# Resources for NCSA affiliates, FY 2020-21

First session – Aug. 20, 2020

ILLINOIS

NCSA | National Center for Supercomputing Applications

# Today's speakers*

- **Dr. Donna Cox**, Director of the Advanced Visualization Laboratory (AVL) ; lead of Research & Education (NCSA)
- **Olena Kindratenko**, Senior Education & Outreach coordinator, R&E (NCSA)
- **Alice Delage**, Senior Research Coordinator, R&E (NCSA)
- **Dan Lapine**, Technical Program Manager (NCSA)
- **Vlad Kindratenko**, Senior Research Scientist (NCSA), Adjunct Associate Professor (ECE), Research Associate Professor (CS)
- **Tim Boerner**, Assistant Director, XSEDE & Delta project offices (NSCA)






** Thank you to Senior Assistant Director of Research & Engagement Amanda Lombardo for her valuable contribution to the preparation of this session*

# Today's program

- **Introduction** - Dr. Donna Cox, donnacox@illinois.edu

R&E resources:

- NCSA Students Pushing INnovation (**SPIN**) & other Ed. programs - Olena Kindratenko, kindrat2@illinois.edu

- NCSA **Faculty Fellows program** - Alice Delage, adelage@illinois.edu

Computational resources:

- NCSA queue on the **Campus Cluster** - Dan Lapine, lapine@illinois.edu

- **HAL Cluster** for ML/DL- Vlad Kindratenko, kindrtnk@illinois.edu

- **Delta** - Tim Boerner, tboerner@illinois.edu

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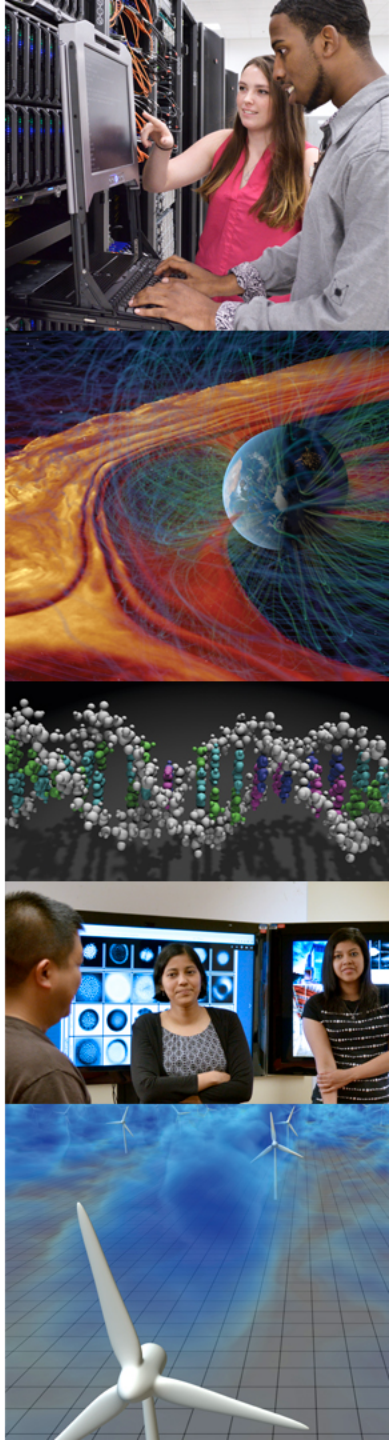
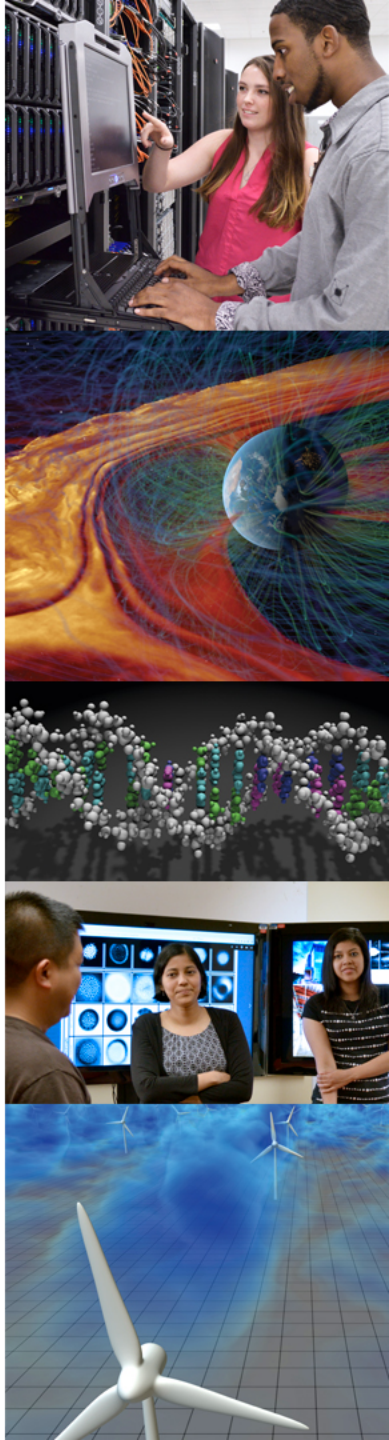


# Research & Education resources
## (a sample)



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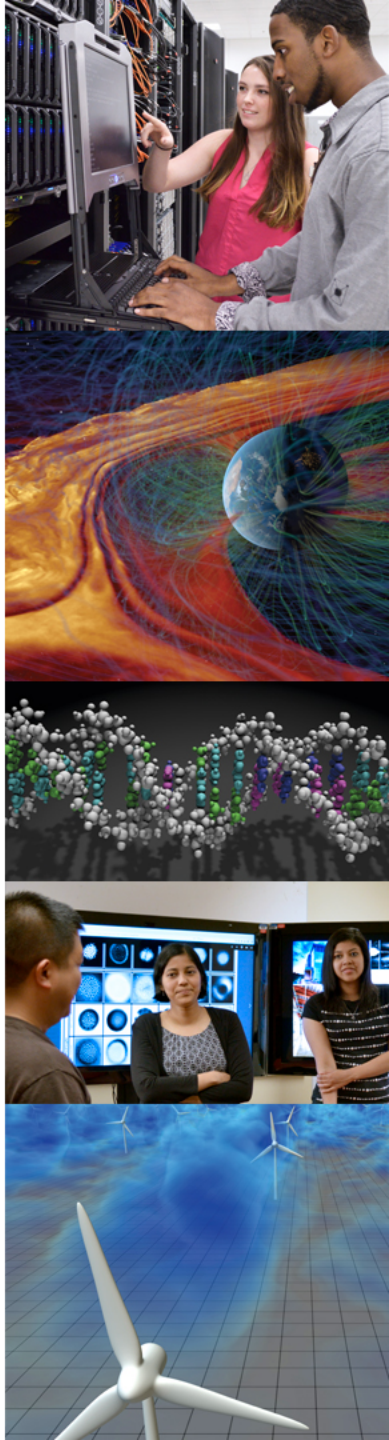
# Research & Education Introduction

NCSA's Value Added Proposition:

to engage campus units to develop strong, collaborative research teams of professors, postdocs and students that work with expert NCSA staff to advance the state-of-art in science, technology, and scholarship on campus, nationally, and internationally.



