

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

Emanuel Gull, assistant professor of physics, College of Literature, Science, and the Arts, is recommended for promotion to associate 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:

2012 – present	Assistant Professor, Department of Physics, University of Michigan
2009 – 2011	Post-doctoral Research Scientist, Department of Physics, Columbia University

Summary of Evaluation:

Teaching – Professor Gull has taught at the undergraduate and graduate levels, with a particular focus on teaching computational physics, which is his area of expertise. He has taught three different courses during his time at Michigan, including a 500-level course on computational physics, which he created and has taught five times. The course has proved to be broadly popular with students, receiving substantially positive evaluations and attracting a growing number of participants over its five years on the teaching schedule. He also taught “Waves, Heat, and Light” (Physics 340) twice and “Introduction to Computational Physics” (Physics 411) twice. Michigan has led the way in recent years with the introduction of new classes on computational physics at both the undergraduate and graduate levels, and with the comprehensive integration of computer methods into physics teaching at all levels. Professor Gull has played a central role in these developments, having created the graduate computational physics course – one of the first of its kind in the nation – and taught the undergraduate course twice. In addition to his formal teaching, Professor Gull has been an active and successful mentor to many students. He has shepherded graduate students through to their Ph.D., having advised five doctoral students in his five years at Michigan. This is a larger-than-usual number for a purely theoretical research group in the Department of Physics.

Research – Professor Gull has established a highly visible, cutting-edge, vigorous, and well-funded research program in quantum condensed matter theory. His research is devoted to developing and applying numerical methods to problems of fundamental interest for strongly correlated solids. He is exploring five closely related research directions and has been extraordinarily successful with all of them. This requires enormous ingenuity and creativity with computer algorithms, combined with a deep understanding of the underlying analytic structure of the theory, and finely tuned judgement as to what problems to address. Professor Gull has all these qualities and is regarded by his peers as being among the best in the world at carrying out this program. To support his work, he has been awarded highly competitive grants from national agencies (Department of Energy and National Science Foundation) as well as private funding agencies (Simons Society of Fellows and the Alfred P. Sloan Foundation). These grants enable

him to support a large and vibrant research group. Professor Gull has published 62 peer-reviewed papers, and several open source software publications. His three most highly cited papers have received 519, 435, and 322 citations since 2006 and his h-index is 28. Citation data for 2017 indicates that five of Professor Gull's highly cited papers are placed in the top 1% of his academic field.

Recent and Significant Publications:

- “Knight shifts, nuclear spin-relaxation rates, and spin echo decay times in the pseudogap regime of the cuprates: Simulation and relation to experiment,” with C. Xi and J. P. F. LeBlanc, *Nature Communications*, 8, 2017, p. 14986.
- “Finite temperature quantum embedding theories for correlated systems,” with D. Zgid, *New Journal of Physics*, 19, 2017, p. 023047.
- “Voltage quench dynamics of a Kondo system,” with A. E. Antipov and Q. Dong, *Physical Review Letters*, 116, 2016, p. 036801.
- “Solutions of the two dimensional Hubbard model: Benchmarks and results from a wide range of numerical algorithms,” with J. P. F. LeBlanc, et al., *Physical Review X*, 5, 2015, p. 041041.

Service – Professor Gull has made significant service contributions at the department, university, and national levels, representing both his expertise in research computing and his dedication to under-graduate and graduate students. He has served on the Department of Physics' Computing Committee since his arrival on campus in 2012, and through his expertise in advanced research computing, he has made significant contributions to this committee. He has also served on the university-wide Michigan Institute for Computational Discovery and Engineering (MICDE) Management Committee since 2015, and became the head of the MICDE Center for Scientific Software Infrastructure in 2017.

External Reviews:

Reviewer (A)

“In my opinion, Prof. Gull is one of the brightest and most accomplished computational condensed matter physicists in his generation. I have no hesitation in saying that he would get tenure in my department. ...he has a refreshing honesty. I strongly recommend that you grant him tenure and promote him to associate professor.”

Reviewer (B)

“I honestly believe that he is very likely the best among people working on the numerical approaches to correlated electron systems. ... I am certain he would be promoted at any Institution in the US and elsewhere.”

Reviewer (C)

“Prof. Gull's achievements have bestowed upon him honors and awards...that put him near the top of the list of...numerical condensed matter theorists of his age group. Further, the awards he has received both from DOE (Early Career) and NSF are testaments to the value placed by the referees and funding agencies in his ability to deliver quality science.”

Reviewer (D)

“Professor Gull is an expert in the algorithmic aspects of quantum many body theory and computational physics. ... This has been an extremely important field in physics for decades and its [sic] gaining more and more importance with time. ...the candidate has an extremely high standing, and I would put him at the top of his [cohort].”

Reviewer (E)

“One highlight surely has to be the 2015 Phys Rev Letter which is the most convincing evidence to date that the ground state of the Hubbard model is a d-wave superconductor at modest doping, as well as showing other experimental features such as the pseudogap.”

Reviewer (F)

“I regard Emanuel as truly exceptional among physicists [in his cohort] today. ...I believe that he has the qualities to be a tenured professor at any university in the United States and Michigan is lucky to have him!”

Reviewer (G)

“Dr. Gull is truly [an] outstanding scholar and teacher. He is a leading figure in one of the central areas of condensed matter physics, with a body of important results and a very well thought out and important research program. ...Emanuel Gull is a most remarkable scientist: a person of great technical power and physical and mathematical insight.”

Reviewer (H)

“...his work on designing a Continuous Quantum Monte Carlo algorithm...has received tremendous attention from workers in the field. This publication will certainly stay in any book about computational methods in the future, and this is probably just a start for Emanuel. I would rank him as one of the more gifted numerical scientist[s]...maybe simply the more gifted. ...I believe he would beat the competition in his field of expertise in most of the institutions over the world.”

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 Assistant Professor Emanuel Gull be promoted to the rank of associate professor of physics, with tenure, College of Literature, Science, and the Arts.



Andrew D. Martin, Dean
Professor of Political Science and Statistics
College of Literature, Science, and the Arts

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