

# Christoph A. Keller

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CONTACT INFORMATION Mathematics Dept, U of Arizona  
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EMPLOYMENT **University of Arizona**  
· Assistant Professor, Department of Mathematics, Jan 2018 – June 2022  
· Associate Professor, Department of Mathematics, July 2022 –

**ETH Zürich**  
· Assistant Professor in Mathematical Physics, Oct 2015 – Dec 2018

**Rutgers, The State University of New Jersey**  
· Postdoctoral researcher, Sep 2012 – Sep 2015

**California Institute of Technology**  
· Postdoctoral researcher, Sep 2009 – Aug 2012  
· Prize Fellowship

**Harvard University**  
· Postdoctoral researcher, Sep 2008 – Aug 2009  
· supported by a SNF fellowship

EDUCATION **ETH Zürich**, Zürich, Switzerland  
Ph.D., 2006–2008  
· Thesis: Conformal Aspects of String Theory  
· Advisor: Professor Matthias R. Gaberdiel  
M.Sc., 2001–2006

GRANTS Research Project ‘Conformal Field Theories in Holography and String Theory’  
· NSF, 2021-24, USD 225,000  
Collaboration Grant for Mathematicians  
· Simons Foundation, 2019–2024, USD 42,000  
Research Project ‘Conformal Field Theory, Holography and Vertex Operator Algebras’  
· Swiss National Science Foundation, 2017–2021, USD 240,000

TEACHING Courses:  
· Spring 2023: Theory of Statistics  
· Fall 2022, Spring 2023: Theory of Probability  
· Spring 2022: Introduction to Abstract Algebra, Part B  
· Fall 2021: Introduction to Abstract Algebra, Part A  
· Fall 2020, Spring 2021: Mathematical Analysis for Engineers  
· Spring 2020: Cryptography  
· Fall 2019: Introduction to Mathematical Physics  
· Spring 2019: Linear Algebra  
· Fall 2018: Mathematical Analysis for Engineers  
· Summer 2018: Monstrous and Other Moonshine

- Spring 2018: Calculus II
- Fall 2017: Introduction to Vertex Operator Algebras
- Spring 2017: Introduction to String Theory
- Fall 2016: Mathematical Methods of Physics I
- Spring 2016: Introduction to String Theory
- Fall 2015: Monstrous Moonshine

Schools and Lecture Series:

- Holographic Conformal Field Theories in Two Dimensions, KIAS, May 2019
- Lectures on Mathieu Moonshine: Winter School in Mathematical Physics, Les Diablerets, January 2016

#### PHD STUDENTS

- Thomas Gemünden, *Non-Abelian Orbifolds and Twisted Modules of Vertex Operator Algebras*, 2020. (Jointly with G. Felder.)
- Jason Quinones, *Mathematical Aspects of Field Theory: Nahm's Equations and Weak Jacobi Forms*, 2020. (Jointly with S. Cherkis.)
- Jeremy Roberts, in progress.

In addition I have supervised numerous Master and Bachelor theses in physics and mathematics.

#### PROFESSIONAL ACTIVITIES

Referee for: Journal of High Energy Physics, Journal of Physics A: Mathematical and Theoretical, Nuclear Physics B, Communications in Mathematical Physics, International Journal of Mathematics, Letters in Mathematical Physics, National Science Foundation, SciPost, Journal of the Physical Society of Japan.

Member of Academic Committee of the International Physics Olympiad 2016 in Zurich

#### INVITED SEMINARS AND CONFERENCE TALKS

##### **Holography, Symmetric Orbifolds and Moduli Spaces**

- McGill University, Montréal, June 2022

##### **Extremal CFTs and Lattice Orbifolds**

- Caltech, Pasadena, December 2021

##### **Three Applications of Conformal Perturbation Theory**

- ‘Workshop on Quantum Fields & Strings’, Seoul National University, Seoul, July 2021

##### **Holographic Families of VOAs**

- Rocky Mountain Representation Theory seminar, Boulder, February 2021

##### **Holographic Orbifold CFTs in Two Dimensions**

- UC Davis, May 2020

##### **Fun with Modular Forms: Moonshine and Black Holes**

- KSU, Manhattan, October 2019

##### **Holographic Conformal Field Theories in Two Dimensions**

- KIAS, Seoul, May 2019
- ASU, Phoenix, February 2019

##### **Holographic Orbifold CFTs**

- Plenary speaker, String-Math 2018, Sendai, June 2018
- Caltech, Pasadena, May 2018

### **Conformal Field Theories and the Entropy of Black Holes**

- Lehigh University, Bethlehem, May 2018

### **Phase transitions in large $c$ CFTs**

- University of Geneva, Geneva, November 2017
- EPFL, Lausanne, November 2017

### **Symmetric Orbifolds, Siegel Modular Forms, and their Spectrum**

- *Automorphic Forms, Mock Modular Forms and String Theory*, Banff, November 2017

### **VOAs with sparse light spectrum**

- *7th Seminar on Conformal Field Theory*, Erlangen, July 2017

### **Genus Two Partition Functions and Renyi Entropies of Large $c$ CFTs**

- SISSA, Trieste, May 2017

### **The large $N$ limit of permutation orbifolds**

- *Classical and quantum aspects of the AdS3/CFT2 correspondence*, GGI, Florence, May 2017

### **Mathieu Moonshine and Symmetry Surfing**

- TU Wien, Vienna, April 2017
- ENS, Paris, April 2017
- CMSA, Harvard University, Cambridge, February 2017
- DESY, Hamburg, January 2017
- CERN, Geneva, November 2016
- University of Amsterdam, Amsterdam, October 2016
- Trinity College, Dublin, October 2016
- *Automorphic forms, mock modular forms and string theory*, SCGP, Stony Brook, August 2016