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# NCSA Administrative Support Coverage Plan

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**DIRECTOR'S OFFICE**
Office Operations **SW**

**C3.ai DTI**
Institute Operations
**SW**

**Computational Science and Engineering (CSE)**
Program Operations
**NH2**

*Also supported by NCSA Administration*

## ADMINISTRATION

- Directorate Operations **RP**
- Administrative Support Coordination Office (ACO) **RP**
- Business IT **RP**
- Business Office **RP**
- Communications **RP**
- Facilities **RP**
- Human Resources **MC**
- Project Coordination Office (PCO) **RP**

## ENGAGEMENT

- Directorate Operations **AM**
- Astronomy **DS**
  - *Dark Energy Survey (DES)*
  - *Large Synoptic Survey Telescope (LSST)*
- Center for Astrophysical Surveys (CAPS) **DS**
- Center for AI Innovation (CAII) **PJ**
- Center for Digital Agriculture (CDA) **PJ**
- Healthcare Innovation Program Office (HIPO) **LY**
- Industrial Application Domains **PJ**
- Industry Program **PJ**
- Blue Waters Project Office **SV**
- Center for Exascale-enabled Scramjet Design Project Office (CEESD) **NH2**
- Midwest Big Data Hub (MBDH) **JS**
- XSEDE Project Office **AM**
- Research and Education **DS**
  - *Advanced Visualization Laboratory (AVL)*
  - *Students Pushing INnovation (SPIN)*
  - *Relativity*
  - *Innovative Systems Laboratory (ISL)*
  - *Data Analysis & Visualization (DAV)*
  - *Faculty Programs*

## ICI

- Directorate Operations **NH1**
- Cybersecurity (CSD) **NH1**
  - *Incident Response and Security (IRST)*
  - *Cyberinfrastructure Security Research (CISR)*
- Innovative Technology Services (ITS) **NH1**
- Integrated Data and Database Services (IDDS) **NH1**
- Network Engineering and Research (NERD) **NH1**
- Scientific Computing Services (SCS) **NH1**
  - *System Administration*
- Storage Enabling Technologies (SET) **NH1**

## SOFTWARE

- Directorate Operations **LY**
- Middleware Technology Group (MTG) **LY**
- Research Software Applications and Learning Technology (ReSALT) **LY**
- Software Applications and Data Laboratory (SADL) **LY**
- Software Design Delivery and Deploy (SD3) **LY**
- Tools for Research Institutions and Infrastructure (TRI) **LY**
- Visual Analytics (VA) **LY**

## USER SERVICES

- Directorate Operations **JS**
- Advanced Application Support (AAS) **JS**
- Scientific Engineering Application Support (SEAS) **JS**
- Technology Management Group (TMG) **JS**

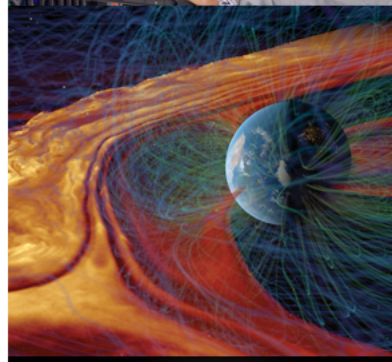
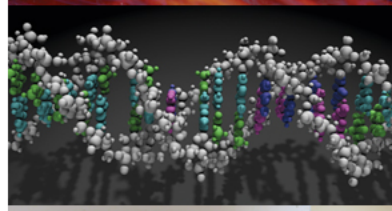
| | | | | | |
|---|---|---|---|---|---|
| **MC** | Mo Clements | **JS** | Jean Soliday | **LY** | Lisa Yanello |
| **PJ** | Pam Joop | **DS** | Deanna Spivey | **NH1** | New Hire 1 |
| **AM** | Amber Moore | **SV** | Susan Vinson | **NH2** | New Hire 2 |
| **RP** | Rachel Park | **SW** | Stacy Walker | | |

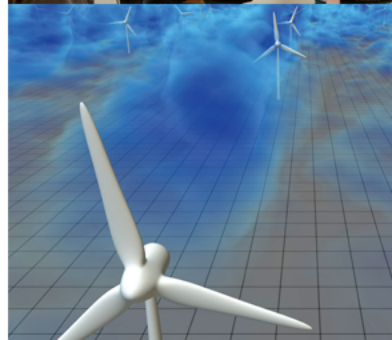
The NCSA organizational chart reflected in this plan is
1) intended to communicate the current administrative support portfolios only and
2) subject to change based on the ongoing Center-wide reorganization.

*revised 5/1/20*

*Draft version* of NCSA new org chart (May 2020)



