Ella Orion Lachman, Ph.D.

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Education

2017 **Ph.D., Weizmann Institute of Science, Israel** in Condensed Matter Physics.
Thesis title: *Study of magnetically doped topological insulators using a scanning SQUID-on-tip microscope*
Advisor: Prof. Eli Zeldov

2012 **M.Sc. Physics, Weizmann Institute of Science, Israel**
Thesis title: *Study of Vortex Dynamics in Type-II Superconductors by SOT microscopy*.
Advisor: Prof. Eli Zeldov

2009 **B.Sc. Physics and Chemistry (Exact-Sciences program), Hebrew University of Jerusalem, Israel**
magna cum laude

Experience

Physics research

since 2017 **Postdoctoral researcher.** Quantum Materials Laboratory, UC Berkeley (USA)
Advisor: James Analytis

- Produced high quality single crystals of $Co_3Sn_2S_2$.
- Demonstrated the existence of a frustration-drive spin glass coexisting with the ferromagnetic phase.
- Initiated a collaboration with Dr. Anahory at Hebrew University of Jerusalem to explore the microscopic origins of exchange bias in the material.

This work resulted in a publication in Nature Communications. Another manuscript is under review.

2009 – 2017 **Graduate student** Zeldov group, Weizmann Institute of Science (Israel)
Advisor: Eli Zeldov

- Designed and built a scanning SQUID microscope working at 300 mK.
- Demonstrated the superparamagnetic nature of the magnetization in magnetically doped topological insulators.
- Demonstrated the relation between larger superparamagnetic domains and a higher temperature for the quantum anomalous Hall effect.

This work resulted in 2 publications in Science Advances and in npj Quantum Materials.

Experience (continued)

2008 – 2009 **Undergraduate Student Position.** Banin group, Hebrew University of Jerusalem (Israel)
Advisor: Uri Banin
- Used a combination of confocal and atomic force microscopy to study fluorescent single nano particles.

This work appeared in a publication in Nano Letters.

Teaching and Science communication

2020 **Completed the Learner-centered Teaching course** (10-hour class, instructor led and peer reviewed, pedagogical training in learner-centered active teaching approaches). Lesson subject: learning vector arithmetic through the Halbach array.

May2020 – Dec2020 **COO** LittleBig Science:
https://lbscience.org/about/
https://www.facebook.com/MadaGB
Includes various projects management and human resources management
Initiated and directed "Virtual Lectures" project.

since 2016 **Contributing writer and editor** LittleBig Science

2016 – 2017 **Contributing writer.** Davidson Institute's website: http://davidson.weizmann.ac.il.

2011 – 2012 **Visitors' guide.** Clore Garden of Science, Weizmann Institute of Science.

Awards and distinctions

2018-2020 Awardee of the Weizmann Institute of Science - National Postdoctoral Award Program for Advancing Women in Science.

2009 Graduated *magna cum lauda*.

Seminars and Talks

Dec 2020 **Condensed Matter Seminar (UCLA, USA)**, Magnetic Textures in Quantum Materials: from Topology to Magnonics.

Feb 2020 **Quantum Matter Seminar (Caltech, USA)**, Exchange biased Anomalous Hall Effect driven by frustration in a magnetic Kagome lattice.

Oct 2019 **3rd EPiQS-TMS alliance workshop on Topological Phenomena in Quantum Materials (KITP, USA)**, Exchange biased Anomalous Hall Effect driven by frustration in a magnetic Kagome lattice.

Mar 2018 **American Physical Society March meeting (Los Angeles, USA)**, Observation of Superparamagnetism in Coexistence with Quantum Anomalous Hall $C = \pm 1$ and $C = 0$ Chern States.

Oct 2017 **ABC...z seminar, (UC Santa Barbara, USA)**, Magnetism in magnetically doped topological insulators revealed by SQUID-On-Tip microscopy.

Mar 2016 **GLAM Special Seminar, (Stanford, USA)**, SQUID-On-Tip microscopy of magnetically doped topological insulators.

Seminars and Talks (continued)

- **American Physical Society March meeting (Baltimore, USA)**, Visualization of superparamagnetic dynamics in magnetic topological insulators.

Dec 2015

- **The Israel Physical Society Conference 2015, (BIU, Israel) - Invited talk**, Visualization of superparamagnetic dynamics in magnetic topological insulators.

Skills

Experimental - Hardware

- Cryogenics, Scanning probe microscopy, micropipette handling and SQUID-On-Tip fabrication, evaporation and sputtering, crystal growths, transport measurements, magnetic measurements, strain measurements, VdW materials manipulation.

Experimental - Software

- Design and automation of experiments (LabView), image and data analysis (MatLab, Python), Arduino programming and interfacing with chip evaluation boards.

3D part design

- table-top scale (SPM system, strain system), high precision mm sized parts for CNC fabrication, micron-sized sample masks for e-beam and optical lithography.
  Using Autodesk Inventor, Layout Editor and Eagle Cad.

