, Photonic Crystals and Plasmonics, August 3-7, 2015, New York, NY. Sponsor: International Conference on Metamaterials.

16. **A. Laraoui**, C. A. Meriles, Approach to dark spins initialization in nanodiamond, **Invited Talk**, Workshop on Diamond- spintronics, photonics, bio-applications, April 27-29, 2013, Hong Kong.
17. C. A. Meriles, **A. Laraoui**. The Nitrogen-Vacancy center as a probe of mesoscopic spin ensembles, **Invited Talk**, Gordon Research Conferences, Magnetic resonance, June 12-17, 2011, University of New England, Biddeford, ME.
18. B. Hillebrands, H. Schultheiss, F. Ciubotaru, **A. Laraoui**, M. van Kampen, L. Lagae, and A. N. Slavin. Current Induced Spin-Wave Emission from Ferromagnetic Nanostructures, **Invited Talk,** International Symposium: Twenty Years of Spintronics Retrospective and Perspective, December 8-9, 2009, Paris, France.
19. B. Hillebrands, H. Schultheiss, B. Obry, F. Ciubotaru, **A. Laraoui**, S. Hermsdörfer, A.A. Serga, M. van Kampen, X. Jenssens, L. Lagae, and A. N. Slavin. Nanomagnetism – a perspective from the dynamic side**, Keynote Lecture**, Trends in NanoTechnology International Conference, September 07-11, 2009, Barcelona, Spain.
20. B. Hillebrands, H. Schultheiss, F. Ciubotaru, **A. Laraoui**, M. van Kampen, L. Lagae, and A. N. Slavin. Current Induced Spin-Wave Emission from Ferromagnetic Nanostructures, **Invited Talk**, International Magnetics Conference 2009, May 4-8, 2009, Sacramento, California.
21. B. Hillebrands, H. Schultheiss, F. Ciubotaru, **A. Laraoui**, M. van Kampen, L. Lagae, and A. N. Slavin. Current Induced Spin-Wave Emission from Ferromagnetic Nanostructures, **Invited Talk**, IEEE nanotechnology materials and devices Conference. October 20-22, 2008, Kyoto, Japan.
22. **A. Laraoui**, M. Vomir, E. Beaurepaire, J.-Y. Bigot. Femtosecond spin dynamics in magnetic nanostructures, July 16th, 2007, **Invited Talk**, International Quantum Electronics Conference – Europe, June 17-22, 2007, Munich, Germany.
23. J.-Y. Bigot, **A. Laraoui**, M. Vomir, M. Albrecht. Ultrafast magnetization dynamics: concept and applications to spin photonics, **Invited Talk**, FCILA 2007, June 4-7, 2007, Lyon, France.
24. J.-Y. Bigot, M. Vomir, L.H.F. Andrade, E. Beaurepaire, **A. Laraoui**. Recent progresses in Femtomagnetism: Time dependent anisotropy and dynamics of superparamagnets, **Invited talk**, Workshop on Novel trends in magnetism, October 1-7, 2005, Corfu, Greece. Sponsor: CNRS.

Section 2.1.9 Invited seminars since joined UNL in reverse chronological order (underlined: the presenter).

1. **A. Laraoui**. Diamon Quantum Sensing Microscopy, Seminar, University of Washington, Seattle, April 24, 2024.
2. **A. Laraoui**. Studying Nanoscale Magnetic Phenomena in Magnetic Thin Films Using Diamond Magnetic Microscopy, MME Seminar, September 6, 2023.
3. **A. Laraoui**. Studying Nanoscale Magnetic Phenomena in Magnetic Thin Films Using Diamond Magnetic Microscopy, EQUATE/NCMN Seminar, September 6, 2023.

4. **A. Laraoui**. Study Nanoscale Magnetic Phenomena with Nitrogen-Vacancy Magnetic Microscopy, Institute of Chemistry and Materials of Strasbourg, July 19, 2023, Strasbourg, France
5. **A. Laraoui**. Diamond Magnetometry studies of nanoscale magnetic phenomena, May 8, 2023, Department of Physics, University of Nebraska-Kearny, Kearny, NE
6. **A. Laraoui**. Probing solid state Phenomena in quantum materials using quantum sensors, March 22, 2023, Department of Physics and Astronomy, Wichita State University, Wichita, KS.
7. **A. Laraoui**. Studying individual spin-crossover Fe-triazole nanorods, April 5, 2023, Department of Physics and Astronomy, City College of New York, New York, NY.
8. **A. Laraoui**. Diamond quantum sensing microscopy for chemistry applications, November 2022, Department of Chemistry, University of Nebraska-Lincoln,
9. **A. Laraoui**. Diamond scanning probe microscopy of antiferromagnets, April 2021, Optical Science Engineering seminar at Center of High Technology Materials- University of New Mexico, Albuquerque, NM.
10. **A. Laraoui**. Diamond quantum sensing, October 2020, Department of Chemistry, University of Nebraska-Lincoln, invited guest lecture for Prof. Rebecca Lai course, Lincoln, NE.
11. **A. Laraoui**. Quantum diamond microscopy: A new tool for quantum sensing, September 2020, Department of Physics and Astronomy, Creighton University, Omaha, NE.
12. **A. Laraoui**. Diamond Nitrogen Vacancy Centers for Quantum Sensing, October 2019, Nebraska Center of Materials Nanoscience Seminar series, Lincoln, NE.