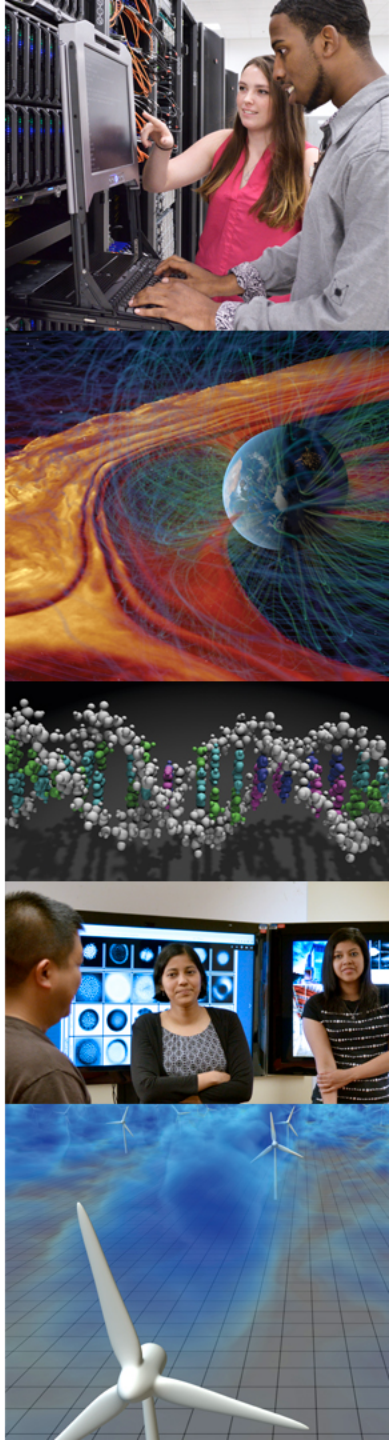


# Research & Education Introduction

## Visualization at NCSA

## Several visualization Groups at NCSA including AVL, DAV and Visual Analytics groups

## NCSA planning a Visualization Summit