### **Cauchy conformal fields in $d > 2$**

- LMU, München, May 2016
- MIT, Cambridge, February 2016
- *GeNeZiSS*, Bern, November 2015

### **The large $N$ limit of permutation orbifolds**

- *New Moonshines, Mock Modular Forms and String Theory*, Durham, August 2015

### **Holography and the conformal bootstrap**

- Durham University, Durham, May 2015

### **2d holographic CFTs and permutation orbifolds**

- Princeton University, Princeton, April 2015

### **Modular invariance and holographic CFTs**

- *(Mock) Modularity, Moonshine and String Theory*, Perimeter Institute, Waterloo, April 2015

### **Conformal Field Theory: Tools and Applications**

- ETH Zürich, Zürich, April 2015

### **Universal Spectrum of 2d Conformal Field Theory in the Large $c$ Limit**

- McGill University, Montreal, March 2015

### **Holographic CFTs and Permutation Orbifolds**

- Johns Hopkins University, Baltimore, February 2015

### **String Universality for Permutation Orbifolds**

- *Bootstrap 2015*, Weizman Institute, May 2015
- City College of New York, New York, February 2015

### **3d Gravity, Universality and Poincaré Series**

- University of Michigan, Ann Arbor, November 2014
- Harvard University, Cambridge, October 2014
- Boston University, Boston, October 2014
- Yale University, New Haven, October 2014
- Stanford University, Stanford, October 2014
- Perimeter Institute, Waterloo, September 2014
- Brandeis University, Waltham, September 2014

### **Non-rational VOAs and modular invariant partition functions**

- Department of Mathematics, Rutgers University, Piscataway, September 2014

### **Conformal Field Theory: Tools and Applications**

- Durham University, Durham, July 2014

### **Poincare Sums, the Spectrum of 2d CFTs and 3d Gravity**

- *Back to the Bootstrap IV*, Porto University, Porto, July 2014

### **Partition functions and Poincare series**

- *Southeastern String Meeting*, Duke University, Durham, April 2014

### **Constraints on 2d CFT partition functions**

- Caltech, Pasadena, February 2014
- CERN, Geneva, December 2013
- King's College, London, September 2013
- University of Hertfordshire, Hatfield, September 2013
- *19th European Workshop on String Theory*, Bern, September 2013
- *String-Math 2013*, SCGP, Stony Brook, June 2013

### **Conformal Field Theories, Modular Forms and Geometry**

- Harvard University, Cambridge, November 2013
- University of Alberta, Edmonton, February 2013

### **Modular Constraints on Calabi-Yau Compactifications**

- Harvard University, Cambridge, February 2013
- YITP, Stony Brook, January 2013
- Institute for Advanced Study, Princeton, November 2012
- Chalmers University, Gothenburg, September 2012

### **The ABCDEFG of instantons and W-algebras**

- UCLA, Los Angeles, May 2012
- King's College, London, January 2012
- Porto University, Porto, January 2012
- CERN, Geneva, January 2012

- Utrecht University, Utrecht, December 2011

### **Crossing Symmetry, $g=2$ , AGT, and all that**

- *Workshop on Holography and Universality of Black Holes*, McGill University, Montreal, September 2011

### **From SO/Sp instantons to W-algebra blocks**

- LMU Munich, July 2011
- *UNIFY Workshop on Frontiers in Theoretical Physics*, Porto, June 2011
- ETH Zurich, Zurich, January 2011

### **The AdS<sub>3</sub>/CFT<sub>2</sub> correspondence, modularity and extremal CFTs**

- *Southern California Strings Seminar*, Los Angeles, October 2010

### **Siegel modular forms and CFT partition functions at genus two**

- *Workshop on Topological String Theory, Modularity and non-perturbative Physics*, Erwin Schrödinger Institut, Vienna, July 2010

### **Phase transitions in large N symmetric orbifold CFTs**

- University of Milano-Bicocca, December 2009
- *Workshop on Holography and Universality of Black Holes*, McGill University, Montreal, November 2009
- *15th European Workshop on String Theory*, Zurich, September 2009

### **Conformal field theories, modular forms, and differential operators**

- University of Alberta, Edmonton, March 2009

### **Pure gravity, extremal CFTs and constraints from modularity**

- McGill University Montreal, February 2009
- ENS Paris, January 2009
- LMU München, January 2009
- Brown University, November 2008

### **CFT and modular differential operators for weak Jacobi forms**

- *BIRS workshop on Number Theory and Physics at the Crossroads*, Banff, September 2008

### **Dual CFTs to pure gravity on AdS<sub>3</sub>**

- AEI Potsdam-Golm, July 2008

### **Brane dynamics and RG flows on the worldsheet**

- Les Houches summer school, student seminar, July 2007

### **Brane backreactions and the Fischler-Susskind mechanism**

- *11th Annual UK meeting on Integrable Models, Conformal Field Theory and Related Topics*, London, May 2007

### **Bulk induced boundary perturbations**

- Workgroup talk, RTN Winter School, CERN, January 2007

POPULAR TALKS

**Symmetrien in der Mathematik und Physik**

- Inaugural lecture, ETH Zurich, March 2015

**Quantum Gravity in 3d**

- Junior-Senior Honors Seminar on Mathematical Aspects of General Relativity, Rutgers, May 2014

**What is string theory?**

- Swiss Scientific Olympiads Day, Bern, February 2007

REFERENCES

Professor Hirosi Ooguri  
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REFERENCES  
(TEACHING)

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