Section 2.2 Research Funding Record

Section 2.2.1 Internally Funded Research Grants: Total funds = **$4,3M** (PI's part: **$380,766**)

Project Title	*Sponsor*	*Role (PI or Co-PI)*	*Dates*	*Total Amount (do not include UNL cost share)*	*% Attributed to Candidate (do not include UNL cost share)*
Quantum Solutions for Energy Challenges: A Collaborative Leap Toward Sustainability	*UNL-Grand Challenges*	*Co-PI*	*9/1/2023-8/31/2025*	*$150,000*	***%25***
Quantum Approaches Addressing Global Threats.	*UNL-Grand Challenges*	*Co-PI*	*10/1/2023-9/31/2028*	*$4,170,000*	***%7.6***

1. **Title:** Quantum Solutions for Energy Challenges: A Collaborative Leap towards Sustainability, **Funding Agency:** UNL's Grand Challenges, **Dates:** 9/1/2023-8/31/2025. **PI:** Mohammad Ghashami. **Co-PIs:** Abdelghani Laraoui, Arman Roohi, and Sonya Türkman. **Total Amount:** $150,000, **SAP WBS**# 21-1123-4055. **Abstract:** The energy crisis is one of the most pressing challenges of our time due to rising energy demands, depleting fossil fuels, and climate change. Addressing these challenges requires a multi-faceted approach to provide clean, affordable, and sustainable sources of energy. Quantum materials and technology have

the potential to revolutionize energy systems at both Nano and Macro-scales. At small scales, quantum materials can enable the development of more efficient computer processors that can perform calculations at higher speeds and with lower energy consumption. At a larger scale, quantum materials can be used to design better solar cells, improving energy conversion efficiency and reducing carbon emissions. Moreover, quantum technologies such as quantum sensing and quantum computing can play a key role in developing new energy storage solutions, optimizing the performance of renewable energy systems, and improving the efficiency of energy distribution networks. By harnessing the unique properties of quantum materials, such as their ability to manipulate and control the behavior of electrons and photons, we can design novel energy technologies that are more efficient, cost-effective, and environmentally friendly. This collaborative planning proposal aims to bring together an interdisciplinary team of faculties, students, and staff to explore the potential of quantum solutions for addressing the pressing energy challenges of our time and develop a competitive catalyst proposal.

2. **Title:** Quantum Approaches Addressing Global Threats., **Funding Agency:** UNL's Grand Challenges, **Dates:** 10/1/2019-10/31/2020 PI: Christian Binek, Co-PIs: Abdelghani Laraoui, et *al*. **Total Amount:** $4.170,000, **SAP WBS**# 21-0527-4005. **Abstract:** Quantum Science and Engineering (QSE) is one of seven Grand Challenges themes which have been identified by the University of Nebraska-Lincoln (UNL) community as areas in which to focus UNL's expertise and resources. The field of QSE emerged from the second quantum revolution and its derived quantum technologies which include quantum sensing, quantum computing and emulation, quantum materials design for information technology and more. QSE provides a unifying set of tools and scientific principles which allow us to address a multitude of global challenges. Those are big problems, which affect life on planet Earth, and humanity as an integral part of it, in profound and overwhelmingly detrimental ways. The team identified four global challenges which QSE and specifically interdisciplinary expertise at UNL can help to mitigate. Those include consequences from climate change, sustainable agriculture and food production, the climate impacting energy crisis not solved but rather created by traditional information and communication technologies, and the detrimental economic and societal consequences associated with the absence of a quantum-ready workforce and a quantum-literate public. A team of 22 principal investigators utilizes synergy through interdisciplinary, non-traditional teamwork involving Mathematics, Physics and Astronomy, Public Relations, Mechanical and Materials Engineering, Electrical and Computer Eng., Computer Science, and Chemistry with fully integrated contributions from Arts and Humanities through the Glenn Korff School of Music and the Johnny Carson Center for Emerging Media Arts.

