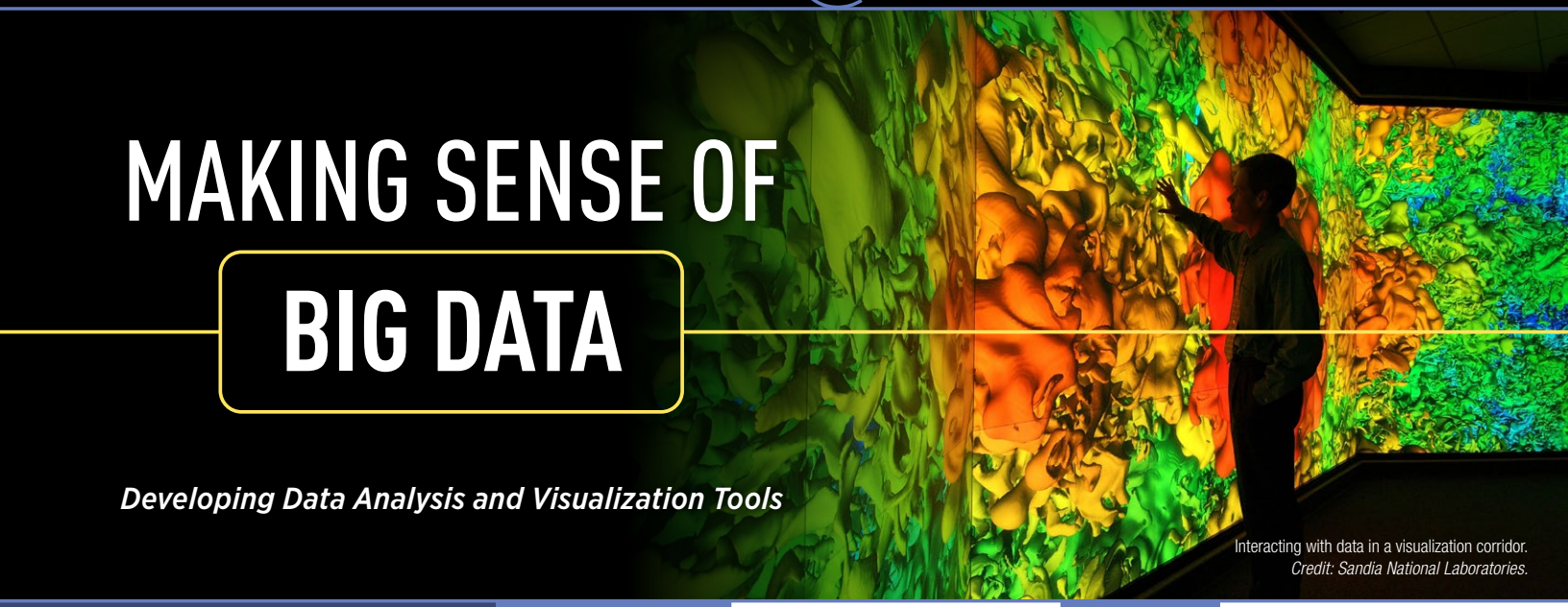
ASCR@40

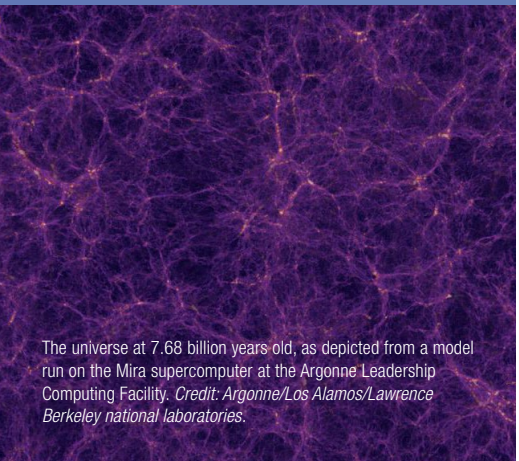
MAKING SENSE OF BIG DATA

Developing Data Analysis and Visualization Tools



Interacting with data in a visualization corridor. *Credit: Sandia National Laboratories.*

Because large computational simulations produce enormous datasets, extracting and highlighting salient information presents significant challenges. As data volumes continue to grow, researchers have needed to harness many processors and develop parallel methods to store and sift through results for timely analysis. In addition, researchers have developed functional and adaptive visualization software and hardware to help them understand and interact with simulation results. In the past two decades, the Advanced Scientific Computing Research (ASCR) program has funded state-of-the-art tools for grappling with these challenges, including the development of large-scale data analysis and visualization software and specialized display devices.



The universe at 7.68 billion years old, as depicted from a model run on the Mira supercomputer at the Argonne Leadership Computing Facility. *Credit: Argonne/Los Alamos/Lawrence Berkeley national laboratories.*

INNOVATIONS

OPEN-SOURCE SOFTWARE AND HARDWARE ADVANCES

Twenty years ago, ASCR began funding research on data analysis and visualization, leading to solutions that accelerate research in a variety of fields.

- Open-source scientific data analysis and visualization software such as ParaView and VisIt.
- Specialized display technologies, such as the Cave Automatic Virtual Environment, an immersive virtual reality space that allows scientists to interact with simulation data within a room-like area.
- Indexing technologies, such as FastBit, find important results in large data volumes. Compression methods reduce the overall footprint of scientific data. And online analysis methods eliminate data-storage-and-retrieval time.
- New workflows that analyze data as they are produced rather than archiving information for later analysis. These methods optimize DOE user-facility collaborations and allow real-time data analysis and on-the-fly experimental adaptation.

IMPACT

INSIGHTS AND ENHANCED PRODUCTIVITY

ASCR's investments in data analysis and visualization have contributed to significant scientific advances.

- Scientific insights in diverse research areas, from drug discovery to combustion to cosmology.
- Enhanced productivity on DOE's experimental user facilities.
- Scientific discovery through machine learning.

TAKEAWAY

A NEW TOOL FOR DISCOVERY

ASCR's investments in large-scale data analysis and visualization have advanced knowledge across a broad range of scientific disciplines, leading to data-driven discoveries.

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