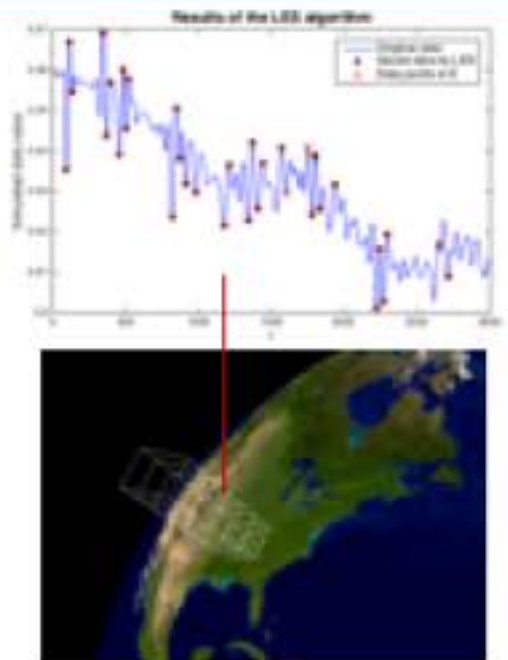


FASTMath Team Members: R. Archibald¹, F. Bao³, A. Gelb², H. Tran¹, & C. Webster^{1&4}

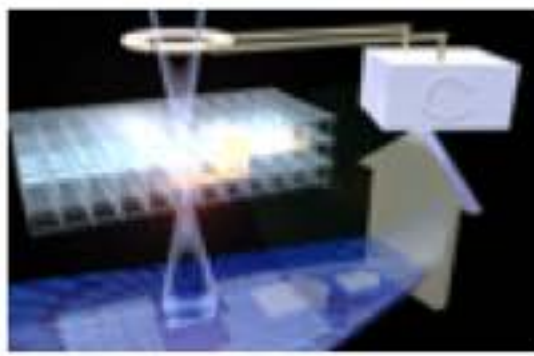
Sparse functional representation of data, to enable faster IO and analysis of big datasets

In-situ analysis of streaming climate data

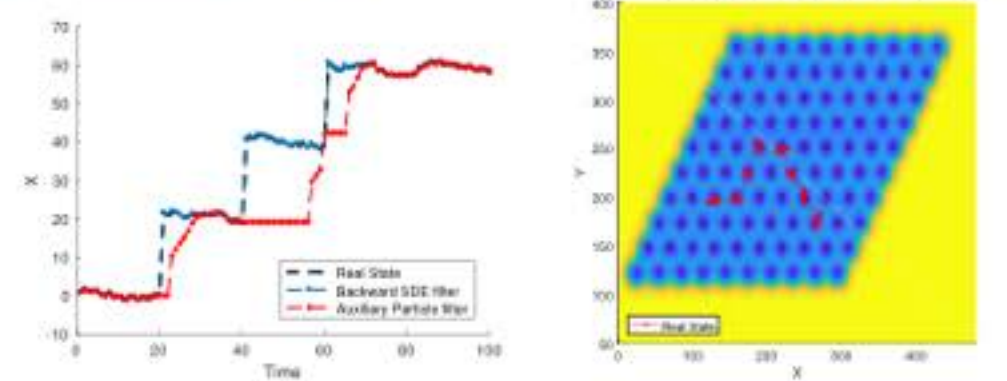
- Developing effective online data monitoring and archiving strategy over temporal and spatial domains while respecting practical storage and memory capacity constraints
- Streaming methods improves the quality and quantity of information available to scientists for analysis