Section 2.2.2 Externally Funded Research Grants at UNL. Total funds = **$21,330,671** (**Laraoui**'s share: **$1,663,614**)

Project Title	*Sponsor*	*Role (PI or Co-PI)*	*Dates*	*Total Amount (do not include UNL cost share)*	*% Attributed to Candidate (do not include UNL cost share)*
Probing Room-temperature Skyrmions at the Nanoscale using	*UNL-MRSEC*	*PI*	*10/1/2019-10/31/2020*	*$50,000*	***%100***

Diamond Quantum Sensors					
1. Objective-first sorting and time resolved diamond magnetic microscopy of superparamagnetic nanoparticles	*NSF-UNM subaward*	*PI*	*8/1/2019-8/31/2021*	*$122,500*	***%100***
2. RII Track-1: Emergent Quantum Materials and Technologies (EQUATE)	*NSF*	*SI, Focused Research Group 2 leader*	*6/1/2021-5/31/2026*	*$20,000,000*	***%6***
3. MRI: Acquisition of Optical Access in a Cryogenic Scanning Probe Microscope	*NSF*	*Co-PI, initiator and main contributor of the writing*	*9/1/2021-8/31/2025*	*$358,171*	***%25***
4. ExpandQISE: Track 1: Understanding and controlling decoherence in hybrid spin qubit-magnon systems for advancing education and building workforce in emerging quantum technologies	*NSF-WSU subaward*	*Co-PI*	*10/1/2023-9/30/206*	*$800,000*	***%30***

1. **Title:** Probing Room-temperature Skyrmions at the Nanoscale using Diamond Quantum Sensors, **Funding Agency:** UNL-MRSEC, **Dates:** 10/1/2019-10/31/2020 **PI:** Abdelghani Laraoui, **Total Amount:** $50,000, **SAP WBS**# 25-0521-0184-043. **Abstract:** Magnetic skyrmions are nanoscale spin textures characterized by topological charge and are proposed for the next generation of ultradense magnetic memories. Here, we employ a scanning spin probe microscope, based on nitrogen vacancy (NV) color centers in diamond tips, to map room-temperature skyrmions in ferromagnetic layers, composed of ultrathin Co layers sandwiched between 5d transition metal (such Ir, Pt, W) layers, and in NCO thin films. These measurements are correlated with magnetic and magneto-transport bulk measurements and compared with theoretical models.
2. **Title:** Objective-first sorting and time resolved diamond magnetic microscopy of superparamagnetic nanoparticles, **Funding Agency:** NSF sub-award from University of New Mexico, **Dates:** 8/1/2019-8/31/2021, **PI:** Abdelghani Laraoui, **Total amount:** $122,500, **SAB WEB**# 26-1123-0243-001. **Abstract:** The goal of this research is to develop alternative strategies for high-sensitivity, parallel characterization of individual magnetic nanoparticles. The research project aims to study the magnetic dynamics of superparamagnetic iron oxide nanoparticles with 15-25 nm diameter, with a goal of improving their applicability in nanoscience applications. The magnetic properties of thousands of individual nanoparticles are simultaneously characterized using a magnetic microscope based on color centers doped near the surface of a diamond chip. Correlative transmission electron microscopy and magnetic images of numerous individual nanoparticles is used to elucidate the relationship between nanoparticle size, shape, magnetization relaxation, and hysteresis curve properties. A second aim of this research project is to study the correlation of composition, morphology, and magnetic dynamics of small transition metallic magnetic nanoparticles with a size range (2-10

nm) and establish a fundamental understanding of the effect of size, surface structure, and inter-particle dipolar interactions on their magnetic properties. The target magnetic sensitivity of 10 nT in 1 second integration time for a 400 nm x 400 nm pixel is sufficient to characterize particles down to 2 nm in diameter.

3. **Title:** RII Track-1: Emergent Quantum Materials and Technologies (EQUATE), **Funding Agency:** NSF, **Dates:** 6/1/2021-5/31/2026, **PI:** Matthew Andrews, **Co-PI:** Christian Binek, Focused Research Group 2 Leader: Abdelghani Laraoui, **Total amount:** $20, **SAB WEB**#25-0521-0238-005 (**$690,167*)*** + 25-0521-0238-018 ($471,404 for Equipment), **Total amount, amount attributable to me:** $1,161,571. **Abstract:** In the "second quantum revolution," quantum mechanics is applied to information theory and information technology. The State of Nebraska is participating in the second quantum revolution by launching an interdisciplinary, interdepartmental, and multi-campus research and education cluster on Emergent Quantum Materials and Technologies (EQUATE) to increase jurisdictional competitiveness in the area of quantum science and technologies. The project focuses on research and workforce development to advance knowledge on topics related to quantum materials, technologies, and computation. Quantum materials are a new class of materials that exhibit quantum phenomena at macroscopic length scales and are expected to advance the technological landscape through the advent of quantum technologies. These new technologies will revolutionize fields such as information technology, medical technology, and cryptography, with impact on security areas such as defense and banking. EQUATE converges for the first-time the complementary quantum science and technology expertise of the University of Nebraska at Lincoln, the University of Nebraska at Omaha, the University of Nebraska at Kearney, and Creighton University, in partnership with Nebraska's community and tribal colleges, to open up unique opportunities for Nebraska. EQUATE consolidates the quantum science and technology expertise of 20 faculty researchers across the four Nebraska research institutions, establishing collaboration and feedback between theory and experiment to guide discoveries and expedite the findings of new emergent quantum materials and phenomena.