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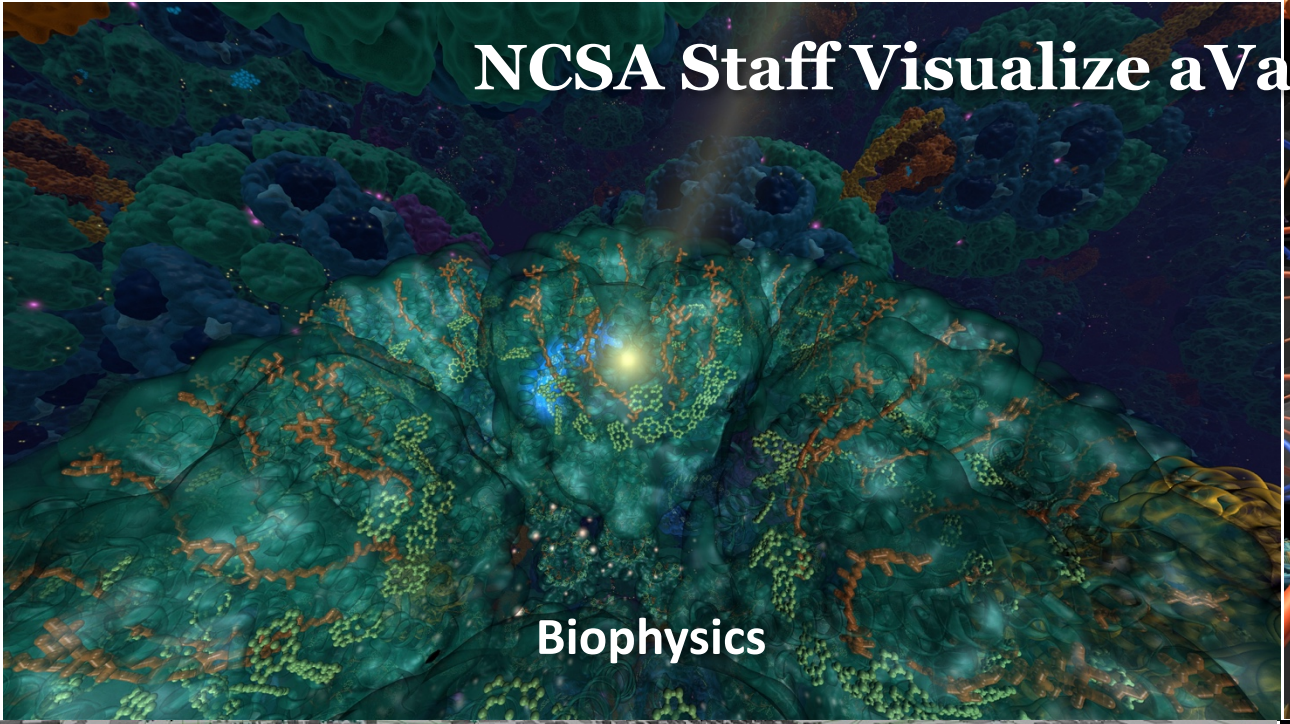
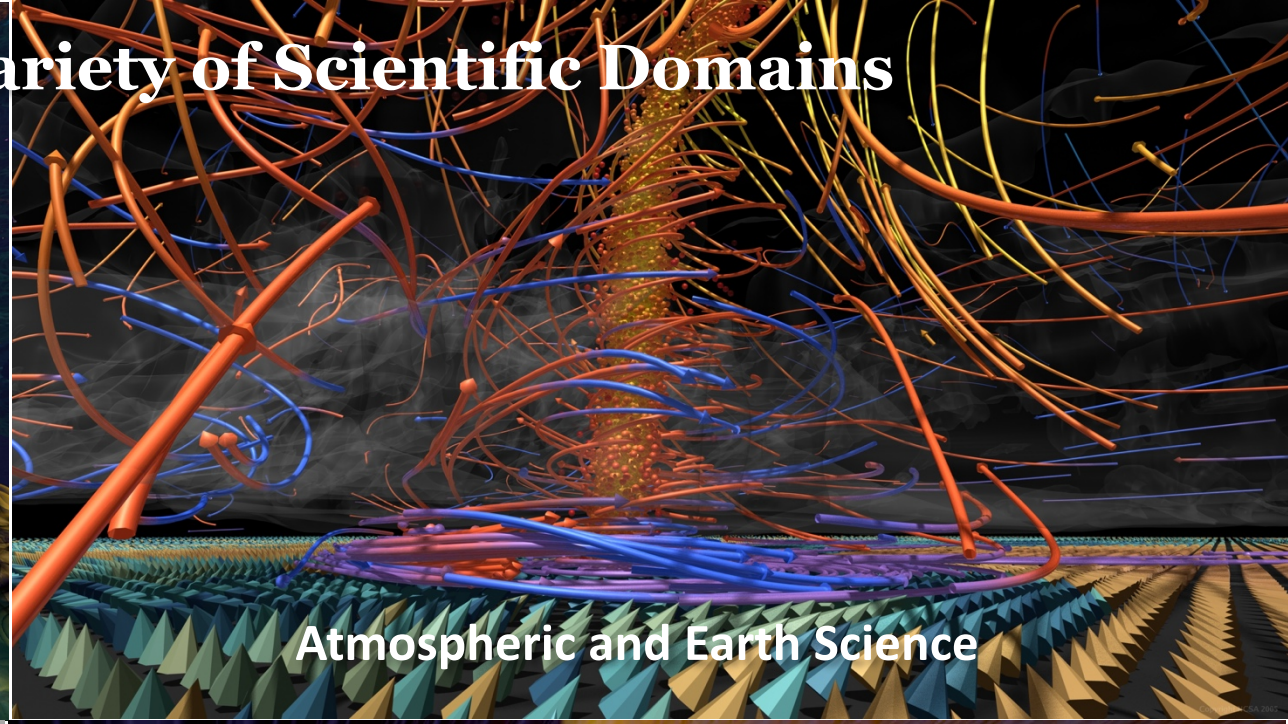
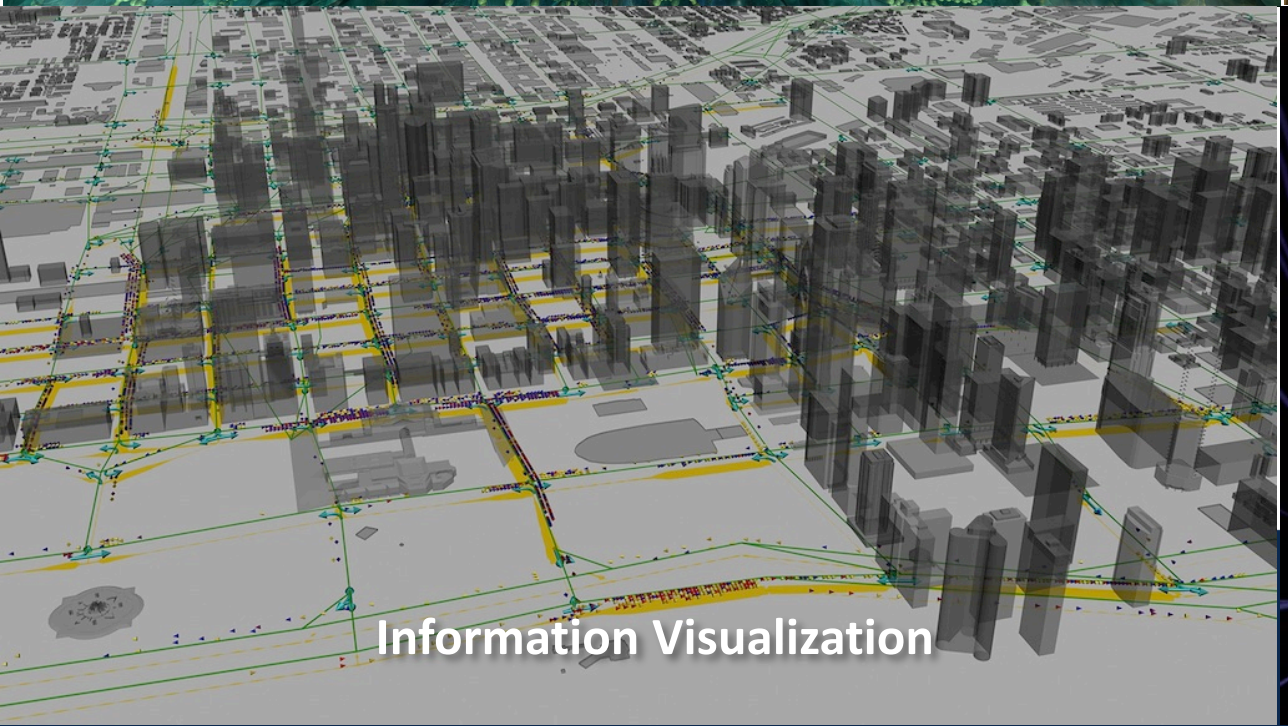
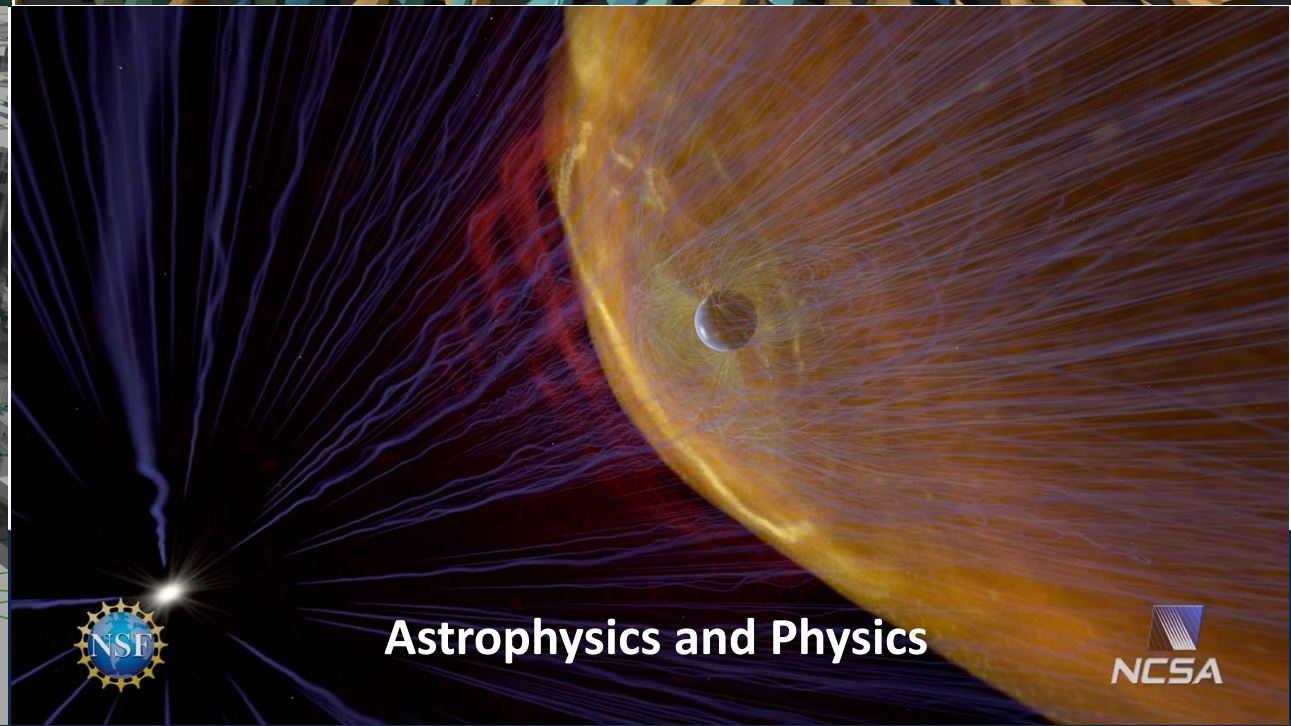
# NCSA Staff Visualize aVariety of Scientific Domains



