OSCER
State of the Center

Henry Neeman, Director
OU Supercomputing Center for Education & Research
A Division of OU Information Technology
hneeman@ou.edu

Wednesday September 26 2018
University of Oklahoma

Use Our Ugly Symposium Website!

Our ugly Symposium website

http://symposium2018.oscer.ou.edu/

has a pretty complete agenda and speaker information, and is so ugly that it's actually reasonably optimized for handhelds like phones and tablets.

We encourage you to use it!

Preregistration Profile 2018

- **Organizations**: 63 preregistered (or speaking)
  - **Academic**: preregistered 22 institutions in 7 states (CA,IL,KS,MO,OH,OK,TX)
    - Includes 14 institutions in EPSCoR states (KS,OK)
  - **Industry**: preregistered 21 private companies
  - **Government**: preregistered 9 agencies (federal, state)
  - **Non-governmental**: preregistered 6 organizations
- **Demographics**: 250 preregistered (and/or speaking)
  - 28% OU, 72% non-OU (or unknown)
  - 77% Oklahoma, 23% non-Oklahoma (or unknown)
  - 80% from EPSCoR states, 20% non-EPSCoR (or unknown)
  - 62% academic, 38% non-academic (or unknown)

Attendee Profile 2002-2017

- Over 4000 attendees at the previous 16 Symposia
  - 69 in 2002, 225-350 per year thereafter, usually 275±50
- Organizations: 343 through 2017
  - **Academic**: from 122 institutions in 27 US states & territories
    - 67 institutions in 12 EPSCoR jurisdictions
    - 35 institutions in Oklahoma
      - PhD-granting, masters-granting, bachelors-granting, community colleges, career techs, high school
      - Historically Black University, Tribal College, 3 Native American Serving Non-tribal Institutions
      - public, private, for-profit
  - **Industry**: from 165 firms
  - **Government**: from 35 agencies (federal, state, municipal, foreign)
  - **Non-governmental/nonprofit**: from 21 organizations

Symposium 2018 Sponsors: Thank You!

- Sponsors (13)
  - Gold (2): Dell EMC, **Formulus Black**
  - Silver (7): **Cloudian**, **Eagle Technologies**, Intel, Lenovo, Red Hat/**Crossvale**, Silicon Mechanics
  - Bronze (3): NVIDIA, Rogue Wave Software, Spectra Logic
  - Snack Break (1): Silicon Mechanics (midmorning)
  - Academic (1): Great Plains Network

Thank you all! Without you, the Symposium couldn't happen.

Over the past 16 Symposia, we've had a total of 93 companies as sponsors – and half have repeated (and/or were acquired by/merged with other sponsors).

Thanks!

- OU IT
  - OU Interim CIO/VPIT Eddie Huebsch
  - Symposium committee: Dana Brunson (OSU), Debi Gentis (OU)
  - Symposium coordinator: Debi Gentis
  - Sponsorship coordinators: Chance Grubb, Katie Schott
  - OSCER Operations Team: Dave Akin, Patrick Calhoun, Kali McLennan, Jason Speckman
  - OSCER Research Computing Facilitators: Jim Ferguson, Horst Severini
  - OSCER Assoc Dir Research Strategy Advisor: George Louthan
  - All of the OU IT folks who helped put this together
- CCE Forum
  - Jake Maurer, Kristin Livingston
  - The whole Forum crew who helped put this together

Thanks: Plenary Speakers

- Mike Norman, San Diego Supercomputer Center, University of California San Diego
- Bob Panoff, Shodor Education Foundation
- Dan Stanzione, Texas Advanced Computing Center, University of Texas at Austin

Thanks: Gold Sponsor Speakers

- Adnan Khaleel, DellEMC
- Rob Peglar, Formulus Black

Thanks: Breakout Speakers

1. Dan Andresen, Kansas State University
2. Shady Boukhary, Midwestern State University
3. Keith Brewster, University of Oklahoma
4. Eduardo Colmenares, Midwestern State University
5. Brady Deetz, Laureate Institute for Brain Research
6. Kyle Hutson, Kansas State University
7. Mark Laufersweiler, University of Oklahoma
8. BJ Lougee, Federal Reserve Bank of Kansas City
9. George Louthan, University of Oklahoma
10. Chongle Pan, University of Oklahoma
11. Dimitrios Papavassiliou, University of Oklahoma

Thanks!