4. **Title:** MRI: Acquisition of Optical Access in a Cryogenic Scanning Probe Microscope, **Funding Agency:** NSF, Dates: 9/1/2022-8/31/2025, **PI:** Christian Binek, **Co-PIs:** Abdelghani Laraoui, Xia Hong, Xiaoshan Xu, **Total amount:** $358,171 + UNL's cost share of $153,502 = $511,673, **SAB WEB**# 25-0527-0001-001, **Total amount, amount attributable to me:** $89,542.75 (without cost share). **Abstract:** This Track 1 Major Research Instrumentation award is for the acquisition of a Nitrogen Vacancy (NV)-Attocube (Atto) atomic force microscope (AFM) integrated with a confocal microscope (CFM), which allows magnetic, optical, and quantum measurements at the nanometer scale. The instrument will be located at the Surface and Materials Characterization division of the Nebraska Center for Materials and Nanoscience (NCMN) at the University of Nebraska-Lincoln (UNL). The acquisition of the module will transform the existing NSF-funded low-temperature high-magnetic-field multifunctional scanning probe microscope into a versatile platform for NV quantum sensing and fundamental research on quantum entanglement. The point defect atomic nature of the NV center and its spin millisecond quantum coherence lifetime allow measurements of a wide range of quantum materials with high sensitivity and spatial resolution (< 40 nm). Additionally, it operates at high magnetic fields and across a wide range of temperatures. The system can support various experiments, including magnetic imaging of solid-state materials and biomolecules as well as mapping optical and thermal properties of low-dimensional materials.

Currently, there are five similar instruments in the U.S. with limitations in types of materials studied (e.g., only superconductors) or magnetic field range (only < 0.5 T). In acquiring the NV-AttoAFM/CFM, the goal is to position UNL at the forefront of quantum sensing capabilities ushering in the age of applied quantum technologies in Nebraska and U.S. Midwest. The infrastructure of NCMN, a user facility serving the Midwest research community and startup companies, includes the technical support of a PhD-trained expert in scanning probe microscopy, which ensures long-term maintenance, sustainability, and user support.

5. **Title:** ExpandQISE: Track 1: Understanding and controlling decoherence in hybrid spin qubit-magnon systems for advancing education and building workforce in emerging quantum technologies, **Funding Agency:** NSF sub-award from Wichita State University, **Dates:** 10/1/2023 - 9/30/2026, **PI:** Kapildeb Ambal, **Co-PIs:** Abdelghani Laraoui, Jian Wang, **Total amount:** $800,00, **SAB WEB#** 26-1123-0380-001, **Total amount, amount attributable to me:** $240,000. **Abstract:** Quantum technologies are expected to become integral to the future sustained economic well-being of the country. Quantum computing and quantum sensing are essential parts of evolving quantum technologies. While many quantum technologies, such as quantum computers based on superconducting qubits, are already available to do advanced calculations, the need for ultra-low (< 0.1K) temperatures makes them challenging and less accessible. The team focuses on studying and controlling the quantum decoherence in hybrid diamond spin qubit-magnetic excitation (magnon) systems that could potentially serve as scalable quantum information processing platforms operating at higher temperatures (? 1 K) than superconducting qubits. The project's goals are to design, fabricate, characterize, and model hybrid architectures where diamond spin qubits and their interactions are controlled by magnons and spin current effects using heterostructures of thin-film or two-dimensional magnetic materials. The principal investigators at Wichita State University benefit from extending the capabilities in advanced nanofabrication of quantum materials and cryogenic quantum sensing from the University of Nebraska-Lincoln. The project also aims to advance education and build a workforce in emerging quantum technologies by training a postdoc, several graduate/undergraduate/K-12 (abbreviating Kindergarten through 12th grade) students, and four K-12 teachers**.**

Section 2.3 Other (Non-Research) Funding Record

Section 2.3.1 Internally Funded Non-Research Grants.

Project Title	*Sponsor*	*Role (PI or Co-PI)*	*Dates*	*Total Amount* *(do not include UNL cost share)*	*% Attributed to Candidate* *(do not include UNL cost share)*
Name of Distinguished Lecturer: Prof. María-Carmen Asensio, Materials Science Institute of Madrid (ICMM) of the Spanish Scientific Research Council	*UNL-Office of Research and Economic Development*	*Co-PI*	*5/2/2021-5/20/2021*	*$3,000*	*0*

1. **Title:** Name of Distinguished Lecturer: Prof. María-Carmen Asensio, Materials Science Institute of Madrid (ICMM) of the Spanish Scientific Research Council, **Funding Agency:** UNL's Office of Research and Economic Development, **Dates:** 5/2/2021-5/20/2021, PI: Peter Dowben. Co-PI's: Abdelghani Laraoui, Alexander Sinitskii, Takashi Komesu, **Total amount:** $3,000. **SAP WBS** # 26-0521-9001-007.

Section 2.4 Research Patents and Awards

Section 2.4.1 Research Patents

1. **Title:** Method for hyper-polarizing nuclear spins at arbitrary magnetic fields. **List of Investors:** Carlos A. Meriles, Daniela Pagliero, and **Abdelghani Laraoui**, US Patent App. 14/961,974. Date of publication; January 15, 2019.