# Award winning staff at NCSA

**2010** — **Hubble 3D**
Best Film Produced Exclusively for Giant Screen, Best Film for Learning
Giant Screen Cinema Association

**2011** — **Hubble 3D**
Best 3D Feature-Documentary,
3D Creative Arts Awards

**2015** — **Solar Superstorms**
Honorable Mention,
Espinho Fulldome Festival

**2016** — **Solar Superstorms**
Award Winner,
Jena Fulldome Festival

**2016** — **Solar Superstorms**
Audience Award,
IPS Brno Fulldome Festival

**2016** — **Solar Superstorms**
Official Selection,
Gwacheon International Film Festival

**2016** — **Solar Superstorms**
Official Selection,
SIGGRAPH Electronic Theater

**2016** — **A Beautiful Planet**
Truly Moving Picture Award,
Heartland Film

**2017** — **Solar Superstorms**
Official Selection,
Astra Film Festival, Romania

**2017** — **First Light in the Renaissance**
1st Place Best Scientific Visualization, Supercomputing

**2017** — **Milky Way Analogue Isolated Disk Galaxy**
2nd Place Best Scientific Visualization, Supercomputing

**100%** — **A Beautiful Planet**
100% Rating,
Rotten Tomatoes

**2018** — **Solar Superstorms**
Official Selection,
Macon Film Festival

**2018** — **Solar Superstorms**
Annual Dome Film Award,
Beijing Film Festival

**2019** — **Photosynthesis in a Chromatophore**
Official Selection,
SIGGRAPH Electronic Theater

**2019** — **Birth of Planet Earth**
Director's Award,
IPS Brno Fulldome Festival

**2019** — **Birth of Planet Earth**
Best Astronomical Visualizations, Reflections of the Universe Fulldome Festival

**2019** — **Birth of Planet Earth**
Official Selection,
Macon Film Festival

**2019** — **Birth of Planet Earth**
Official Selection,
Astra Film Festival, Romania

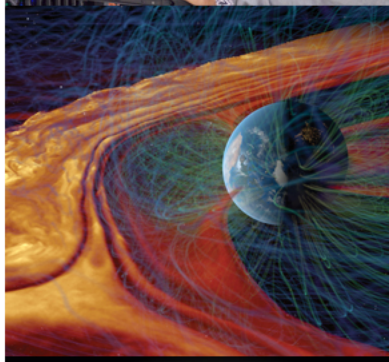
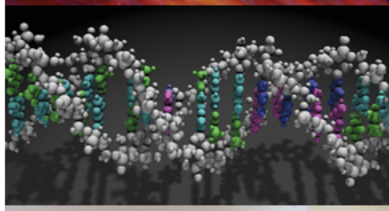
**2019** — **Birth of Planet Earth**
Official Selection,
Immersive Film Festival Espinho, Portugal

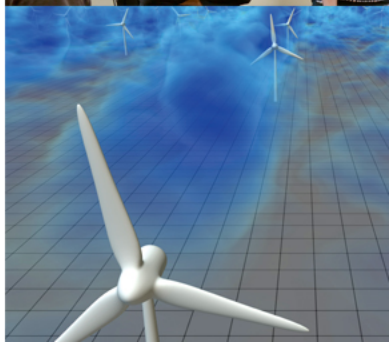
**2019** — **Birth of Planet Earth**
Official Selection,
DTLA Film Festival, Los Angeles, CA

**2019** — **Photosynthesis in a Chromatophore**
Semi-finalist,
SC19 Vis Showcase

**2019** — **Photosynthesis in a Chromatophore**
Official Selection,
SIGGRAPH Asia Electronic Theater

**2019** — **The Collision that Formed the Moon**
Official Selection,
SIGGRAPH Asia Electronic Theater



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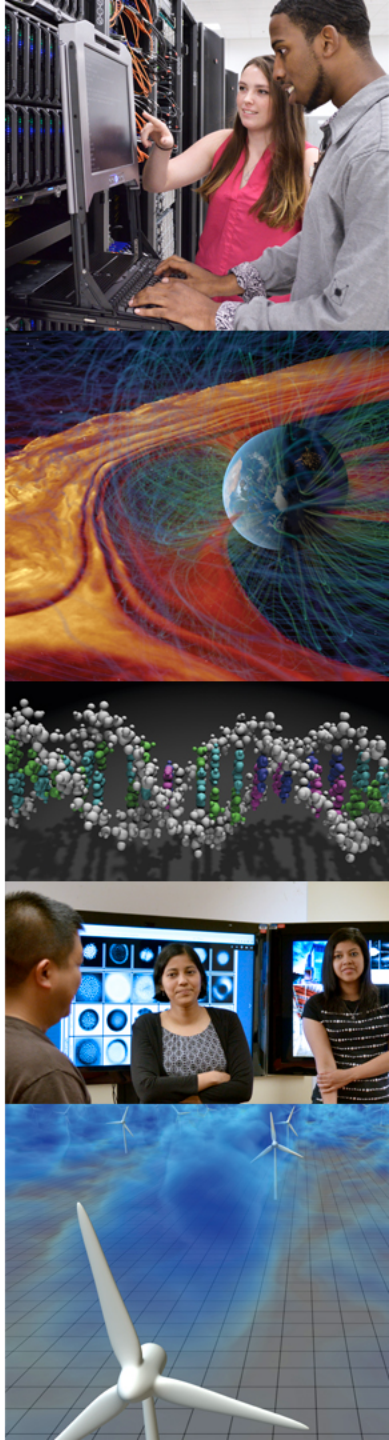
# Research & Education Introduction

Expert NCSA Staff and
Advanced Digital Technologies
provide a value added experience
for NCSA Affiliates.



