DOE Office of Science ($7B): Delivers scientific discoveries & tools to transform our understanding of nature & advance energy, economic & national security of the US
• Provides ~half of US Federal support for basic research in the physical sciences
• Supports 23,000+ researchers & staff at 300+ institutions and 10 DOE Labs
• World’s largest collection of science user facilities operated by one organization

ASCR Applied Math lays the algorithm, modeling & simulations groundwork for
• transforming DOE’s scientific computing capabilities,
• accelerating the process of scientific discovery, and
• creating AI ecosystems for science at scale

Portfolio of Major Programs (Applied Math Budget: $40M)
• Base Math projects: Linear Algebra, Optimization, PDEs, UQ, Core areas
• Math Postdoc Fellowships for DOE Lab workforce development
• Early Career Research Program for 5-year projects (universities, Labs)
• Multifaceted Mathematics for large collaborative projects & grand challenges
• Scientific Machine Learning and Artificial Intelligence: New awards (FY19, FY20)
• Algorithms for AI & Data Science at Scale: New workshop!
Purpose: Explore the use of randomness as a foundation & key strategy for high-performance scientific computing

Randomized algorithms are transforming scientific computing in

- **AI & Deep Learning**: Stochastic Gradient Descent
- **Data reduction**: Compressive Sensing, Randomized Projections
- **Massive & streaming data analysis**: Randomized Numerical Linear Algebra

Fundamental properties of randomness can be harnessed for other massive data & post-Moore **computational grand challenges**

- High computational complexity and the development of efficient algorithms
- High data dimensionality and finding sparse representations for data from user facilities
- Better algorithm scalability for low-power, high-performance **edge computing**
- Reduced ill-conditioning and sensitivity for inverse problems
- Improved algorithm reliability and robustness to noise

Foundational long-term research & plans are needed for **hybrid algorithms** that anticipate massive data & post-Moore computing challenges over the next decade

**Chair**: Tammy Kolda (Sandia)

**Co-Chairs**: Aydin Buluc (LBNL), Stefan Wild (ANL)