Section 2.4.2 National and International Research Awards and Recognition

1. New York Academy of Sciences' Blavatnik Award (nominated) for best postdoctoral , City College of New York. 10/2013.
2. Marie Curie Postdoctoral Fellowship,10/2007-3/2009, University of Kaiserslautern of Technology Kaiserslautern, Germany.
3. French Optical Society Award to attend Spintronics Summer School, Cargese, France, 5/2005-6/2005.

Section 3 Teaching Accomplishments (other than classroom instruction)

Section 3.1 Postdoctoral Researchers

Section 3.1.1 Numbered list (in reverse chronological order) of Postdoctoral researchers supervised.

1. Dr. Mohammadjavad Dowran, PhD in Atomic-Molecular & Optical Physic, University of Oklahoma; Norman, OK, August 2021. **Direct supervision at UNL:** 100%. **Dates of Appointment:** 9/1/2021 – 6/30/2023. **Percentage Funding provided by me:** 100% **Funding:** 9/1/2021- 6/30/2020 (Laraoui UNL ORED startup). **Current employment:** Advanced R&D Engr/Scientist – Honeywell, Minneapolis, MN.

Section 3.2 PhD Students

Section 3.2.2 Numbered list (in reverse chronological order) of PhD students supervised at UNL currently in progress.

1. Rupak Timilsina. **Status:** defended his PhD thesis on April 26, 2024. **Co-supervisor:** None. **Percentage Funding provided by me:** 100%. **Funding:** 9/1/2020 - 5/31/2021 (UNL startup), 6/1/2021-present (NSF), **Graduation date:** 5/2024.
2. Adam Erickson. **Status:** passed the comprehensive exam on April 15 of 2024 and will defend his PhD thesis in November of 2024. **Co-supervisor:** None. **Percentage Funding provided by me:** 100%. **Funding:** 1/1/2020 - 10/31/2020 (MRSEC), 11/1/2020 - 7/31/2021 (UNL startup), 8/1/2021- present (NSF), **Expected graduation date:** 12/2024.

3. Suvechhya Lamichhane, **Status:** completed all required courses (90 credit hours), will pass the comprehensive exam in September of 2024, and defend her PhD thesis in April of 2025. **Supervisor:** Sy-Hwang Loiu. **Percentage Funding provided by me:** 0%. **Funding:** 9/1/2021 - present (NSF EQUATE funds), **Expected graduation date:** 5/2025.
4. Sehrish Iqbal, **Status:** accepted the GRA offer, joined my group on May 20, 2024. **Co-supervisor:** None. **Percentage Funding provided by me:** 100%. **Funding:** 5/1/2024 - present (UNL' Grand Challenges award), **Expected graduation date:** 5/2028.
5. Swapnil Barman, **Status:** accepted the GRA offer, joined my group on June 1st, 2024. **Co-supervisor:** None. **Percentage Funding provided by me:** 100%. **Funding:** 6/1/2024 - present (NSF), **Expected graduation date:** 5/2029.

Section 3.4 Undergraduate Students

Section 3.4.1 List of undergraduate students supervised in independent research study

1. Ben Hammons, Electrical Engineering (ECE), UNL, **Funding:** 8/26/2023- present (paid by Laraoui through UNL' grand challenges center award cost object 21-0527-4005). **Number of research hours:** 12h/week.
2. Joshua Barker, Electrical Engineering (ECE), UNL, **Funding:** 8/26/2023- present (paid by Laraoui NSF funds cost object 25-0521-0238-005). **Number of research hours:** 10h/week.
3. Mason Brady, Northern Michigan University, 6/1/2024- 8/31/2024 (REU paid through NSF EQUATE center), **Number of research hours:** 40h/week.
4. Dylan Jacks, Iowa State University, 6/1/2024- 8/31/2024 (REU paid through NSF EQUATE center), **Number of research hours:** 40h/week.
5. Nathan Rieneke, Agricultural engineering (AGEN), UNL, **Funding:** 1/17/2023- present (Laraoui startup + UCARE funding), **Number of research hours:** 12h/week.
6. Enrique Stolz, Alfred University, New York. **Funding:** 6/1/2023- 8/31/2023 (REU paid through NSF EQUATE center), **Number of research hours:** 40h/week.
7. Mauricio Velasco, Central Community College in Columbus, NE. **Funding:** 6/1/2023-8/31/2023 (REU through NSF EQUATE center), **Number of research hours:** 40h/week.
8. Patrick Osborn, Department of Physics and Astronomy, Ohio State University, **Funding:** 6/1/2022- 8/31/2022 (REU through NSF EQUATE center), **Number of research hours:** 40h/week.
9. John Kunkee, Department of Physics, Nebraska Wesleyan University, **Funding:** 6/1/2022-8/31/2022 (REU through NSF EQUATE center), **Number of research hours:** 40h/week.
10. Riley Chase, Mechanical & Materials Engineering (MME) -UNL, **Funding:** 10/1/2021-12/31/2022 (Laraoui startup), **Number of research hours:** 12h/week.
11. Mohammad Sbai, Mechanical & Materials Engineering (MME) -UNL, **Funding:** 9/1/2020-5/31/2022 (my NSF funds from cost object 26-1123-0243-001), **Number of research hours:** 10h/week.