To all of your for participating, and to those many of you who've shown us so much loyalty over the past 16 years.

They Made Me Who and What I Am

Dr. Renate Neeman

Dr. Beverly Bishop
(1922 - 2008)

Dr. Mike Norman

She made me **who** I am.

They made me **what** I am.

http://arts-sciences.buffalo.edu/content/dam/arts-sciences/center-for-hearing-deafness/Third%20Annual%20Neuroscience%20Research%20Day.pdf

Outline

- OU
  - Resources
  - Accomplishments
- OCII/OneOCII

Resources

Dell Intel Haswell HPC Cluster

Peak speed: 391 TFLOPs*

*TFLOPs: trillion calculations per second

634 compute nodes

1268 Intel Xeon “Haswell” and
“Sandy Bridge” CPU chips

13,060 CPU cores

30+ TB RAM

almost 400 TB global public disk

1.4 PB global “condominium” disk

Mellanox FDR10 Infiniband
(3:1 oversubscribed, 13.33 Gbps,
~1 microsec latency)

Dell N-series Gigabit/10G Ethernet

CentOS 7

~30% of the nodes are “condominium”
(owned by individual research teams).

schooner.oscer.ou.edu

Photo: Jawanza Bassue

Schooner: non-condominium nodes

- Compute nodes, non-condominium
  - 266 x R430, dual E5-2650v3 10-core 2.3/2.0 GHz, 32 GB RAM
  - 72 x R430, dual E5-2660v3 10-core 2.6/2.2 GHz, 32 GB RAM
  - 48 x R430, dual E5-2670v3 12-core 2.3/2.0 GHz, 64 GB RAM
- Accelerator-capable nodes, non-condominium
  - 28 x R730, dual E5-2650v3 10-core 2.3/2.0 GHz, 32 GB RAM
  - 5 x R730, dual E5-2670v3 12-core 2.3/2.0 GHz, 64 GB RAM
- Large RAM node, non-condominium
  - 1 x R930, quad E7-4809v3 8-core 2.0/1.8 GHz, 1024 GB RAM
- Accelerators, non-condominium
  - 6 x NVIDIA K20M
  - 24 x Intel Xeon Phi 31S1P
- Subtotal peak CPU speed, non-condominium: 280.4 TFLOPs

Schooner: Old Condominium

As an experiment, we're transferring condominium nodes from Boomer over to Schooner.

- Compute nodes, condominium, old
  - 73 x R620, dual E5-2650 (Sandy Bridge), oct core, 2.0 GHz, 32 GB RAM
- Accelerator-capable nodes, condominium, old
  - 6 x R720, dual E5-2650, oct core, 2.0 GHz, 32 GB RAM
- Accelerators, condominium, old
  - 12 x NVIDIA M2075
  - 6 x NVIDIA K20M
- Storage, diskfull nodes, condominium, old
  - 4 x R720xd, 12 x 3 TB = ~19 TB useable each
- Subtotal peak CPU speed, old condominium: 20.2 TFLOPs

