



PennState
Institute for CyberScience

ICS-ACI: A Next-Generation Research Tool

The Institute for CyberScience Advanced CyberInfrastructure (ICS-ACI) is Penn State's high-performance research cloud. ICS-ACI provides researchers with the powerful compute, storage, software, and network solutions needed to address modern research questions.



The Institute for CyberScience Advanced CyberInfrastructure is housed in Penn State's Tower Road Data Center.



Powerful, flexible, and secure, ICS-ACI delivers a full spectrum of computing and data services to support research across disciplines.



PennState
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ics.psu.edu

Technical Support and Information:

i-ASK Support Center
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814-865-iAsk (4275)

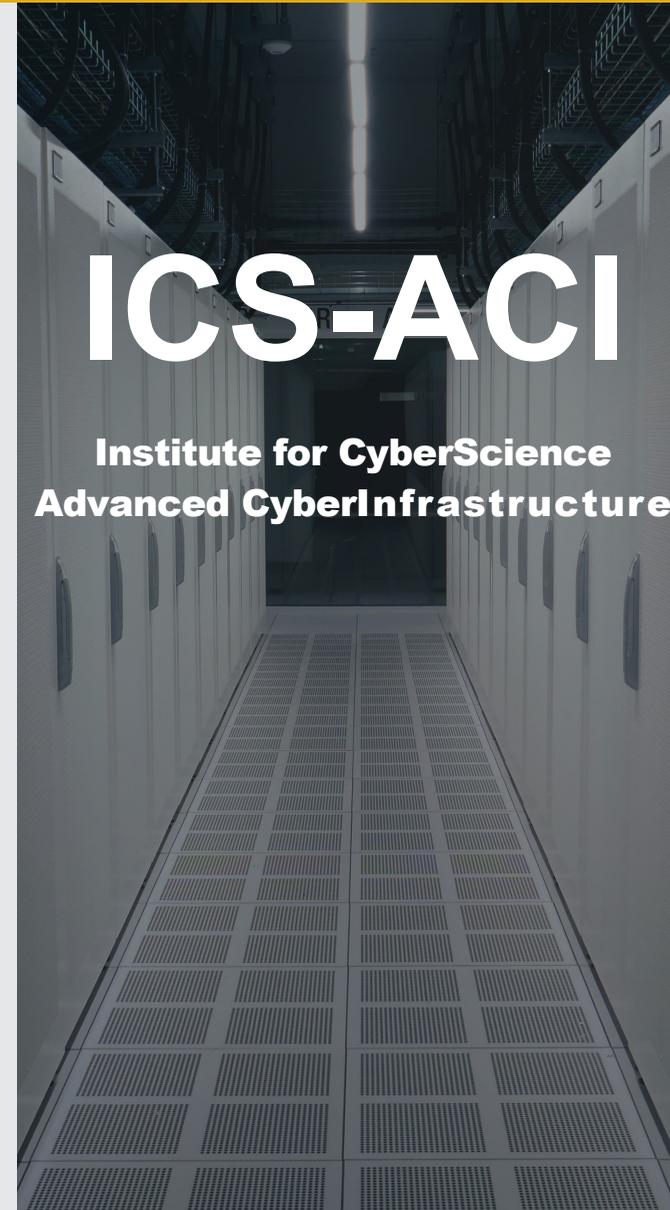
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ICS: Driving Computational Research

The Institute for CyberScience (ICS) enables computational and data-enabled research at Penn State. We operate a cutting-edge research cyberinfrastructure and work to build a community of expert scholars across disciplines.



Rapid Growth

Since deployment in 2015, ICS-ACI has grown radically, currently standing at 23,000 cores and 20 PB of storage. ICS-ACI also incorporates advanced technologies like FDR Infiniband and NVidia Tesla GPUs.

ICS-ACI aims to reach 48,000 cores in 2018, add a Hadoop Big Data environment, merge into an HPC Hybrid Cloud, and more. Penn State's administration makes substantial investments in ICS-ACI, and we're excited to partner with industry and researchers to make the system even more powerful.



The Institute for CyberScience

Advanced CyberInfrastructure

System Specifications

- 23,000 Processing Cores
- 20 PB High-Performance Storage
- Over 650 Teraflops Total Theoretical Peak Performance

ICS-ACI meets NIH dbGaP data compliance standards. We are targeting compliance with Export Control and NIST 800-171 and 800-53.