12. Thomas Baumert, Mechanical & Materials Engineering (MME)-UNL, **Funding:** 1/1/2020-5/31/2020 (my NSF funds from cost object 26-1123-0243-001), **Number of research hours:** 10h/week.
13. Abdul Majeed Al Naabi, Mechanical & Materials Engineering (MME) -UNL, **Funding:** 10/1/2019- 3/31/2020 (my NSF funds from cost object 26-1123-0243-001), **Number of research hours:** 10h/week.

Section 3.4.2 Average number of undergraduate students advised per year: 3

3.4.3 High School Students

1. Ben Hammons, Lincoln Public Schools, **Funding:** 6/1/2022- 8/12/2022 and 6/1/2023-8/12/2023 (paid via NCMN Young Nebraska Scientists award), **Number of research hours:** 30h/week.

Section 3.5 Visiting Scholars and Students

Section 3.5.1 Numbered list (in reverse chronological order) of visiting scholars and students supervised during their official visit to UNL.

1. Yifei Wang, visiting PhD student. **Home affiliation**: Japan Advanced Institute of Science and Technology, Nomi, Japan. **Dates of visit to UNL:** 9/1/2023 – 12/31/2023.
2. Thitinun (Nick) Gas-osoth, visiting PhD student. **Home affiliation**: Japan Advanced Institute of Science and Technology, Nomi, Japan. **Dates of visit to UNL:** 5/4/2023 – 8/3/2023.
3. Sajib Halder, visiting MS student. **Home affiliation**: Wichita State University, Wichita, KS. **Dates of visit to UNL:** 5/1/2021 – 7/31/2021.
4. Dr. Kapildeb Ambal, Visiting Assistant Professor. **Home affiliation**: Wichita State University, Wichita, KS. **Dates of visit to UNL:** 5/1/2021 – 7/31/2021.

Section 3.6 Graduate Student Committee Membership

Section 3.6.1 Numbered list (in reverse chronological order) of UNL PhD students for whom I have served as a doctoral committee member.

1. Rupak Timalsina (PhD supervisor: Abdelghani Laraoui), UNL Department of Mechanical and Materials Engineering Department. He will graduate on 4/26/2024.
2. Kai Huang (PhD Supervisor: Evgeny Tsymbal), UNL Department of Physics & Astronomy. Graduated on 12/11/2023.
3. Alexander Ruder (PhD Advisor: Mathias Schubert), UNL Department of Electrical and Computer Engineering department. Graduated on 11/30/2023.
4. Ali Al-Ramini (PhD Advisor: Fadi Alsaleem), UNL Department of Mechanical and Materials Engineering Department. Graduated on 11/13/2023.
5. Ahsan Ullah, (PhD Advisor: Xiaoshan Xu), UNL Department of Physics & Astronomy. Graduated on 6/20/2023.

6. Kun Wang (PhD Supervisor: Xia Hong), UNL Department of Physics & Astronomy. Graduated on 5/1/2023.
7. Megan Stokey (PhD Advisor: Mathias Schubert), UNL Department of Electrical and Computer Engineering department. Graduated on 4/26/2023.
8. Haohan Wang (PhD Supervisor: Xiaoshan Xu), UNL Department of Physics & Astronomy. Graduated on 7/6/2022.
9. Matt Hilfiker (PhD Advisor: Mathias Schubert), UNL Department of Electrical and Computer Engineering department. Graduated on 4/19/2022.

Section 3.6.3 Numbered list (in reverse chronological order) of other PhD students at other universities for whom I have served as an external PhD reviewer.

1. Liam Hanlon (PhD Advisor: Marcus Doherty), Research School of Physics and Engineering, Laser Physics Center, Australian National University, Canberra, Australia. Graduated on 3/2022.

Section 3.8 Other Teaching Accomplishment (overall teaching grade score = 4.2/5):

- **Spring 2024:** MATL-492/892: Introduction to Quantum Materials and technologies. **Course Description:** This course introduces basic laws of quantum mechanics (coherence, entanglement, two-level system, topology, etc.) and introduces revolutionary quantum technologies including quantum communications, quantum sensing, and quantum computing. The boundary between classical and quantum physics, quantization of electromagnetic (EM) field and its consequences, quantum electromagnetic and atomic physics, quantum topological materials and their applications in quantum technologies are discussed. **Number of Students Attended**: 15 (4 undergraduate + 11 graduates). **Course evaluation results**: not displayed yet.

