

# Kyle Luther

PhD candidate in Physics  
Princeton University, Princeton, NJ, 08540

✉ [kluther@princeton.edu](mailto:kluther@princeton.edu)  
🏠 [kyleluther.github.io](https://kyleluther.github.io)  
🔗 Google Scholar

## 🎓 EDUCATION

---

**Princeton University** 2016 - 2022  
PhD in Physics  
*Advisor: H. Sebastian Seung*

**University of California Berkeley** 2014 - 2016  
Bachelor of Arts in Physics  
*Highest Distinction in General Scholarship*

**Folsom Lake Community College** 2012 - 2014  
Associate Degree

## 🏛️ RESEARCH

---

**Graduate Researcher in Seung Lab at Princeton** 2017-present  
*Group led by H. Sebastian Seung*

**Unsupervised learning** Analyzed brain-inspired models of unsupervised learning (*sparse coding, correlation game*). Devised and implemented novel brain-inspired models of unsupervised learning (*kernel similarity matching, invariant subspace features*).

**Manifold learning** Devised and implemented a novel manifold learning algorithm posed as a two player game (*embedding game*).

**Initialization of deep networks** Analyzed the impact of Batch Normalization on deep network initialization and devised a novel initialization scheme inspired by the analysis.

**3D image segmentation** Performed automated neuron segmentation with convolutional networks in 3D images. Created software for data augmentation of 3D images (*augmentem*).

**Undergraduate Researcher in Perlmutter Lab at UC Berkeley** 2014-2016  
*Group led by Saul Perlmutter*

**Star-finder software** Created software to find recently exploded supernovae in satellite images. The key component of this software relied on a random forest classifier applied to hand-crafted features inside image patches.

**Undergraduate Researcher in Fortney Lab at UC Santa Cruz** summer 2014  
*Group led by Johnathan Fortney*

**Radiative transfer software** Optimized code used to calculate radiative transfer through exoplanetary atmospheres. Optimization performed by transcribing key components of python code into C.

## 📖 PUBLICATIONS

---

### Preprints

**Sensitivity of sparse codes to image distortions**  
*arXiv (accepted and to appear in Neural Computation), 2022*  
**K Luther**, HS Seung

**Kernel similarity matching with Hebbian neural networks**  
*arXiv, 2022*  
**K Luther**, H. Sebastian Seung

**3D reconstruction of cell nuclei in a full Drosophila brain**  
*bioRxiv, 2021*

S Mu, S Yu, NL Turner, CE McKellar, S Dorkenwald, F Collman, S Koolman, M Moore, S Morejohn, B Silverman, K Willie, R Willie, D Bland, A Burke, Z Ashwood, **K Luther**, M Castro, O Ogedengbe, W Silversmith, J Wu, A Halageri, T Macrina, N Kemnitz, M Murthy, HS Seung

### Journal & Conference Publications

### **Learning and segmenting dense voxel embeddings for 3D neuron reconstruction**

*IEEE Transactions on Medical Imaging, 2021*

K Lee, R Lu, **K Luther**, HS Seung

### **Reexamining the principle of mean-variance preservation for neural network initialization**

*Physical Review Research, 2020*

**K Luther**, HS Seung

### **Unsupervised learning by a softened correlation game: duality and convergence**

*53<sup>rd</sup> Asilomar Conference on Signals, Systems, and Computers, 2019*

**K Luther**, R Yang, HS Seung

### **Learning metric graphs for neuron segmentation in electron microscopy images**

*16th IEEE ISBI Conference, 2019*

**K Luther**, HS Seung

### **The discovery of a gravitationally lensed supernova Ia at redshift 2.22**

*The Astrophysical Journal, 2018*

D Rubin, B Hayden, X Huang, G Aldering, R Amanullah, K Barbary, K Boone, M Brodwin, SE Deustua, S Dixon, P Eisenhardt, AS Fruchter, AH Gonzalez, A Goobar, RR Gupta, I Hook, MJ Jee, AG Kim, M Kowalski, CE Lidman, E Linder, **K Luther**, J Nordin, R Pain, S Perlmutter, Z Raha, M Rigault, P Ruiz-Lapuente, CM Saunders, C Sofiatti, AL Spadafora, SA Stanford, D Stern, N Suzuki, SC Williams

### **Characterizing transiting exoplanet atmospheres with JWST**

*The Astrophysical Journal, 2016*

TP Green, MR Line, C Montero, JJ Fortney, J Lustig-Yaeger, **K Luther**



## **TEACHING**

---

### **Neural Networks: Theory and Applications (COS 485)**

*Assistant in Instruction, Spring 2018, 2019*