Atomic Forge Analysis

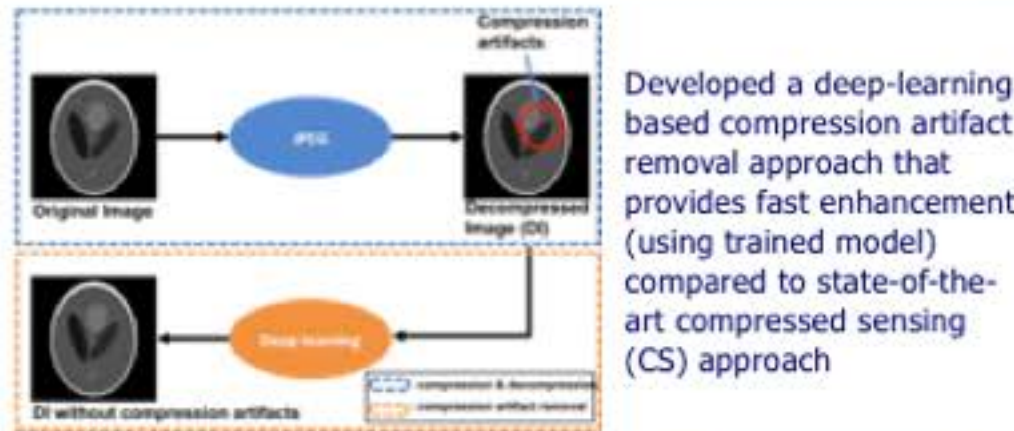


- Need fast accurate forward models for atomic states of tracked atoms.
- Need computational control of beam position and intensity.
- Will enable 3D atomic fabrication: quantum computing, spintronics, etc.

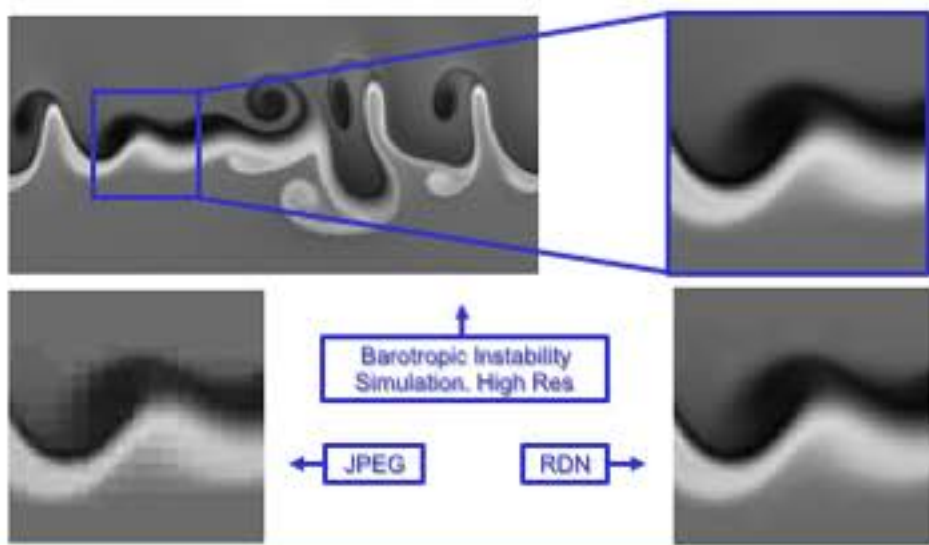


Left: Tracking of multiple well potential in 1D.
 Right: Tracking of multiple well lattice potential in 2D

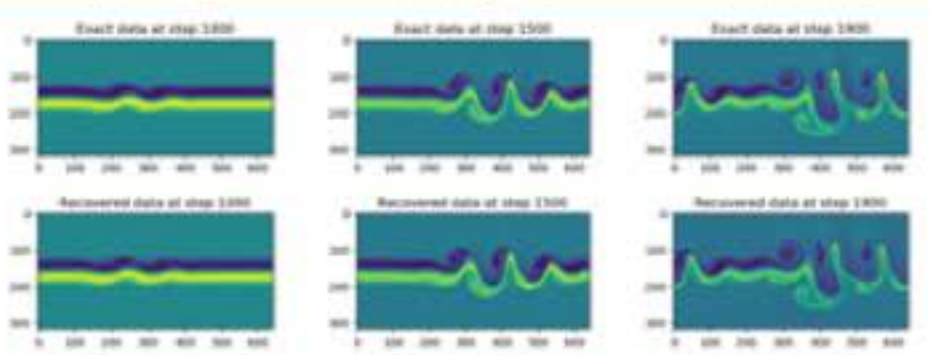
Machine Learning of Streaming Data



Developed a deep-learning based compression artifact removal approach that provides fast enhancement (using trained model) compared to state-of-the-art compressed sensing (CS) approach