- **Fall 2023:** MATL360/260, Elements of Materials Science Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys, polymers and ceramics, Experience in investigation of properties of engineering materials. **Number of Students Attended**: 70, **Course evaluation results:** 4.45/5 (averaged for labs and lecture).

- **Spring 2023:** MATL-492/892: Introduction to Quantum Materials and technologies. **Course Description:** This course introduces basic laws of quantum mechanics (coherence, entanglement, two-level system, topology, etc.) and provides an introduction to revolutionary quantum technologies including quantum communications, quantum sensing, and quantum computing. The boundary between classical and quantum physics, quantization of electromagnetic (EM) field and its consequences, quantum electromagnetic and atomic physics, quantum topological materials and their applications in quantum technologies are discussed. **Number of Students Attended**: 15 (4 undergraduate + 11 graduates). **Course evaluation results**: 4.65/5 (averaged).

- **Fall 2022:** MATL360/260, Elements of Materials Science Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys,

polymers and ceramics, Experience in investigation of properties of engineering materials. **Number of Students Attended**: 70, **Course evaluation results:** 4.41/5 (averaged for labs and lecture).

- **Spring 2022:** MATL-492/892: Introduction to Quantum Materials and technologies. **Course Description:** This course introduces basic laws of quantum mechanics (coherence, entanglement, two-level system, topology, etc.) and introduces revolutionary quantum technologies including quantum communications, quantum sensing, and quantum computing. The boundary between classical and quantum physics, quantization of electromagnetic (EM) field and its consequences, quantum electromagnetic and atomic physics, quantum topological materials and their applications in quantum technologies are discussed. **Number of Students Attended**: 26 (7 undergraduate + 19 graduates). **Course evaluation results:** 3.95/5 (averaged).

- **Fall 2021:** MATL360/260, Elements of Materials Science Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys, polymers and ceramics, Experience in investigation of properties of engineering materials. **Number of Students Attended**: 71, **Course evaluation results:** 4.184/5 (averaged for labs and lecture).

- **Spring 2021:** Devolved a new class MATL-492/892: Introduction to Quantum Materials and technologies. Course Description: This course introduces basic laws of quantum mechanics (coherence, entanglement, two-level system, topology, etc.) and introduces revolutionary quantum technologies including quantum communications, quantum sensing, and quantum computing. The boundary between classical and quantum physics, quantization of electromagnetic (EM) field and its consequences, quantum electromagnetic and atomic physics, quantum topological materials and their applications in quantum technologies are discussed. **Number of Students Attended**: 12 (2 students from UNL's Physics & Astronomy Department), **Course evaluation results:** 4.1/5 (averaged).

- **Fall 2020:** MATL360-260, Elements of Materials Science Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys, polymers and ceramics. Experience in investigation of properties of engineering materials. **Number of Students Attended**: 70, **Course evaluation results:** 4.08/5 (averaged for labs and lecture).

- **Spring 2020:** MATL360-260, Elements of Materials Science Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys, polymers and ceramics. Experience in investigation of properties of engineering materials. **Number of Students Attended**: 72. **Course evaluation results:** 4.033/5 (averaged for labs and lecture).

Section 4 Service Accomplishments

Section 4.1 Professional Service

Section 4.1.2 Numbered list (in reverse chronological order) of Journals for which I have reviewed papers.

1. Nano Letters: 2 in 2023
2. ACS Nano: 2 in 2023
3. Nature publishing group (NPG) Asia Materials: 1 in 2023
4. Advanced Materials: 2 in 2023, 1 in 2023
5. Nanophotonics: 1 in 2022
6. Nature Communications: 1 in 2024, 2 in 2023, 2 in 2020, 1 in 2019
7. Physics Review Letters: 1 in 2023, 2 in 2022, 3 in 2021, 2 in 2020, 1 in 2019
8. Physics Review X: 1 in 2020, 1 in 2019
9. Physics Review X Quantum: 1 in 2020
10. Applied Physics Letters: 2 in 2023, 2 in 2022, 2 in 2021, 2 in 2020
11. Physics Review Applied: 2 in 2024, 2 in 2022, 2 in 2021, 1 in 2020
12. APL Photonics: 1 in 2024, 1 in 2021, 1 in 2020
13. Physical Review B: 2 in 2023, 2 in 2022, 2 in 2021, 2 in 2020, 2 in 2019
14. Physics Review Materials: 2 in 2021, 1 in 2020
15. International Laser Physics: 1 in 2020

Section 4.1.5 Numbered list (in reverse chronological order) memberships in Professional Organizations

1. American Physical Society (APS), member: 10/2019 – present.
2. Materials Research Society (MRS), member: 10/2021– present.
3. International society for optics and photonics (SPIE), member: 11/2023– present.
4. IEEE Magnetics Society, member: 9/2023– present.

Section 4.1.8 Numbered list (in reverse chronological order) of Research Review panels.