Schooner: New Condominium

- Compute nodes, condominium, new
  - 7 x R630, dual E5-2640v3 8-core 2.6/2.2 GHz, 32 GB RAM
  - 6 x R430, dual E5-2650Lv3 12-core 1.8/1.5 GHz, 64 GB RAM
  - 84 x R430, dual E5-2670v3 12-core 2.3/2.0 GHz, 64 GB RAM
  - 5 x R430, dual E5-2670v3, 12-core 2.3/2.0 GHz, 128 GB RAM
  - 14 x R430, dual E5-2650v4 12-core 2.2/1.8 GHz, 64 GB RAM
- Accelerator-capable nodes, condominium, new
  - 1 x R730, dual E5-2650v3 10-core 2.3/2.0 GHz, 32 GB RAM
  - 3 x R730, dual E5-2670v3 12-core 2.3/2.0 GHz, 64 GB RAM
- Large RAM node, non-condominium
  - 1 x R930, quad E7-4809v3 8-core 2.0/1.8 GHz, 3072 GB RAM
  - 1 x R930, quad E7-4830v4 14-core 2.0/1.6 GHz, 2048 GB RAM
- Accelerators
  - 8 x NVIDIA K20M
- Subtotal peak CPU speed, new condominium: 90.7 TFLOPs

