Seppe Kuehn, Ph.D.

Curriculum Vitae

Department of Ecology and Evolution
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CURRENT POSITION

Assistant Professor	Department of Ecology and Evolution	University of Chicago	7/2020 - present
Core Member	Center for the Physics of Evolving Systems	University of Chicago	7/2020 - present
Member	Institute for Biophysical Dynamics	University of Chicago	8/2021 - present

EDUCATION & POSITIONS

Assistant Professor	Department of Physics	U. of Illinois at Urbana-Champaign	2016 - 2020
Res. Assist. Prof.	Department of Physics	U. of Illinois at Urbana-Champaign	2014 - 2016
Post Doctoral	Physics & Biology	The Rockefeller University (with S. Leibler)	2007 - 2013
Ph.D.	Chemical Physics	Cornell University (with J. Marohn)	2007
B.S. Magna Cum Laude	Physics	Beloit College	2000

PUBLICATIONS

1. "Genomic patterns in the global soil microbiome emerge from microbial interactions." Kyle Crocker, Milena Chakraverti-Wuerthwein, Zeqian Li, Madhav Mani, Karna Gowda, **Seppe Kuehn** (Submitted, 2023) bioRxiv: https://doi.org/10.1101/2023.05.31.542950

2. "Environmental modulators of algae-bacteria interactions at scale" Chandana Gopalakrishnappa, Zeqian Li, and **Seppe Kuehn**. (In review, *Cell Systems*, 2023) bioRxiv: https://doi.org/10.1101/2023.03.23.534036

3. "Learning the functional landscape of microbial communities" Abby Skwara, Karna Gowda, Mahmoud Yousef, Juan Diaz-Colunga, Alvaro Sanches, Mikhail Tikhonov, and **Seppe Kuehn**. (In review *Nature Ecology & Evolution*, 2023) bioRxiv: https://doi.org/10.1101/2023.03.24.534159

4. "Algae drive convergent bacterial community assembly when nutrients are scarce." Kaumudi Prabhakara and **Seppe Kuehn**. *bioRxiv* https://doi.org/10.1101/2022.06.27.497809 (In press, *iScience*) (2023).

5. "The community-function landscape of microbial consortia." Alvaro Sanchez, Djordje Bajic, Juan Diaz-Colunga, Abigail Skwara, Jean Vila, and **Seppe Kuehn**. (invited review) *Cell Systems* 14 122 (2023).

6. "Genomic structure predicts metabolite dynamics in microbial communities." Karna Gowda, Derek Ping, Madhav Mani and **Seppe Kuehn**. *Cell*. **185** 530-546. (2022).

7. "An ensemble approach to the structure-function problem in microbial communities." Chandana Gopalakrishnappa, Karna Gowda, Kaumudi Prabhakara and **Seppe Kuehn**. (Invited review) *iScience* **23** 11 01678 (2022).

8. "Closed microbial communities self-organize to persistently cycle carbon." Luis Miguel de Jesus Astacio, Kaumudi Prabhakara, Zeqian Li, Harry Mickalide and **Seppe Kuehn**. *PNAS* **118** 45 e2013564118 (2021).

9. "Higher-order interaction inhibits bacterial invasion of a phototroph-predator microbial community." Harry Mickalide, **Seppe Kuehn**. *Cell Systems*. (2019) 9, 6, 521-533.e10 (2019).

10. "Evolution of generalists by phenotypic plasticity." David T. Fraebel, Karna Gowda, Madhav Mani and **Seppe Kuehn**. *iScience* **23** 11 01678 (2020).

11. "Hitchhiking, collapse and contingency in phage infections of migrating bacterial populations." Derek Ping, Tong Wang, David T. Fraebel, Sergei Maslov, Kim Sneppen, **Seppe Kuehn**. *The ISME Journal* 14, 2007–2018 (2020).

12. "Massively parallel screening of synthetic microbial communities." Jared Kehe, Anthony Kulesa, Anthony Ortiz, Cheri M Ackerman, Sri Gowtham Thakku, Daniel Sellers, **Seppe Kuehn**, Jeff Gore, Jonathan Friedman, Paul C Blainey. *PNAS* 116, 26. 12804-12809. (2019)

13. "Frequency- and amplitude-dependent microbial population dynamics during cycles of feast and famine." Jason Merritt and **Seppe Kuehn**. *Physical Review Letters*. 121, 098101. (2018).

14. "Biophysical constraints determine the selection of chemotaxis phenotypes during directed evolution." Hongyan Shih, Harry Mickalide, David T. Fraebel, Nigel Goldenfeld and **Seppe Kuehn**. *Physical Biology* 15 (6) 2018.

15. "Environment determines evolutionary trajectory in a constrained phenotypic space." David T. Fraebel, Harry Mickalide, Diane Schnitkey, Jason Merritt, Thomas Kuhlman and **Seppe Kuehn**. *eLife*. (2017);10.7554/eLife.24669. Featured in Scientific American, NSF News from the field and `www.phys.org`.

16. "Dynamic structure of locomotor behavior in walking fruit flies." Alexander Y. Katsov, Limor Freifield, Mark Horowitz, **Seppe Kuehn** and Thomas R. Clandinin. *eLife* (2017); 10.7554/eLife.26410.