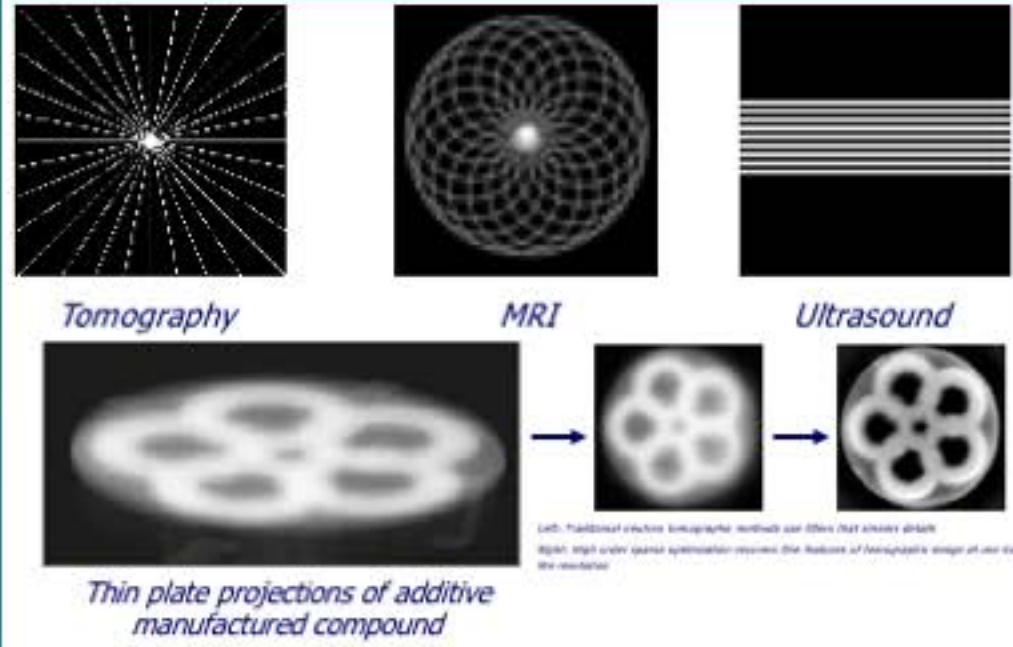


Sparse data representations



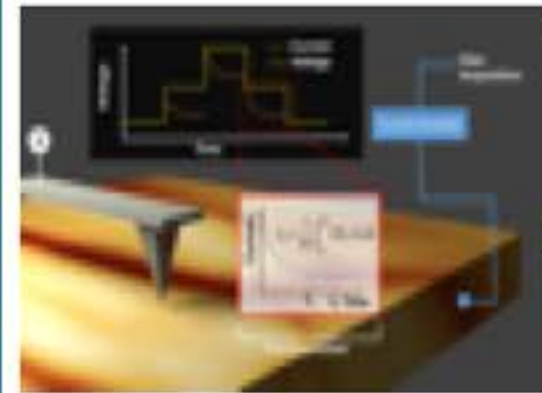
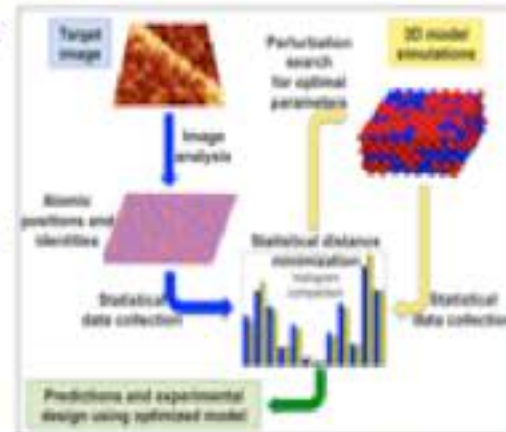
Streaming dictionary reconstruction of above barotropic instability capable of highly accurate (10^{-3} relative error) reconstruction of entire simulation using only 25 basis set.

Sampling and fast algorithms



Knowledge Extraction from Images

- Atomic resolution imaging data is readily abundant given advances in instrumentation
- No framework to extract knowledge from data
- We utilize concept of statistical distance to derive materials properties from atomic resolved data, providing a generative model exists



- Acquisition of current-voltage curves for electronic materials characterization at the nanoscale dates back decades
- We increase speed of acquisition by 1000x through full information capture + Bayesian inference methods

More Information: <http://www.fastmath-scidac.org> or contact Rick Archibald, Archibaldrk@ornl.gov