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# Research & Education Student Programs

**Olena Kindratenko**
Senior Education & Outreach Coordinator

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# Student Program - SPIN

- NCSA's Students Pushing INnovation (SPIN) internship program lunched in 2012
- UIUC undergraduates in any major work on leading-edge research projects with the world-class NCSA researchers and faculty affiliates
- Program activities:
  - Academic Year or Summer session
  - Paid internships
    - Summer: 20 hours a week for 8 weeks
    - Academic Year: 5 hours a week for 16 weeks each semester
    - Pay rate: $12.50 in hours
  - Research, professional development, and social events
  - Eligible for Fiddler Innovation Undergraduate Research Award
- Student Participants:
  - Domestic and international students
  - Trained 332 undergraduates since the program inception
  - 24% female students
  - 17 SPIN interns received Fiddler Innovation Undergraduate Research Award

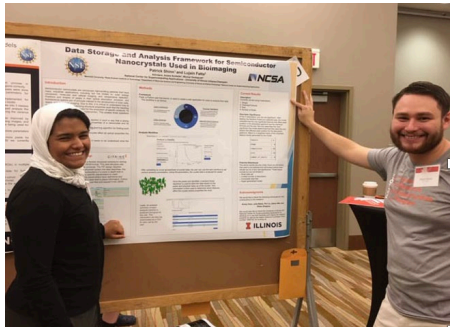
# Student Program – INCLUSION REU

- Incubating a New Community of Leaders Using Software, Inclusion, Innovation, Interdisciplinary and OpeN-Science (INCLUSION) Research Experience for Undergraduates (REU) is a software-in-research training experience
- NSF REU Site lunched in 2017
- Program activities:
  - 10 summer weeks – includes $500/week stipend, room and board, travel allowances
  - Pairs of students work with pairs of mentors from different disciplines on socially-impactful projects
  - Eligible for Fiddler Innovation Undergraduate Research Award
- Student Participants:
  - Domestic students from and outside of Illinois
  - Trained 34 undergraduates
  - 75% were minority and underrepresented in STEM
  - 3 INCLUSION REU students received Fiddler Innovation Undergraduate Research Award

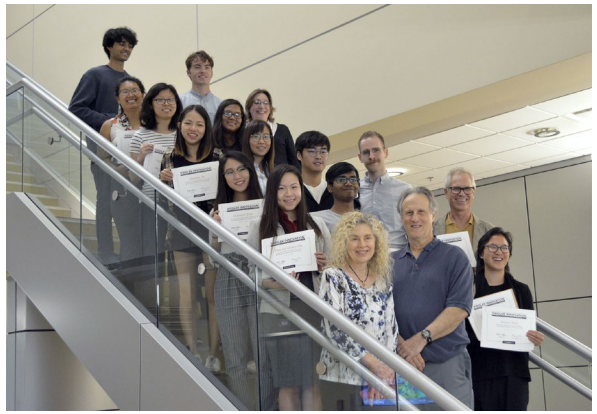
# Student Program – NCSA International Research Internship

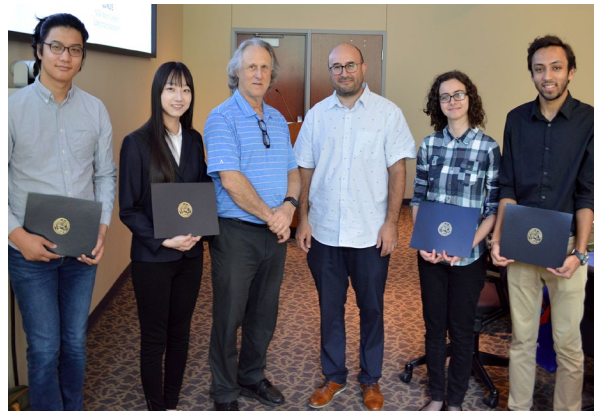
- Lunched in 2018
- Program activities:
  - 10 week-summer research program
  - Participants work with mentors from different disciplines on socially-impactful projects
  - Participants pared with REU INCLUSION and/or SPIN students
  - Research, professional development, and social events
  - Students responsible for program fees, campus housing, airfare, health insurance, and visa fees
  - Program fees: $2,500

- Student Participants:
  - International students who are currently enrolled in any major and in any year of studies in U.S. university
  - foreign students enrolled in universities in their home countries
  - in good academic standing



# Fiddler Innovation Endowment Award





The Fiddler Innovation Undergraduate Award is part of an endowment from Jerry Fiddler and Melissa Alden to the University of Illinois in support to the Emerging Digital Research and Education in Arts Media (eDream) Institute, which is based at the National Center for Supercomputing Applications

32 undergraduate, graduate, and NCSA faculty affiliates received the award

FIDDLER INNOVATION ENDOWMENT
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# Professional Development Program – CIP

- Cyberinfrastructure Professional Intern Program (CIP) designed to address the shortage of a workforce with the specialized skills needed to support advanced CI operations
- NSF CIP Site lunched in 2017
- Program activities:
  - Fall or Spring semester
  - Paid internships
  - Work directly with NCSA engineers to gain hands-on experience in the cyberinfrastructure operations
  - Spend the first two weeks training and learning about the different cyberinfrastructure aspects
  - Paired with one of the advanced infrastructure groups
- Student Participants:
  - Domestic and international from undergraduates to PhD level
  - Trained 17 interns
  - 24% underrepresented in STEM and veterans with disabilities

# NCSA Faculty Fellow program

- Goal: to catalyze and develop long-term research collaborations between Illinois departments, research units, and NCSA.

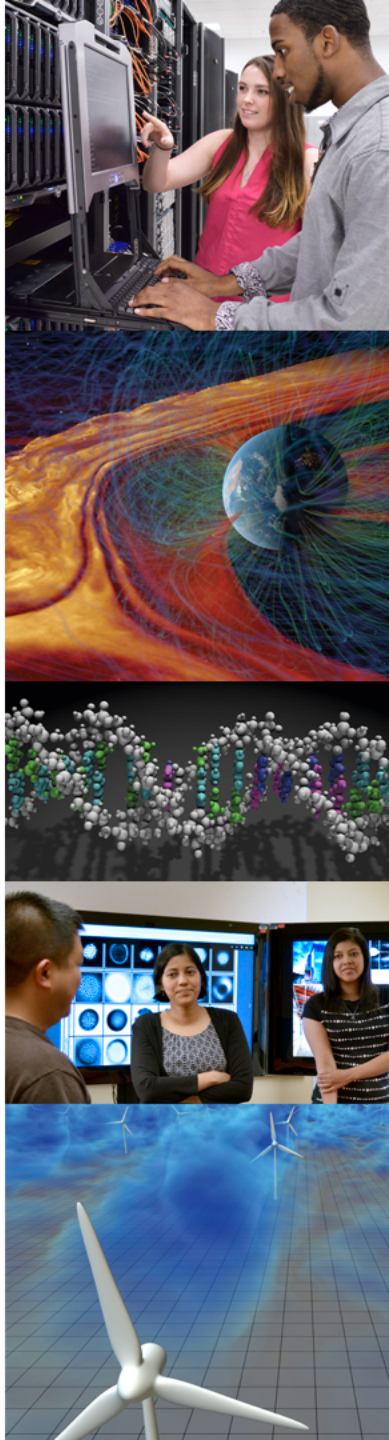
- Competitive program provides seed funding for demonstration, start-up projects, workshops, and/or other activities with the potential to lead to longer-term collaborations around research, development & education.

