Approved by the Regents
May 18, 2017

PROMOTION RECOMMENDATION
The University of Michigan-Flint
College of Arts and Sciences
Department of Computer Science, Engineering, and Physics

James Alsup, assistant professor of physics, Department of Computer Science, Engineering, and Physics, College of Arts and Sciences, is recommended for promotion to associate professor of physics, with tenure, Department of Computer Science, Engineering, and Physics, College of Arts and Sciences.

Academic Degrees:

Ph.D.	2010	University of Tennessee, Knoxville
B.S.	2005	University of Tennessee, Knoxville

Professional Record:

2011 – Present	Assistant Professor of Physics, University of Michigan-Flint
2010 – 2011	Visiting Assistant Professor of Physics and Mathematics, Colorado State University-Pueblo
2005 – 2010	Research and Teaching Assistant, University of Tennessee, Knoxville
2003 – 2005	Science Alliance Internship/Research Experience, University of Tennessee, Knoxville

Summary of Evaluation:

Teaching – Through fostering critical analysis skills, logistical independence, and the insistence on maintaining high expectations for his students, Professor Alsup is an accomplished teacher who encourages his students to expand the boundaries of their knowledge. Employing a "studio-based" pedagogy, Professor Alsup's classes are a masterful blend of interactive lecturing via instructional technology, group work, in-class example problems, and labs. Professor Alsup has taught six different introductory courses as well as three upper division courses to mathematics and physics majors, including PHY 391 in which students work on undergraduate research projects. To provide a greater appreciation of the breadth of Professor Alsup's teaching, consider the following two bookends of a student's career. One of the courses that Professor Alsup teaches is the First Year Experience course, "Tales from the Dark Side" – a journey of exploration black holes, dark matter, and dark energy. At the conclusion of students' careers, Professor Alsup provides invaluable opportunities for students to engage in undergraduate research – a facet of his teaching that he places high priority given that these experiences instill an early commitment to the discipline and also lead to greater success in graduate school. Professor Alsup is an outstanding mentor and teacher for both majors and students enrolling in General Education courses at the University of Michigan-Flint.

Research – Professor Alsup is a high-energy theoretical physicist specializing in condensed matter – a branch of physics that describes different states of matter and the transition between these states. The focus of Professor Alsup's research is to develop the calculations that capture how in

superconductivity a metal transition from a state that opposes electrical current to a state where current is entirely free to flow. By conceptualizing superconductivity as a gravitating black hole, Professor Alsup and his colleagues have been able to mathematically describe a type of superconductor near absolute zero temperature, thereby enabling the discovery of a system that possesses both superconducting and insulating states of matter. One external reviewer notes that only a few researchers world-wide have mastered such numerical techniques to investigate the transport properties of holographic models. Specifically, this reviewer was quite impressed by the progress Professor Alsup and his colleagues have made in the paper "Holographic Fermi Liquids in a Spontaneously Generated Lattice" (2016) in *Physics Review D.* It is clear that Professor Alsup is establishing himself on a world-wide basis for his theoretical physics work. Since his arrival at the University of Michigan-Flint in 2011, Professor Alsup has published six peer-reviewed papers and has presented over a dozen papers nationally and internationally.

Recent and Significant Scholarly Activity:

Peer-Reviewed Journal Articles

Alsup, J., Papantonopoulos, E., Siopsis, G., and Yeter, K. (2016). "Holographic Fermi Liquids in a Spontaneously Generated Lattice." *Physical Review D*, 93, 105045; arXiv:1603.03382.

Alsup, J., Papantonopoulos, E., Siopsis, G., and Yeter, K. (2014). "Duality Between Zeroes and Poles in Holographic Systems With Massless Fermions and a Dipole Coupling." *Physical Review D*, 90, 126013; arXiv:1404.4010.

Alsup, J., Papantonopoulos, E., Siopsis, G., and Yeter, K. (2013). "Spontaneously Generated Inhomogeneous Phases via Holography." *Physical Review D*, 88, 105028; arXiv:1305.2507v2.