Teaching and Outreach

- Learner-centered Teaching.
  Guiding groups of all ages (K-12 to seniors) and education levels (non-scientific to physics undergraduates) through physics exhibits at the Clore garden of science.
  Public speaking in both Hebrew and English about supreconductivity, the wonders of microscopy, superconductivity and topological phases.
  Writing about scientific subjects to the general public.

Research Publications

Journal Articles

1. Anahory, Y., Naren, H. R., **Lachman**, **E.**, Buhbut Sinai, S., Uri, A., Embon, L., Yaakobi, E., Myasoedov, Y., Huber, M. E., Klajn, R. & Zeldov, E. (2020). Squid-on-tip with single-electron spin sensitivity for high-field and ultra-low temperature nanomagnetic imaging. *Nanoscale, 12*, 3174–3182. https://doi.org/10.1039/C9NR08578E

2. **Lachman**, **E.**, Murphy, R. A., Maksimovic, N., Kealhofer, R., Haley, S., McDonald, R. D., Long, J. R. & Analytis, J. G. (2020). Exchange biased anomalous hall effect driven by frustration in a magnetic kagome lattice. *Nature Communications*, *11*(1), 560. https://doi.org/10.1038/s41467-020-14326-9

3. Uri, A., Kim, Y., Bagani, K., Lewandowski, C. K., Grover, S., Auerbach, N., **Lachman**, **E.**, Myasoedov, Y., Taniguchi, T., Watanabe, K., Smet, J. & Zeldov, E. (2019). Nanoscale imaging of equilibrium quantum hall edge currents and of the magnetic monopole response in graphene. *Nature Physics*. https://doi.org/10.1038/s41567-019-0713-3

4 **Lachman**, **E.**, Mogi, M., Sarkar, J., Uri, A., Bagani, K., Anahory, Y., Myasoedov, Y., Huber, M. E., Tsukazaki, A., Kawasaki, M., Tokura, Y. & Zeldov, E. (2017). Observation of superparamagnetism in coexistence with quantum anomalous Hall $C = \pm 1$ and $C = 0$ Chern states. *npj Quantum Materials*, *2*(1), 70. https://doi.org/10.1038/s41535-017-0072-1

5 Embon, L., Anahory, Y., Jelić, Ž., **Lachman**, **E.**, Myasoedov, Y., Huber, M. E., Mikitik, G. P., Silhanek, A. V., Milošević, M. V., Gurevich, A. & Zeldov, E. (2017). Imaging of super-fast dynamics and flow instabilities of superconducting vortices. *Nature Communications*, *8*(1), arXiv 1706.00628, 85. https://doi.org/10.1038/s41467-017-00089-3

6 Uri, A., Meltzer, A. Y., Anahory, Y., Embon, L., **Lachman**, **E.**, Halbertal, D., HR, N., Myasoedov, Y., Huber, M. E., Young, A. F. & Zeldov, E. (2016). Electrically Tunable Multiterminal SQUID-on-Tip. *Nano Letters*, *16*(11), arXiv 1606.05088, 6910–6915. https://doi.org/10.1021/acs.nanolett.6b02841

7 **Lachman**, **E.**, Young, A. F., Richardella, A., Cuppens, J., Naren, H. R., Anahory, Y., Meltzer, A. Y., Kandala, A., Kempinger, S., Myasoedov, Y., Huber, M. E., Samarth, N. & Zeldov, E. (2015). Visualization of superparamagnetic dynamics in magnetic topological insulators. *Science Advances*, *1*(10), e1500740–e1500740. https://doi.org/10.1126/sciadv.1500740

8 Finkler, A., Vasyukov, D., Segev, Y., Ne'eman, L., **Lachman**, **E.**, Rappaport, M. L., Myasoedov, Y., Zeldov, E. & Huber, M. E. (2012). Scanning superconducting quantum interference device on a tip for magnetic imaging of nanoscale phenomena. *The Review of scientific instruments*, *83*(7), 073702. https://doi.org/10.1063/1.4731656

9 Yoskovitz, E., Menagen, G., Sitt, A., **Lachman**, **E.** & Banin, U. (2010). Nanoscale Near-Field Imaging of Excitons in Single Heterostructured Nanorods. *Nano Letters*, *10*(8), 3068–3072. https://doi.org/10.1021/nl101614s

Extra Curricular

- Fellow physicist and editor at "Mada Gadol Baktana", the largest independent science outreach group in Israel. http://lbscience.org/
- Co-organizer, Weizmann Condensed Matter student journal club (2014)
- Zeldov Group website and blog coordinator (2014-2017)
- A member of the Israeli Physics Society (2012-2015)
- A member of the American Physics Society (since 2015)
- Member of the Weizmann Institute's theater ensemble (2015-2017)