

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

Kai Sun, 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.	2009	University of Illinois, Urbana-Champaign
B.S.	2002	Peking University

Professional Record:

2012 – present	Assistant Professor, Department of Physics, University of Michigan
2009 – 2012	Post-doctoral Fellow, University of Maryland, College Park

Summary of Evaluation:

Teaching – Professor Sun is an excellent teacher who is pedagogically creative and has a thorough command of the material. He has taught a variety of courses at the advanced undergraduate and graduate levels, including “Solid State,” “Advanced Condensed Matter,” and a 600-level special topics course, all of which are related to his discipline. Professor Sun also taught the second semester Quantum Mechanics course for physics majors. Since condensed matter is a major field in physics, these courses are an important part of the department’s curriculum. Student evaluations show that he has been highly effective with scores in the upper quartile across the board. Professor Sun has also played a key role in updating the condensed matter course sequence from a two-semester to a three-semester sequence. This is a valuable contribution towards strengthening condensed matter theory in the department. In particular, Professor Sun developed a modernized version of “Advanced Condensed Matter,” which brings a quantum field theory approach to the forefront and includes topics such as topological insulators and strongly correlated systems that are closely connected to his research program.

Research – Professor Sun has established a highly visible, vigorous, and well-funded research program that focuses on two important areas of quantum condensed matter physics; namely, strongly correlated systems and topological states of matter, and of particular recent importance, the interplay between the two. Both of these fields represent highly competitive, cutting edge research that has ties to many branches of physics beyond condensed matter and also beyond physics. Professor Sun participates in interdisciplinary collaborations, most recently in setting up a new Interdisciplinary Research Group within the Materials Research Science and Engineering Center (MERSEC). He is also a partner in a three-faculty M-Cubed program pursuing research in topological insulator nanostructures and devices. This internally funded “incubator” program has scored a major success by being awarded a grant from the National Science Foundation. Professor Sun’s research papers also include work with UM physics faculty in particle physics, soft condensed matter physics, and atomic, molecular and optical physics, which are three other subfields of great strength and importance in the department. This kind of breadth, crossing subfields, greatly aids in the overall cohesion of the Department of Physics’ theoretical research program. A signal of Professor Sun’s high standing in his subfield is his

excellent funding. He has secured a prestigious Alfred P. Sloan Foundation grants and has successfully competed for two grants from the National Science Foundation. This is an impressive achievement for a junior theory colleague and bodes well for his research support in the years ahead.

Recent and Significant Publications:

“Adiabatic continuity, wavefunction overlap and topological phase transitions,” with J. Gu, *Physical Review B*, 94, 2016, p. 125111.

“Discretized Chern-Simons gauge theory on arbitrary graphs,” with K. Kumar and E. Fradkin, *Physical Review B*, 92, 2015, p. 115148.

“Phonons and elasticity in critically coordinated lattices,” invited review with T. C. Lubensky, et al., *Reports on Progress in Physics*, 78, 2015, p. 073901.

“Two-dimensional Fermi surfaces in Kondo insulator SmB₆,” with G. Li, et al., *Science*, 346, 2014, pp. 1208-1212.

Service – Professor Sun has performed significant and important service for the Department of Physics and the college. He has served on the Graduate Qualifying Exam Committee (three times) and on the Graduate Program Admissions Committee. He also worked with other departmental faculty to organize an international workshop on “Strongly Correlated Topological Insulators: SmB₆ and Beyond.” Professor Sun worked to develop a new joint seminar series for theoretical condensed matter and quantum chemistry, and served on the Condensed-Matter and Atomic, Molecular and Optical (CM-AMO) Seminar Committee.

External Reviewers:

Reviewer (A)

“I believe his works are of very high quality, and his level of accomplishments is comparable to that of junior researches at the best institutions in [the] USA and abroad. ... He is [a] highly qualified, commonsense physicist, capable of doing solid research and keep[ing] high productivity.”

Reviewer (B)

“In my opinion, he is one of the best condensed matter theorists [in his cohort] in the world, and you are fortunate to have him in your faculty. ... Kai’s scholarly output from Michigan has been exemplary. ...I put Kai Sun at the top group of theorists [in his cohort]... This gives you some idea about how highly I think of Kai Sun.”

Reviewer (C)

“He is clearly one of the stars in the field. In his short career he has produced a number of key results which have made a significant impact. ... The work that he has done at Michigan as an Assistant Professor of Physics has been...stellar. ...in my opinion...[he] belongs to the select group of the very best theorists [in his cohort] in our field who are a very strong bunch.”

Reviewer (D)

“Kai’s proposal that SmB₆ [sic] is a topological Kondo insulator...has generated considerable activities in the field, making Kai an intellectual leader in this area. His work after he became a faculty [member] at Michigan has stimulated many experiments, including quantum oscillation,

ARPES, and surface conductivities; some of these experiments are performed in U. of Michigan.”

Reviewer (E)

“The field of topological insulators is star-studded, and Kai Sun surely is one of the stars. ... Kai Sun is a brilliant and creative physicist with a strong record of accomplishment. I have no doubt that he is also a wonderful colleague and teacher. ... there is not a scintilla of doubt that Kai Sun would be enthusiastically granted promotion and tenure at [my institution].”

Reviewer (F)

“Prof Kai Sun has already published [an] astonishing 52 research papers (he only received his Ph.D. in 2009!) and more than half of these (27) are published since he joined the University of Michigan. ... Our research field has seen influx of many extremely bright...theorists in the last decade. Even among this selected group of highly talented people, Prof[.] Kai Sun stands out as one of the leading theorists.”

Reviewer (G)

“Kai has several early papers on fractional Chern insulators and related ideas. ... The work in this area has certainly been very high quality theoretical physics and Kai is one of those who initiated and defined this field, and deserves recognition for this. ...I have an *extremely* positive opinion of Kai Sun. He is a gem.”

Reviewer (H)

“He is one of the few theoreticians [in his cohort] who is strongly interested in a broad range of experimental techniques and understands how the various experimental methods can be used as tests of theoretical models. ...let me express my strong support for the promotion to a tenured associate professor. I am absolutely sure that he will be an asset the University of Michigan is and will remain proud of.”

Summary of Recommendation:

Professor Sun 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 Kai Sun 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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