Alsup, J., Papantonopoulos, E., and Siopsis, G. (2013). "A Novel Mechanism to Generate FFLO States in Holographic Superconductors." *Physics Letters B*, Vol. 720, pps. 379-384; arXiv:1210.1541v2.

Alsup, J., Papantonopoulos, E. and Siopsis, G. (2012). "FFLO States in Holographic Supervonductors." arXiv:1208.4582.

Alsup, J., Siopsis, G. and Therrien, J. (2012). "Hair on Near-Extremal Reissner-Nordstro¨m AdS Black Holes." *Physics Letters D*, 86, 025002; arXiv:1110.3342v2.

Conference Presentations

Alsup, J. (2016). "Fermions in a Spontaneously Generated Holographic Lattice." Numerical Relativity and Holography, Santiago de Compostela, Spain, (June).

Alsup, J. (2016). "Einstein's Equations and Two Black Holes." Science on Tap, University of Michigan-Flint, (March).

Alsup, J. (2016). "Building a Superconductor Out of Black Holes." Physics Seminar, Grand Valley State University, Grand Rapids, Michigan, (March).

Alsup, J. (2015). "A Black Hole and a Hologram." SE&T Colloquium Series, Saginaw Valley State University, Saginaw, Michigan, (March).

Alsup, J. (2014). "Holographic Systems with Massless Fermions and a Dipole Coupling." 24th Midwest Relativitiy Meeting, Oakland University, Oakland, Michigan, (November).

Alsup, J. and Ganguly, R. (2014). "AstroNite: A Case Study in Astronomy Outreach." Michigan Section of the American Association of Physics Teachers Fall Meeting, University of Michigan-Flint, (October).

APS Meeting, Atlanta, Georgia, (April).

Alsup, J. (2014). "How to Build a Superconductor with a Black Hole." Math Seminar, University of Michigan-Flint, (April).

Service – Given Professor Alsup's passion for his discipline and his commitment to inspire students of all ages, it is not surprising that Professor Alsup's earliest forms of service were to his community through his numerous outreach efforts. Since his arrival in the fall of 2011, Professor Alsup has contributed his talents and knowledge to UM-Flint's AstroNite where he ran sessions on the physics of the Mars Lander in which participants built devices that house and protect eggs during a three-story fall. He also has worked the "Comets" exhibit where he explains the composition of celestial bodies. Another example of Professor Alsup's outreach is his public lecture, "The Higgs and Hereafter," at the Longway Planetarium, Flint, Michigan, in 2013, which focused on the recent developments in particle physics and connections to society and popular culture. More recently, Professor Alsup has served his department and college. Given the size and complexity of his home department – Computer Science, Engineering and Physics – his service on numerous department committees is substantive and significant. At the college level, Professor Alsup served as the chair for the Summer Interim Committee in 2015 and on the Selection Committee for the Eugene W. Geniesse, Sr. Science Scholarship from 2012 to present.

External Reviewers:

Reviewer (A): "[Being first author on every paper published], I consider this an extraordinary accomplishment for a faculty member at a primary undergraduate institution such as the University of Michigan-Flint… Based on the quality of the journals, I believe that these articles represent a solid contribution to his field of research and have significant scholarly impact… …I can judge with confidence that this paper ['A Novel Mechanism'] represents a unique approach to this problem. Dr. Alsup also presented this paper at the 2013 American Physical Society (APS) March meeting, known to be the largest gathering of condensed matter physicists in the world, which indicated the interdisciplinary nature of his work."

Reviewer (B): "The subject of the papers is topical, in line with the popular trend of apply holographic models to condensed matter physics… The candidate's research is in a modern and active field, and the papers are published in good quality Physics journals."

