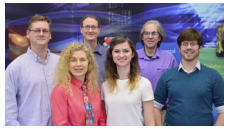
BLUE WATERS
SUSTAINED PETASCALE COMPUTING



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CINEMATIC SCIENTIFIC DATA VISUALIZATION FOR CADENS

Visualizing the first 24 hours after the collision that formed the moon, as a Mars-sized body strikes the early Earth. (To appear in *Birth of Planet Earth*.)

Research Challenge

The Advanced Visualization Lab (AVL) team's challenge for this project was to draw on data from scientists involved in high-performance computing-based research to produce and render cinema-quality visualizations for the upcoming full-dome planetarium show, *Birth of Planet Earth*. The effort is part of AVL's continuing work on the NSF-funded CADENS (Centrality of Advanced Digitally Enabled Science) project. The film will employ these visualizations to explore important questions about Earth's formation, and what that history tells us about the chances of finding other planets capable of sustaining life.

Methods & Codes

The team's work depended on several externally provided software packages: Houdini, a visual effects software package, yt for ingesting and re-gridding data, and VMD (Visual Molecular Dynamics) from John Stone at the Biophysics group at the University of Illinois Urbana-Champaign. AVL also developed its own software tools, including Ytini for yt-Houdini integration, and Bluerend to organize the rendering workflow.

Results & Impact

Blue Waters allowed the team to create a refine two data-driven cinematic animations; both will appear in the full-dome planetarium show, *Birth of Planet Earth*, to be released in 2019:

- Formation of the Moon – the first 24 hours after the collision that formed Earth's moon
- Visualizing Energy Harvesting in a Photosynthetic Purple Bacterium

A work-in-progress trailer for the film is available at https://vimeo.com/277190989

Why Blue Waters

Blue Waters allowed the team to iterate quickly and meet deadlines. Over the course of a single weekend, the group rendered a complex scene made up of six separate layers and 20,870 image frames. That ability to render this large set of images in a short period of time allowed AVL to make several iterations before finalizing a video to send to the International Planetarium Society 2018 conference in Toulouse, France.