

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Electrical Engineering and Computer Science

Louise Willingale, assistant professor of electrical engineering and computer science, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees:

Ph.D. 2007 Imperial College London, Plasma Physics, London, United Kingdom
B.S. 2003 Imperial College London, Physics, London, United Kingdom

Professional Record:

2014 – present Assistant Professor, Department of Electrical Engineering and Computer Science, University of Michigan
2011 – 2014 Assistant Research Scientist, Department of Nuclear Engineering and Radiological Science, University of Michigan
2008 – 2011 Post-Doctoral Fellow, Scientist, Department of Nuclear Engineering and Radiological Science, University of Michigan

Summary of Evaluation:

Teaching: Professor Willingale's teaching activities can be categorized into three areas: classroom teaching, teaching short courses for the greater research community, and training through mentoring and DEI. Her formal course teaching to date has been two upper-level electrical engineering elective undergraduate courses and a special topics graduate course fully developed by her (EECS 330, EECS 334, EECS 598). Teaching short courses is an efficient method to convey specialized and introductory concepts to targeted groups. She has taught several short courses at Michigan and elsewhere. Professor Willingale has been successful in training and mentoring graduate students. She has graduated three Ph.D. students as a co-chair and she is the chair of three additional Ph.D. students in progress, with one expected to graduate this year.

Research: Professor Willingale's research area is high-electromagnetic field plasma science. This is a field rooted in fundamental plasma physics while being closely affiliated with applications ranging from inertial confinement fusion and accelerators to biological imaging. The primary experimental technique employed by Professor Willingale is focusing an ultra-high-intensity laser pulse onto a carefully constructed target which ionizes the target to form a plasma. The combination of these processes creates extremely large electric and magnetic fields which accelerate charged particles to relativistic energies. Professor Willingale investigates the way energy transfers between fields and particles in these laser-plasma interactions, including the production and measurement of self-generated magnetic fields. Professor Willingale has made several discipline-leading breakthroughs in understanding the fundamental mechanisms for power and energy transfer in high energy density (HED) plasmas. She is particularly well known for development of the proton deflectometry diagnostic technique to image the transient electromagnetic fields occurring during a laser plasma interaction.

Professor Willingale's record indicates that she is an emerging leader in high-field science research. She will be the inaugural assistant director for the \$16 million NSF mid-scale facility ZEUS that is currently under construction at Michigan. The NSF ZEUS facility will be the highest power laser in the USA (3 PW) and will operate as a user facility with \$18.5 million in operations funding which began in Fall 2021. Professor Willingale's funding is impressive and primarily from the NSF and the Department of Energy. She has been a PI or co-PI on \$5.8 million in external support, of which \$2.7 million was allocated to Professor Willingale, including a NSF CAREER grant. This funding does not include the value of time and support at the national laser facilities where Professor Willingale performs her experiments. This funding tally also does not include the NSF grants to construct and operate ZEUS, as a user facility for which Professor Willingale is a co-investigator. Her visibility and high standing in her professional community is also reflected by the leadership position she has taken in the profession. The fact that she is serving on multiple executive committees governing national user facilities is remarkable.

Recent and Significant Publications:

- J. L. Peebles, G. Fiksel, M. R. Edwards, J. von der Linden, L. Willingale, D. Mastro Simone, and Hui Chen, "Magnetically collimated relativistic charge-neutral electron-positron beams from high-power lasers," *Physics of Plasmas*, 28, 074501, 2021.
- A. E. Hussein, A. V. Arefiev, T. Batson, H. Chen, R. S. Craxton, A. S. Davies, D. H. Froula, Z. Gong, D. Haberberger, Y. Ma, P. M. Nilson, W. Theobald, T. Wang, K. Weichman, G. J. Williams and L Willingale, "Towards the optimisation of direct laser acceleration," *New Journal of Physics*, 23, 023031, 2021.
- E. R. Tubman, A. S. Joglekar, A. F. A. Bott, M. Borghesi, B. Coleman, G. Cooper, C. N. Danson, P. Durey, J. M. Foster, P. Graham, G. Gregori, E. T. Gumbrell, M. P. Hill, T. Hodge, S. Kar, R. J. Kingham, M. Read, C. P. Ridgers, J. Skidmore, C. Spindloe, A. G. R. Thomas, P. Treadwell, S. Wilson, L. Willingale and N. C. Woolsey, "Observations of pressure anisotropy effects within semi-collisional magnetized plasma bubble," *Nature Communications*, 12, 334, 2021.
- P. T. Campbell, C. A. Walsh, B. K. Russell, J. P. Chittenden, A. Crilly, G. Fiksel, P. M. Nilson, A. G. R. Thomas, K. Krushelnick, and L. Willingale, "Magnetic Signatures of Radiation-Driven Double Ablation Fronts," *Physical Review Letters*, 125, 145001, 2020.
- C. A. J. Palmer, P. T. Campbell, Y. Ma, L. Antonelli, A. F. A. Bott, G. Gregori, J. Halliday, Y. Katzir, P. Kordell, K. Krushelnick, S. V. Lebedev, E. Montgomery, M. Notley, D. C. Carroll, C. P. Ridgers, A. A. Schekochihin, M. J. V. Streeter, A. G. R. Thomas, E. R. Tubman, N. Woolsey, and L. Willingale, "Field reconstruction from proton radiography of intense laser driven magnetic reconnection," *Physics of Plasmas*, 26, 083109, 2019.

Service: Professor Willingale has established an excellent professional reputation by playing a leading role in several national and international workshops, executive committees, and advisory panels. Her executive/advisory roles include user programs at three major U.S. facilities: the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory; the OMEGA laser facility at the University of Rochester's Laboratory for Laser Energetics; and the Matter in Extreme Conditions (MEC) station of the Linac Coherent Light Source (LCLS) at the SLAC National Accelerator Laboratory. Professor Willingale was elected to the executive committee of the High-Energy-Density Science Association (HEDSA), which sets the research priorities for the entire field of high-energy-density science. At UM, she has served as the EE faculty advisor for undergraduate students, a member of the ECE committee for an inclusive department, an ECE faculty search committee member, an evaluator for ECE graduate admissions, and a member of the admissions committee for the UM Applied Physics Program. Professor Willingale has also made serious

commitments to DEI, which is particularly evident through her advising of the Women in Electrical and Computer Engineering (WECE) student group, whose goal is to foster a supportive community among women and gender minorities in ECE fields.

External Reviewers:

Reviewer A: “I have followed Louise’s work for nearly a decade now and during that time she has quickly ascended the ranks to that of a prominent scientists [sic] in the field of short pulsed laser work and high laser intensity science.”

Reviewer B: “Her research portfolio is well-defined and is contributing meaningfully to the advancement of the field in strategically important areas that are likely to have enduring and growing impact over the next decade or so.”

Reviewer C: “...Willingale has strong and internationally recognized research programs in intense magnetic fields. ... She has an excellent record of service and engagement in professional activities related to her research work.”

Reviewer D: “I am pleased to say that Louise has done extremely well and more than met U. Michigan’s expectations for tenure. I have no doubt that were she in my department that she would have been promoted to tenure already.”

Reviewer E: “Prof. Willingale has built up a strong reputation and is internationally recognized as a researcher in the field of intense laser-matter interaction. ... Her work is innovative and of high quality. Louise has published her work in more than 70 peer review journal papers.”

Summary of Recommendation: Professor Louise Willingale is an outstanding researcher, teacher, and mentor. She has established an international reputation for innovation and excellence in the field of high energy density (HED) laser-plasma interactions. She is acknowledged worldwide for her contributions to education through workshops and tutorials, and for her mentoring of diverse students. It is with the support of the College of Engineering Executive Committee that I recommend Louise Willingale for promotion to associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.



Alec D. Gallimore, Ph.D.
Robert J. Vlasic Dean of Engineering
College of Engineering

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