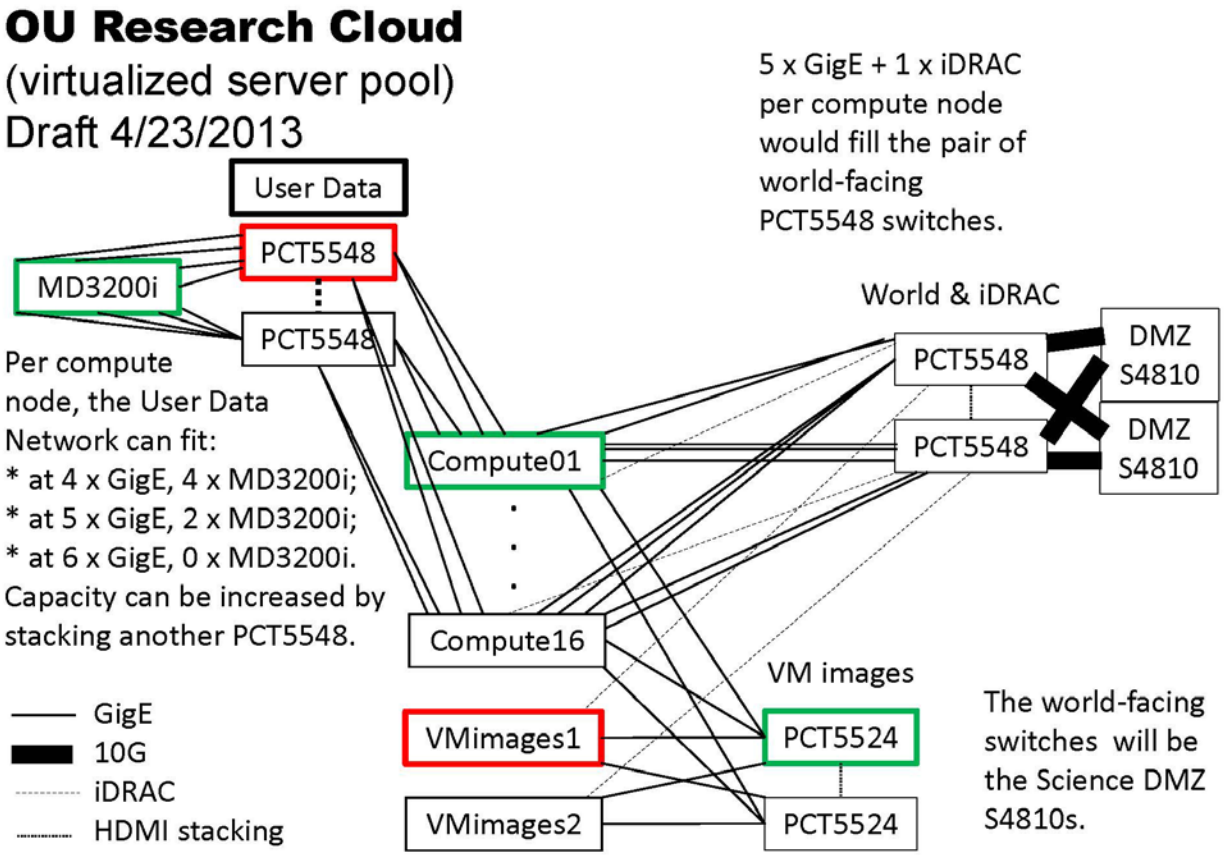
Schooner: non-condominium other

- Interconnects
  - Infiniband: Mellanox FDR10 3:1 oversubscribed (40 Gbps native, 13.33 Gbps oversubscribed)
  - Ethernet: GigE downlinks to nodes, 10GE uplinks to core
- Storage (user-accessible)
  - DataDirect Networks SFA7700X w/70 x 6 TB = ~305 TB useable
  - 6 x home/scratch 12 x 6 TB = ~60 TB useable

Schooner: Peak Speed

- Subtotal peak CPU speed, non-condominium: 280.4 TFLOPs
- Subtotal peak CPU speed, old condominium: 20.2 TFLOPs
- Subtotal peak CPU speed, new condominium: 90.7 TFLOPs
- Total peak CPU speed, public + old condominium + new condominium: 391 TFLOPs
- Schooner condominium: 28% of peak speed, 32% of nodes.

OURcloud


OU Research Cloud
(virtualized server pool)
Draft 4/23/2013
5 x GigE + 1 x iDRAC per compute node would fill the pair of world-facing PCT5548 switches.
User Data
PCT5548
MD3200i
PCT5548
Per compute node, the User Data Network can fit:
* at 4 x GigE, 4 x MD3200i;
* at 5 x GigE, 2 x MD3200i;
* at 6 x GigE, 0 x MD3200i.
Capacity can be increased by stacking another PCT5548.
World & iDRAC
PCT5548
PCT5548
DMZ S4810
DMZ S4810
Compute01
Compute16
VM images
VMimages1
VMimages2
PCT5524
PCT5524
The world-facing switches will be the Science DMZ S4810s.
GigE
10G
iDRAC
HDMI stacking

OURcloud

Oklahoma PetaStore

A mix of disk and tape, available to researchers at OU (and statewide), with a unique business model that makes long term archival storage affordable.

ANNOUNCEMENT COMING LATER IN THIS TALK ….

OSCER Personnel

- Director: Henry Neeman
- Managing Director, Research IT Services: Ashish Pai
- **Associate Director for Research Computing Strategy: George Louthan**
- Senior System Administrator: Dave Akin
- Petascale Storage Administrator: Patrick Calhoun
- System Administrators: Kali McLennan, Jason Speckman
- Research IT Coordinator: Debi Gentis
- Associate Director for Remote & Heterogeneous Computing, Research Computing Facilitator: Horst Severini
- Research Computing Facilitator: Jim Ferguson

OSCER Personnel Transitions

- Left OU
  - Manager of Operations: Kyle Dudgeon (now at Syncsort)
  - Senior Systems Analyst: Brett Zimmerman (now at U Texas Austin)

Accomplishments

OSCER Outcomes: Research

- External research funding to OK institutions facilitated by OneOCII lead institutions (Fall 2001- Summer 2013): **$317M+**
- Funded projects facilitated: **500+**
- OK faculty and staff: **200+** in **30+** academic disciplines
- Specifically needed OneOCII just to be funded: **~$45M** (necessary but far from sufficient)
  - NSF EPSCoR RII Track-1 (2008-13, OU+OSU): $15M
  - NSF EPSCoR RII Track-1 (2013-18, OU+OSU+Noble)): $20M
  - NSF EPSCoR RII Track-2 (OU+OSU+KU+KSU): $6M ($3M to OU+OSU)
  - NSF EPSCoR RII C2 (OU+OSU+TU+LU+Noble+OneNet): $1.17M
  - NSF CC-NIE (OU+OSU+LU+OII+UCO+OneNet): $500K
  - NSF CC*IIE (OU): $400K
  - NSF CC*IIE (OneNet+GPN): $350K
  - **NSF MRI (OU): $968K**
  - NSF MRI (OU): $793K
  - NSF MRI (OSU): $908K
  - NSF MRI (OSU): $950K
  - NSF MRI (Langston U): $250K
  - NSF MRI (UCO): $304K
  - NSF MRI (TU): $180K
  - DOD DURIP (TU): $200K
  - NSF CC* (NSU/SWOSU/SE/RSU): $334K
- Publications facilitated: **2900+**

