Approved by the Regents
May 18, 2023

PROMOTION RECOMMENDATION
The University of Michigan
College of Literature, Science, and the Arts

Emanuel Gull, associate professor of physics, with tenure, College of Literature, Science, and the Arts, is recommended for promotion to professor of physics, with tenure, College of Literature, Science, and the Arts.

Academic Degrees:

Ph.D.	2008	Institut für Theoretische Physik, ETH Zürich
B.S.	2005	ETH Zürich

Professional Record:

2018-present	Associate Professor, Department of Physics, University of Michigan
2012-2018	Assistant Professor, Department of Physics, University of Michigan
August 2012	Junior work group leader (Arbeitsgruppenleiter), Max Planck Institute for the Physics of Complex Systems Dresden, Germany
2009-2011	Post-doctoral Fellow, Columbia University

Summary of Evaluation:

Teaching: Professor Gull's teaching takes place primarily at the graduate level, where his development and teaching of classes on advanced condensed matter physics and computational physics have been appreciated by students. These classes make crucial contributions to the department's graduate teaching mission. Professor Gull has also contributed to our undergraduate program by teaching upper-level courses in computational physics and statistical mechanics and has successfully involved undergraduate students in his research. One of his recent high-profile publications had a Michigan undergraduate as its first author, and Professor Gull has highlighted her critical contributions to the work. Professor Gull is also mentoring an excellent cohort of graduate students and post-doctoral scholars. Despite his occasional challenges with undergraduate classes, his contributions to the educational mission of the department are valued, especially his graduate teaching and mentorship of students at all levels.

Research: Professor Gull is a quantum condensed matter theorist. His research interests focus on numerical methods which combine analytical and electronic structure approaches, high-performance computing techniques, and tools from applied mathematics to model the behavior of condensed-matter systems, particularly those referred to as correlated materials for which a single-particle description is entirely inappropriate. Professor Gull's research program is highly visible and extremely well-funded, at the level of more than $0.5M per year. Following his promotion to associate professor, his efforts expanded into new frontiers; what was previously limited to lattice models in equilibrium has now evolved into studies of real materials in and out of equilibrium. In the time period from 2018-2022, Professor Gull published thirty-seven research articles, one review paper, and two peer-reviewed publications for computer programs and open-source software. Some of these papers are highly cited. According to Google Scholar, Gull has an h-index of 49 and his papers are cited 9,036 times; these numbers significantly exceed those of most candidates for promotion to Professor at a major research university.

Recent and Significant Publications:

Dong, X., Gull, E., & Millis, A.J. (2022). Quantifying the role of antiferromagnetic fluctuations in the superconductivity of the doped Hubbard model. *Nature Physics*, https://doi.org/10.1038/s41567-022-01710-z.

Yeh, C.-N., Shee, A., Sun, Q., Gull, E., & Zgid, D. (2022). Relativistic self-consistent GW: Exact two-component formalism with one-electron approximation for solids. *Physical Review B*, *106*(8), 085121.

Dong, X., Del Re, L., Toschi, A., & Gull, E. (2022). Mechanism of superconductivity in the Hubbard model at intermediate interaction strength. *Proceedings of the National Academy of Sciences*, *119*(33), e2205048119.

Fei, J., Yeh, C.-N., & Gull, E. (2021). Nevanlinna analytical continuation. *Physical Review Letters*, *126*(5), 056402.

Service: Professor Gull takes his service to the department and the physics community seriously and carries it out with success. He has a track record of serving on important departmental committees including the department's Executive Committee, and he co-organizes an interdisciplinary condensed matter/quantum chemistry theory seminar with a partner in the Department of Chemistry. At the university-level, he serves on several important committees impacting the future educational and research landscape of the university. At the national-level, Professor Gull has served as a co-director of the Simons Collaboration on the Many-Electron Problem since 2014. This is a prestigious assignment requiring coordinating scientific efforts of a large collaboration of leading computational scientists. As a leading scientist, he co-organizes summer schools and major scientific conferences. He is much in demand for reviewing submissions to high-visibility journals and proposals to a wide range of domestic and international funding agencies. For his exceptional service as a referee, he has been named an APS Outstanding Referee in 2018.

External Reviewers:

Reviewer (A): "...In my view, he is an outstanding scientist of high abilities, profound creativity, and impressive technical skills. He is extremely efficient, highly motivated, and capable to advance well in numerical calculations of correlated electron systems, chiefly described by the Hubbard model…"

Reviewer (B): "...Dr. Gull is a strong and original computational condensed matter theorist whose work has significant impact. He is a clear a star [sic] and a leader in the field. I strongly support his promotion."

Reviewer (C): "...Emanuel Gull is, simply stated, one of the world leaders in computational quantum physics. He has a recognizable style, which is a combination of algorithmic creativity, extreme rigor in analyzing and questioning data, and uncompromising demand for well controlled methods which are either computationally exact or, if approximate, in which the approximations are clearly stated and benchmarked…"

Reviewer (D): "...The combination of his deep and thoroughly thought through commitment to a particular class of approaches to these problems, extraordinary technical mastery of the subject,

along with his refreshing honesty about the pitfalls and shortcomings of the approach, make him stand out among a talented group of peers (and, indeed, distinguishes him in a positive sense from many of the more senior leaders of the area)…"

Reviewer (E): "...[Professor Gull] is a well-known, very active scientist working in the intersection of computational science, materials science, and condensed matter physics…He involved undergraduates in his work on the notoriously difficult problem of analytic continuation…"

Reviewer (F): "...Professor Gull is an expert on improving methods for numerical simulation of many-electron physics. His work is very highly regarded for its substance and for its creativity…"

Summary of Recommendation:
Professor Gull has shown the highest intellectual quality, productivity, and leadership in creating and disseminating knowledge in physics. The Executive Committee of the College of Literature, Science, and the Arts and I recommend that Associate Professor Emanuel Gull be promoted to the rank of professor of physics, with tenure, College of Literature, Science, and the Arts.

Anne Curzan, Dean
Geneva Smitherman Collegiate Professor of
English Language and Literature, Linguistics,
and Education
Arthur F. Thurnau Professor
College of Literature, Science, and the Arts

May 2023