1. National Science Foundation (NSF), Graduate Research Fellowships Program (GRFP), 12/2023 – 1/2024. Reviewed 17 proposals and discussed them in a review panel.
2. French National Research Agency (ANR), 9/2023, QuantERA ERA-NET Cofund in Quantum Technologies.
3. Department of Energy (DOE), Funding for Accelerated, Inclusive Research (FAIR) program, 5/2023.
4. Department of Energy (DOE), Reaching a New Energy Sciences Workforce (RENEW) program, 6/2023.
5. National Science Foundation (NSF), Convergence Accelerator Track C (Quantum Sensing), 3/2021-6/201, reviewed 10 proposals (total amount for funding is $20M distributed over 4 proposals (3-year Phase 2 projects), Served in the review panel on June 17-18, 2021.

6. National Science Foundation (NSF), SBIR/STTR program, 4/2021. Ad hoc reviewer of one proposal.

Section 4.2 University Service

Section 4.2.2 Numbered list of membership positions on university wide committees.

1. 12/2021- 4/2022, member of EQUATE Quantum Search Committee to hire a tenure track Assistant Professor at UNL's Physics & Astronomy Department. Committee members: Christian Binek (lead), Abdelghani Laraoui, Xia Hong, Evgeny Tsymbal, and Robert Streubel.
2. 4/2023- 12/2023, member of EQUATE Quantum Search Committee to hire a tenure track Assistant Professor at UNL's Physics & Astronomy Department. Committee members: Xiaoshan Xu (lead), Abdelghani Laraoui, Shireen Adenwalla, Alexei Gruverman, and Alexey Kovalev. We hired Dr. Zuocheng Zhang from University of California, Berkeley. He will join UNL Physics Department on July 1st, 2024.

Section 4.3 College Service

Section 4.3.2 Numbered list of membership positions on college wide committees.

1. 11/1/2020- 4/30/2021, served as a member of the Electrical & Computer Engineering (ECE) Quantum Materials Search Committee. Committee members: Yongfeng Lu (lead), Abdelghani Laraoui, Wei Bao, Eva Schubert, Christos and Argyropoulos. Goal: hire an Assistant Professor to join ECE and UNL's quantum initiative. Accomplishment: we hired Laura Wang, an expert in hybrid quantum optics systems.

Section 4.4 Unit Service

Section 4.4.2 Numbered list of membership positions on unit committees.

1. Member of Materials Science Graduate Admissions Committee, 2021-present, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln. Committee members: Bai Cui, Lucia Fernandez Ballester, and Abdelghani Laraoui.

Section 4.5 Other Service Accomplishments

1. I engaged with many outreach activities over the last 4 years that include: hosting 12 high school students from Lyons Decatur High School (Lincoln, NE) in January 2024 (made lab tours, showed basic quantum experiments); gave a presentation on diamond quantum sensing to high school students through NCMN Young Nebraska Scientists in the summer of 2022.
2. I organized the 2024 Nebraska Research and Innovation Conference -Diamond Quantum Sensing: Challenges and Opportunities- that took place on Thursday, March 14, 2024 in Lincoln, NE. 110 person attended he workshop from Iowa, Nebraska, and Kansas.
3. I helped in the NCMN/NNF 7-Years review. I gave a presentation on my research and how important NMCN facilities are important to my group. I also participated in the discussion with UNL Grande Challenges team with external reviewers.

4. I gave a plenary talk on quantum sensing aspects at UNL's Grand Challenges "Quantum Science and Engineering" meeting on October 19-20, 2021.
5. I was part of the group directed by Christian Binek and and David Sellmyer to draft the next 5-year grand challenges of UNL in the Quantum Science and Engineering along the N2025 vision. Over the course of 6 months, I participated and hosted online sessions to choose the urgent challenges of UNL to make it recognized nationally and internationally in quantum technologies. We were fortunate that we got selected, drafted with help of some department chairs (*e.g.*, Jeffery Shield), and submitted a 3-page document to ORED (Nathan Meier).
6. I chaired sessions at the 2023 APS March Meeting, March 5 –10, 2023, Las Vegas, NV.
7. I am the vise session chair of the 2024 International Conference on Magnetism (ICM), Dates: 30 June 2024 – 5 July 2024, Geographic Location Bologna, Italy. I reviewed 14 abstracts and selected invited, contributed, and poster presentations.
8. I reviewed graduate applicants for Materials Engineering (MEAM) since 2021.
9. 10/2023. I helped MME during ABET 2023 MME department evaluation: Met with ABET evaluator to discuss the MATL-260/360 class; supervised the TAs to adjust/clean up the labs, etc.

Section 5 Other Accomplishments

Section 5.1 Professional Development

1. 1/1/2020-present: I was selected by ORED as a fellow for the CAREER Club (worth $10,000). I have attended all meetings with experts in proposal writing, NSF program managers, etc. to write a competitive CAREER proposal.

2. 10/1/2019: 5/31/2020: I was selected by UNL's Office of Research and Development (ORED) to participate for 2019/2020 Research Development Fellows Program (RDFP). I have attended all the meetings and selected to go to Washington DC and meet with NSF program managers. COVID-19 affected the travel and will reschedule it to another date.