17. "Quantitative high-throughput population dynamics in continuous-culture by automated microscopy." Jason Merritt and **Seppe Kuehn**. *Scientific Reports* 6:331737, (2016).

18. "Strongly deterministic population dynamics in closed microbial communities." Zak Frentz*, **Seppe Kuehn*** and Stanislas Leibler. *Physical Review X* **5**, 041014 (2015). Featured in *Physics*. (co-first author)

19. "Behavioral diversity in microbes and low dimensional phenotypic spaces." David Jordan*, **Seppe Kuehn***, Eleni Ketifori and Stanislas Leibler. *PNAS* 110 (34) 14018-14023 (2013). (co-first author)

20. "Microbial population dynamics by digital in-line holographic microscopy." Zak Frentz*, **Seppe Kuehn***, Doeke Hekstra, and Stanislas Leibler, *Review of Scientific Instruments* 81, 084301 (2010). (co-first author)

Papers from Ph.D.

1. "Quantifying Electric Field Gradient Fluctuations over Polymers Using Ultrasensitive Cantilevers." Showkat M. Yazdanian, Nikolas Hoepker, **Seppe Kuehn**, Roger F. Loring and John A. Marohn. *Nano Letters*, 9 (6) 22732279 (2009). 44 citations.

2. "Advances in Mechanical Detection of Magnetic Resonance." **Seppe Kuehn**, Steven A. Hickman, and John A. Marohn, *J. Chemical Physics* 128 (5) 052208 (2008). 104 citations.

3. "Dielectric Fluctuations and the Origins of Noncontact Friction." **Seppe Kuehn**, Roger F. Loring, and John A. Marohn, *Physical Review Letters* **96**, 156103 (2006). Featured in Physics Today, Physik Journal and Physics News Update. 125 citations.

4. "Noncontact Dielectric Friction." **Seppe Kuehn**, John A. Marohn, and Roger F. Loring, *J. Physical Chemistry B Letters* **110** (30) 14525-14528 (2006). 46 citations.

5. "Force-gradient detected nuclear magnetic resonance." Sean R. Garner, **Seppe Kuehn**, Jahan M. Dawlaty, Neil E. Jenkins, and John A. Marohn, *Applied Physics Letters* **84**, 5091 (2004). 77 citations.

6. "Batch fabrication and characterization of ultrasensitive cantilevers." Neil E. Jenkins, Lauren P. DeFlores, Jack Allen, Tse Nga Ng, Sean R. Garner, **Seppe Kuehn**, Jahan M. Dawlaty and John A. Marohn, *J. Vacuum and Science Technology B* **22**, 909 (2004). 75 citations.

7. "The direct production of CO(v=1-9) in the reaction of O(^{3}P)with the ethyl radical." Jonathan P. Reid.,Timothy P. Marcy, **Seppe Kuehn**, and Stephen R. Leone. *J. Chemical Physics* **113** (11) 4572-4580 (2000) 25 citations.

HONORS and AWARDS

Scialog Fellow	Research Corp/Moore Foundation	2014
Helen Hay Whitney Fellow	HHWF	2009
Tunis Wentink Award. Outstanding Ph.D. thesis.	Cornell University	2007
Wachter Prize for excellence in Physical Chemistry	Cornell University	2005
Phi Beta Kappa	Beloit College	2000

PROFESSIONAL SERVICE & SELECTED INVITED TALKS

- 3/2023 Invited speaker. American Physical Society March Meeting. Las Vegas.
- 1/2023 Invited speaker. Princeton Center for Theoretical Science workshop on Microbial Communities.
- 5/2022 Invited speaker. Max Planck Institute for Evolutionary Biology. Workshop on Microbial Communities.
- 2/2022 Invited speaker. qBio/Department of Physics. The University of California San Diego.
- 8/2021 Co-organizer. Program on Ecology and Evolution of Microbial Communities. Kavli Institute for Theoretical Physics, University of California Santa Barbara.
- 3/2021 Invited speaker. Department of Physiccs. The University of Florida.
- 11/2020 Student invited colloquium. Center for the Physics of Biological Function. Princeton University.
- 6/2020. Invited talk. Max Planck Institute for Evolutionary Biology.
- 8/2019 Participant. Workshop Out of Equilibrium Processes in Ecology and Evolution. Oaxaca Casa de Matematica. Banff International Research Station.
- 3/2019 Invited Speaker. Quantitative Biology Seminar. TU Delft.
- 12/2018 Invited Speaker. Colloquium. Department of Ecology and Evolution, University of Chicago.
- 3/2018 Invited speaker. March Meeting of the American Physical Society. Los Angeles, CA.
- 3/2018 Invited instructor. Evolution of diversity. Les Houches School of Physics.
- 7/2017 Participant. Kavli Institute for Theoretical Physics (KITP). Program in Ecology and Evolution. University of California at Santa Barbara.
- 1/2016. Widely Applied Math Seminar. School of Engineering and Applied Sciences. Harvard University.
- 10/2015. Working group: Information theory, ecosystems and Schrodinger's paradox. Santa Fe Institute.