

# Alec Kirkley

alec.w.kirkley@gmail.com

<https://aleckirkley.com/>

## EDUCATION    **University of Michigan**, Ann Arbor, Michigan, USA

Physics PhD Candidate

Sep 2017 –

- Studying complex systems and network theory
- Advisor: Mark Newman

## **University of Rochester**, Rochester, New York, USA

BS Physics, BA Mathematics

May 2017

- Summa Cum Laude, Phi Beta Kappa, Highest distinction in Physics and Mathematics

## WORKING PAPERS

- **Kirkley, Alec**, Cantwell, G. T. & Newman, M. E. J. Probabilistic models on networks with loops
- Cantwell, G. T., **Kirkley, Alec** & Newman, M. E. J. The friendship paradox and network structure
- Li, G., **Kirkley, Alec**, Krofcheck, D. & Klein, B. Entropy in mountainous river networks

## UNDER REVIEW

- **Kirkley, Alec**. Information theoretic network approach to socioeconomic correlations
- Aguilar, J. *et al.* Impact of urban structure on covid-19 spread. *arXiv:2007.15367*
- Klishin, A., **Kirkley, Alec**, Singer, D. J. & van Anders, G. Robust design in systems physics. *arXiv:1805.02691*

## PEER REVIEWED PUBLICATIONS

- Feng, S. & **Kirkley, Alec**. Mixing patterns in interdisciplinary co-authorship networks at multiple scales. *Scientific Reports* **10**, 1–11 (2020)
- **Kirkley, Alec**, Cantwell, G. T. & Newman, M. E. J. Balance in signed networks. *Physical Review E* **99**, 012320 (2019)
- **Kirkley, Alec**, Barbosa, H., Barthelemy, M. & Ghoshal, G. From the betweenness centrality in street networks to structural invariants in random planar graphs. *Nature Communications* **9**, 2501 (2018)

## **GRANTS & AWARDS**

National Defense Science and Engineering Graduate (NDSEG) Fellowship  
NSF Graduate Research Fellowship (awarded, but declined)  
UM Rackham Research Grant  
UM Rackham Travel Grant  
UM Rackham Professional Development Grant  
Elected Phi Beta Kappa junior year at University of Rochester  
University of Rochester Physics Honors Prize for top undergraduate after first two years

## **OUTSIDE PROJECTS**

### **Detroit Data For Transportation UM Collaboration**

- Utilized methods in network science and spatial statistics to determine at which regions and times of day electric scooters are being ridden dangerously in Detroit, and whether or not geofencing these regions was worthwhile
- Communicated results regularly with city of Detroit to impact local policy

### **Michigan Data Science Team**

- Utilized time series models to predict future development indicator data for the United Nations Development Goals Challenge. Placed 18th out of 2000+ competitors by the challenge deadline.
- Led project implementing Natural Language Processing models (LSTM Network, N-gram model) to predict drug ratings given customer reviews for the Drugs.com drug review dataset.

### **Course Projects**

- Data Science II (Complexity): Formulated model for optimal routing through city street networks given spatial covariates, and implemented method in Chicago street networks for routing children to and from schools to avoid violent crime.
- Mining of Large Scale Graph Data: Tracked the evolution of community structure over time in stock correlation and international alliance networks, and found temporal correlations with major world events. Identified anomalous nodes with unusually imbalanced ego networks in terms of signed frustration.
- Statistical Physics: Discovered phase transition in metric related to routing efficiency in random planar networks.
- Statistical Inference, Estimation, and Learning: Investigated long range sign correlations induced from a novel formulation of local triadic balance in signed networks.

## **CODING EXPERIENCE**

**Languages/Frameworks:** Python, C++, Cython, Bash, Stan, Git

**Methods:** Graph algorithms, combinatorial and continuous optimization, statistical physics, bayesian inference, high performance computing, deep learning, data mining, time series analysis, geospatial analysis, natural language processing, web scraping

## PROFESSIONAL ACTIVITIES

- Workshops and schools:
  - Understanding and Exploring Network Epidemiology in the Time of Coronavirus (Net-COVID), Online through UMD COMBINE and UVM, April 2020
  - Complex Networks Winter Workshop, Quebec City, December 2019
  - Complex Systems Summer School, Santa Fe Institute, June 2019
- Conference contributions:
  - “Balance in Signed Networks” (Poster), NetSci, University of Vermont, May 2019
- Invited lectures:
  - “Statistical Physics and Social Systems”, The University of Hong Kong, January 2020
- Referee experience:
  - *Journal of Complex Networks*
  - *Humanities & Social Sciences Communications*

## RELEVANT COURSES

University of Michigan (all graduate level)

- Statistical Inference, Estimation, and Learning
- Mining of Large Scale Graph Data
- Theory of Social and Technological Networks
- Advanced Condensed Matter Physics: Statistical Field Theory and Critical Phenomena
- Statistical Physics
- Quantum Theory I and II

University of Rochester

- Network Science Analytics (graduate level)
- Data Science I: Modern Statistics (graduate level)
- Data Science II: Complexity (graduate level)
- Computational Physics
- Physics and Finance
- Partial Differential Equations and Fourier Analysis
- Real Analysis
- Abstract Algebra
- Advanced Linear Algebra
- Game Theory
- Intermediate Microeconomics
- Intermediate Macroeconomics

**TEACHING**  
**EXPERIENCE**

**PHY 508: Network Theory, Teaching Assistant**  
University of Michigan Department of Physics

**PHY 136: Mechanics, Graduate Student Instructor**  
University of Michigan Department of Physics

**PHY 121: Mechanics, Teaching Assistant**  
University of Rochester Department of Physics and Astronomy

**PHY 113: General Physics I, Teaching Assistant**  
University of Rochester Department of Physics and Astronomy

**Private Math Tutor**  
University of Rochester Mathematics Department