Reviewer (C): "…I would assess his research as highly successful and highly promising for future productivity… That said, the field of holographic gauge/gravity duality applications to condensed matter systems has been ascendant enough in the past decade that I am somewhat familiar with it. It also strikes me as a very 'hot' field, and therefore very competitive, which tends to put folks at smaller schools with higher teaching loads at a disadvantage."

Reviewer (D): "Since entering the tenure track, he has a commendable publication record of a bit over one peer-reviewed, published article per year. Most if these are in PRD, a very good journal."

Reviewer (E): "…the model of holographic superconductors has provided us with a new framework to understand the mechanism for high temperature superconductors… Recently this problem [of constructing holographic background with lattices] is solved by Horowitz, Santos and Tong. But

until now, all over the world only a few research groups have mastered such numerical techniques involved and developed this method in investigating the transport properties of holographic models. I have read [the 2016 PRD paper] and have been quite impressed by the progress they have made in this paper… They found the band structure exhibits a gap due to lattice effects. In this work they have exhibited sophisticated numerical skills in handling PDEs in holographic models as well as the novel ideas on the holographic realization of pseudogap band structure."

Reviewer (F): "…initial forays into studying field theory models that explore the intriguing connections between gravitational theories and condensed matter systems… The work involves a mix of numerical and analytical techniques and is directed toward further understanding condensed matter phenomena, including superconductivity… Four of the five included papers are published in the premier journal in the field for regular-length articles, *Physical Review D*, and are of high quality… This body of work represents an impressive output for a faculty member employed at a primarily undergraduate institution."

Reviewer (G): "I would characterize Dr. Alsup's work as timely and insightful. He has carved out a niche applying AdS/CFT-type techniques to exotic superconductor physics and other condensed matter systems… His work has established new results and conjectures, and extends one of the only analytic toolsets for studying strongly coupled condensed matter systems. The impact of his work is supported by citations from a number of top researchers in his field… All of Dr. Alsup's work is high-quality scholarship. Two papers, in particular stand out to me. 'A Novel Mechanism to Generate FFLO States in Holographic Superconductors' … [and] 'Duality Between Zeros and Poles in Holographic Systems With Massless Fermions and a Dipole Coupling… …I would describe him as active and accomplished."

Reviewer (H): "He has an analytic approach to a given research problem, trying to understand in depth the issues involved, suggesting ways out of the appeared difficulties… However, his strongest point is that he has a master ability in performing numerical calculations and many times helped us to overcome the appeared difficulties."

Summary of Recommendation:

Professor Alsup is a high-energy theoretical physicist specializing in condensed matter – a branch of physics that describes different states of matter and the transition between these states. By developing the calculations that capture how in superconductivity a metal transitions from a state that opposes electrical current to a state where current is entirely free to flow, Professor Alsup and his colleagues have been able to mathematically describe a type of superconductor near absolute zero temperature, thereby enabling the discovery of a system that possesses both superconducting and insulating states of matter. Professor Alsup is also a dedicated teacher who encourages his students to expand the boundaries of their knowledge. Employing a "studio-based" pedagogy, Professor Alsup's classes are a masterful blend of interactive lecturing via instructional technology, group work, in-class example problems, and labs. Finally, Professor Alsup provides invaluable opportunities for students to engage in undergraduate research. In terms of service, Professor Alsup excels in making his theoretical and abstract area of expertise accessible to audiences of all ages through his community outreach efforts at Flint's AstroNite and public lectures at the Longway Planetarium. In sum, Professor Alsup has demonstrated the

requisite excellence in teaching, scholarly achievement and recognition, and service to his community, department and college worthy of promotion to associate professor with tenure. With enthusiasm and great pride, I recommend that James Alsup be promoted to associate professor of physics, with tenure, Department of Computer Science, Engineering, and Physics, College of Arts and Sciences.

Recommended by:

Susan Gano-Phillips, Dean
College of Arts and Sciences

Recommendation endorsed by:

Douglas G. Knerr, Provost and
Vice Chancellor for Academic Affairs

Susan E. Borrego, Chancellor
University of Michigan-Flint

May 2017