- New projects that include NCSA staff as integral contributors to the project.

- Open to all faculty and researchers at UIUC
- Up to $25K for one year
- Application period : usually Jan.- Feb. ;  Awards : July 1-June 30 of the following year.

- More information and how to apply at http://www.ncsa.illinois.edu/about/org/fellowships
- Questions to adelage@illinois.edu

# Computing, AI & Data resources
## (a sample)



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# Campus Cluster

NCSA Investment on Campus Cluster

- NCSA's ICC Tech Rep is Matt Long
- Have 60 TB of allocated storage on the shared GPFS
- Have 16 older IvyBridge nodes
  - 8 have K40 gpus
  - All have 20 Cores, 64GB RAM & FDR IB connectivity
  - These go out of service next April
  - We are looking at replacement options for some or all of these
- Have 4 newer Haswell nodes
  - All have 24 Cores, 256GB Ram and EDR IB connectivity
  - These remain in service until 2023
- All users with access to the ncsa queue can use any of these

# Campus Cluster

Campus Cluster Secondary Queue

- Many ICC nodes allow jobs from the secondary queue if there are no jobs queued from the primary investors on their resources
- These jobs are limited to just 4 hours
- All users have access to all the nodes within the secondary queue in additional to our primary investment
- There are 250+ nodes available for this usage, with a variety of core and ram counts.

ICC website: https://campuscluster.illinois.edu/

Appy for ‘ncsa queue’ access: https://campuscluster.illinois.edu/new_forms/user_form.php

# HAL Cluster

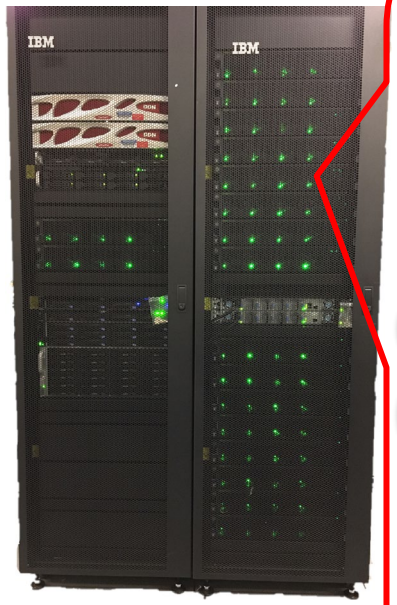
- In 2017, NCSA was funded by the NSF's Major Research Instrumentation program to develop and deploy a computational "instrument" for supporting deep learning applications at scale.
- The machine was named *Hardware Accelerated Learning* (HAL) cluster. It became operational in March 2019 and will continue to operate for the foreseeing future.
- Its purpose is to serve *deep learning* community on campus; any UIUC researcher can get an account on it. System details and account application instructions are here:

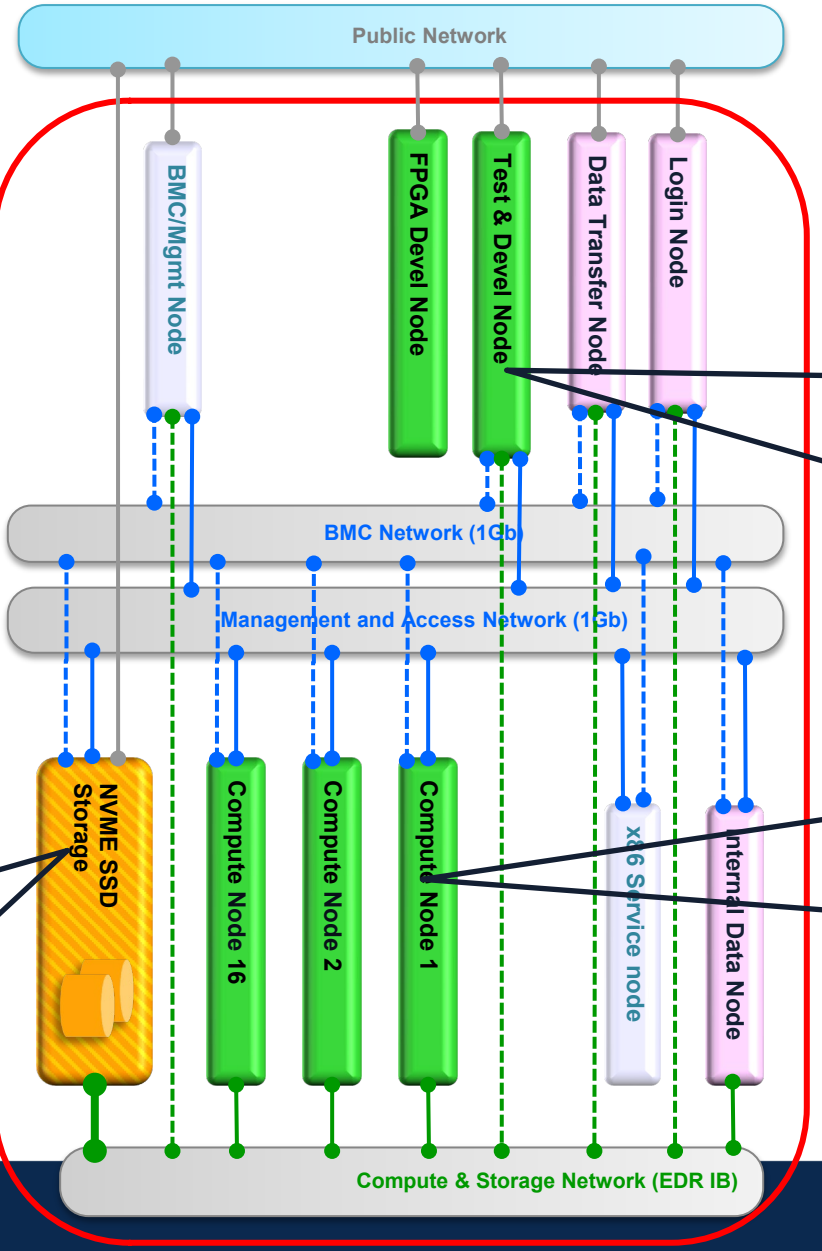
https://wiki.ncsa.illinois.edu/display/ISL20/HAL+cluster