Serving Crucial Research Areas

The impact of ICS-ACI on the Penn State research community is vast. More than 3,000 ICS-ACI users are spread across 10 colleges and 49 different departments. Our users range from physicists, chemists, and earth scientists to psychologists, neuroscientists, political scientists, and more.

Demand for ICS-ACI continues to grow, and the ICS team and Penn State's administration are actively working to grow ICS-ACI to meet this demand.

"ICS-ACI resources spur many of the bold research projects that have made Penn State one of the nation's premier research universities."

"We are committed to enhancing our research cyberinfrastructure and using it to drive digital innovation."

– Dr. Nicholas P. Jones
Provost and Executive Vice President

ICS-ACI users are engaged in major research projects, supported by more than \$280 million in active grants. Since 2013, ICS-ACI users have produced well over 3,000 publications and have been cited nearly 30,000 times.

"ICS-ACI provides us the computing resources we need to characterize extrasolar planets and model their formation. Our jobs start promptly and reliably, and the ICS team even worked with us to architect a new custom cluster that will enable us to expand our science goals."

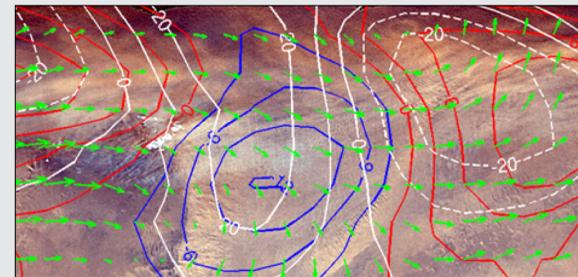
– Dr. Eric Ford
Professor of Astronomy and Astrophysics

Research Highlights

Here is just a small sample of the research the ICS-ACI high-performance research cloud supports.

Forecasting Martian Weather

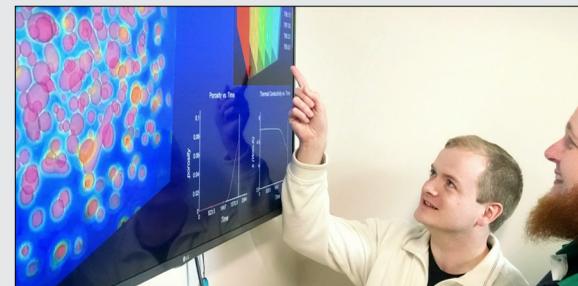
Dr. Steven Greybush uses ICS-ACI to model atmospheric instabilities that give rise to dangerous weather on Mars, work that helps NASA anticipate dust storms and plan safer Mars missions.



Greybush's research group combines big data (millions of spacecraft observations) and big simulation (numerical weather prediction models) to reproduce Mars weather.

Engineering Safer Nuclear Fuel Rod Materials

By performing 3-D simulations of thermal conductivity using ICS-ACI, Dr. Michael Tonks is finding ways to design nuclear fuel rods that are less likely to overheat and cause a meltdown during a nuclear reactor accident.



Grad students in Tonks's lab review a simulation of how fission gas bubbles evolve in nuclear reactor fuel, affecting how fuel conducts heat.

Understanding Borderline Personality Disorder (BPD)

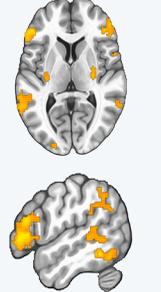
Dr. Michael Hallquist uses ICS-ACI to model the brain's decision-making processes. He aims to uncover the causes of a debilitating but little-understood condition, borderline personality disorder, in adolescents.



Decide when to respond (up to 4s)

You won 139 points

Receive rewards based on timing of choice



Neural Representation of Decision Processes

Decision-making paradigm

$$V_b(i+1) = V_b(i) + e_b(i)t\alpha[\text{reward}(i|t) - V_b(i)] - \gamma(1 - e_b(i)t)(V_b(i) - V_b(0))$$

Mathematical model of behavior

Hallquist's team studies how BPD symptoms may reflect disrupted integration among brain regions used to make decisions and regulate emotion.

Modeling Volcanic Systems



Dr. Christelle Wauthier uses ICS-ACI to assist in her research on subduction volcanism, continental rifting volcanism, and hot-spot volcanism.

To learn more about our infrastructure and software stack, or to view our ICS-ACI service models, please visit our website at

ics.psu.edu