

NSF Institute for Data-Driven Dynamical Design (ID4)

Institute: Data-intensive Science and Engineering

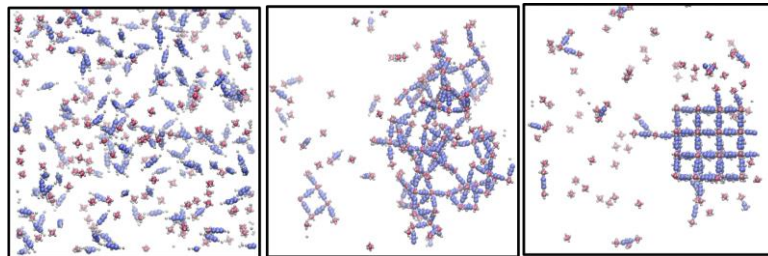
Eric Toberer
Director of ID4
Professor of Physics
Colorado School of Mines

ID4 develops new **use-inspired** machine learning solutions for addressing outstanding challenges in **materials and structures for energy and sustainability**.

Cross-cutting these challenges is a need to **efficiently** understand, predict, and control the **collective dynamics** of complex systems in high dimensions.



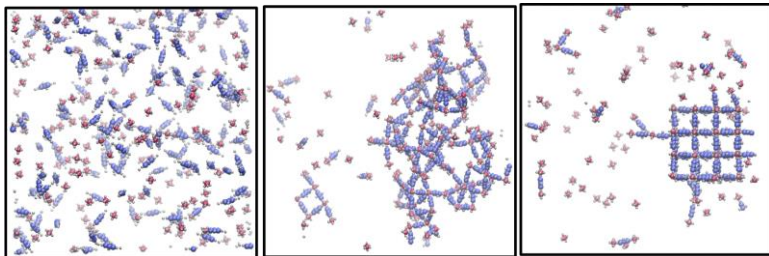
Jane Greenberg Steven Lopez



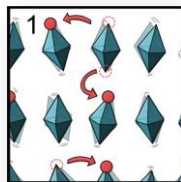
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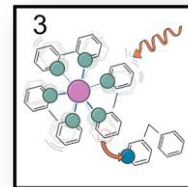
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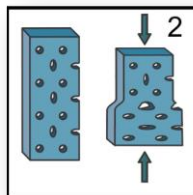
Ion transport



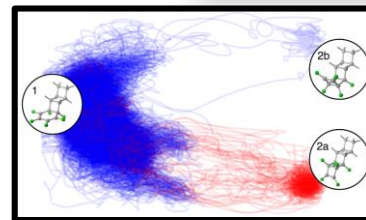
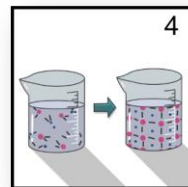
Excited quantum states



Dynamical metamaterials

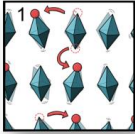


Chemical nucleation

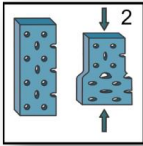


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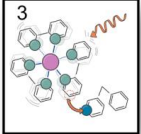
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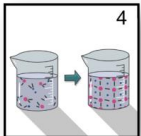
Dynamical metamaterials



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Team strengths:

- Simulation
- Experimental validation
- Autodifferentiation
- Search
- Human-machine interactions
- Visualization
- Metadata and knowledge extraction + representations
- Github repos

The interesting part: **What challenges do we need help on?!**

- Easy access to flexible, cohesive training at intersection of science/data science
- New algorithms for dynamical systems, dimensional reduction
- Rich systems with so many analysis opportunities
- Automated/accelerated experiment
- Hiring
- Code development, use, and dissemination
- Long tail of data generation; associated metadata
- FAIR
- Data waste, missing data
- Connecting REU students across the nation!!!