# HAL cluster

Hardware Accelerated Learning

- RHEL/CentOS 7.6
- CUDA 10.1.105, cuDNN 7.5.0, NCCL 2.4.2
- IBM XLC 16.1.1, IBM XLFORTRAN 16.1.1
- Advance toolchain for Linux on Power 12.0
- IBM Watson Machine Learning Community Edition 1.7.0 (TensorFlow, PyTorch, RAPIDS cuML and cuDF)
- SLURM & Open OnDemand



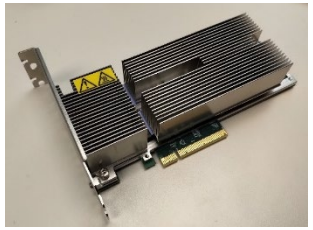



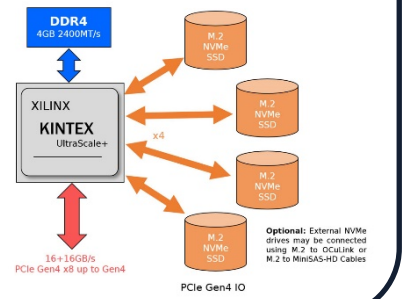

## DDN GS400NVE Flash Array


- 244 TB usable
- NVME SSD-based storage
- Spectrum Scale File System

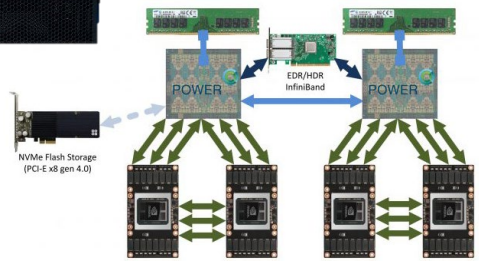
- 16 IBM AC922 nodes
  - IBM 8335-GTH AC922 server
    - 2x 20-core POWER9 CPU @ 2.4GHz
    - 256 GB DDR4
    - 4x NVIDIA V100 GPUs
      - 5120 cores
    - 16 GB HBM 2
  - 2-Port EDR 100 GB IB ConnectX-5 Adapter

## Nallatech 250S+ CAPI FPGA board






## IBM Power9 AC922

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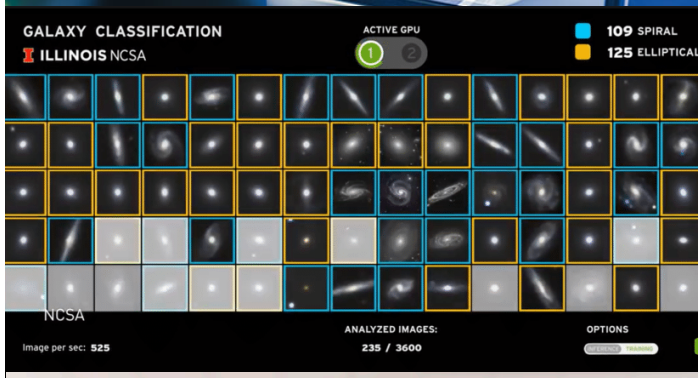
Award #1725729

# Center for AI Innovation

## Three Primary Themes

1. **Research (Academic)**
2. **Scholarship (Students)**
3. **Industry (Companies)**

- Bring together University resources for opportunities to collaborate
- Align research with academic and industry challenges
- Provide students opportunities in AI disciplines from top tier University
- Very active in proposal development, faculty research, opportunities for students, and industrial challenges
- http://ai.ncsa.illinois.edu/


# Overview of Delta

## COMPUTE

Furthering GPU adoption

## DATA

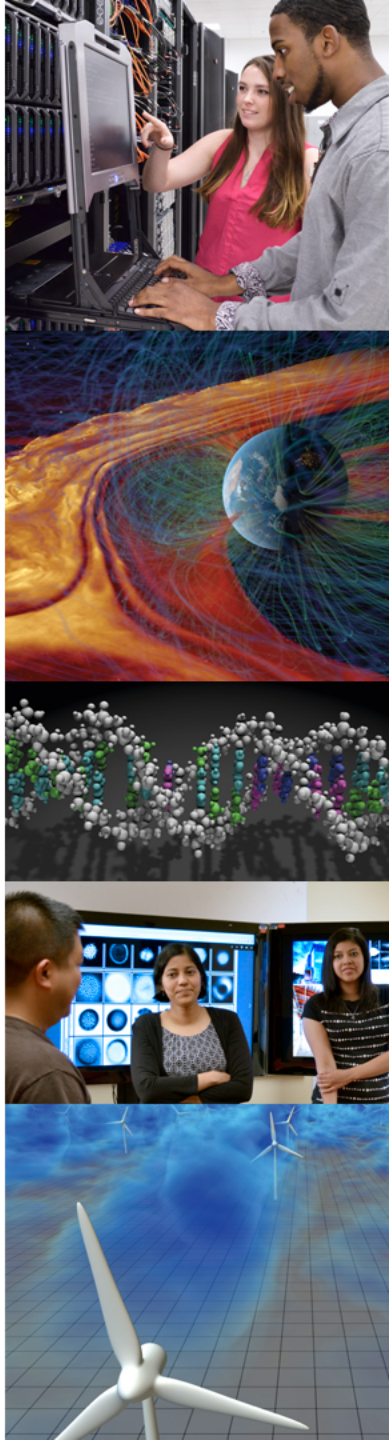
Moving beyond POSIX

## INTERFACE

Improving usability and accessibility

# Thank you!

Today’s slides will be posted at https://wiki.ncsa.illinois.edu/display/NRE/Presentations



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