OSCER Outcomes: Education

Teaching: 9 institutions including 3 MSIs

- Taught parallel computing using OSCER resources:
  - Cameron U – multiple times
  - East Central U (NASNI) – multiple times including **this semester**
  - Oklahoma City U – multiple times
- Taught parallel computing via LittleFe baby supercomputer and OSCER resources:
  - Southeastern Oklahoma State U (NASNI) – 3 semester sequence, multiple times
- Taught computational chemistry using OSCER resources:
  - Northeastern State U (NASNI) – multiple times
  - Southern Nazarene U
  - Rogers State U – multiple times
- Taught Bioinformatics using OSCER resources:
  - U Tulsa – 2 semester sequence

OSCER/OneOCII Outcomes: Resources

7 institutions including 2 MSIs, plus C2 institutions

- NSF Major Research Instrumentation grants: $2.9M
  - OU: PetaStore $793K (in production), **OURRstore $968K (just awarded)**
  - Oklahoma State U: Cowboy cluster, $909K (in production),
    Pistol Pete cluster, $950K
  - Langston U: cluster, $250K (in production)
  - U Central Oklahoma: cluster, $304K (in production)
  - U Tulsa: clusters, $180K + $200K
- Defense University Research Instrumentation Program
  - U Tulsa: cluster, $200K
- LittleFe baby supercomputer grants ($2520 each)
  - OU: Ron Barnes
  - Oklahoma City U: Larry Sells & John Goulden
  - Southeastern Oklahoma State U: Mike Morris & Karl Frinkle
- Networking
  - NSF EPSCoR RII C2 grant: $1.17M
  - NSF CC-NIE grant: $500K
  - NSF CC*IIE grant: $400K
  - NSF CC* grant: $334K

OneOCII CI Grants

COMPLETED

1. Grant No. EPS-0919466, "A cyberCommons for Ecological Forecasting," OU+OSU+KU+KSU, $6M, **COMPLETED**
2. Grant No. EPS-1006919, "Oklahoma Optical Initiative," OU+OSU+Noble+TU+LU+OneNet, $1.17M, **COMPLETED**
3. Grant No. OCI-10310029, "MRI: Acquisition of Extensible Petascale Storage for Data Intensive Research," OU, $793K
4. Grant No. OCI-1126330, "Acquisition of a High Performance Compute Cluster for Multidisciplinary Research," OSU, $908K
5. Grant No. ACI- 1229107, "Acquisition of a High Performance Computing Cluster for Research and Education," LU, $250
6. Grant No. ACI-1440774, "ENCITE: ENabling CyberInfrastructure via Training and Engagement," OneNet+GPN, $130K
7. Grant No. ACI-1341028, "OneOklahoma Friction Free Network," OU+OSU+LU+OII+UCO+OneNet, $500K
8. Grant No. ACI-1440783, "A Model for Advanced Cyberinfrastructure Research and Education Facilitators," OU, $400K

ONGOING

1. Grant No. ACI-1429702, "MRI: Acquisition of a High Performance Computing Cluster for Research at a Predominantly Undergraduate Institution," UCO, $304K
2. Grant No. ACI-1531128, "MRI: Acquisition of Shared High Performance Compute Cluster for Multidisciplinary Computational and Data-Intensive Research," OSU, $950K
3. Grant No. ?, "DURIP-ARO: Heterogeneous Cluster for Cyber-Physical System Security Analytics," TU, $200K
4. Grant No. CNS-1531270, "MRI: Development of Heterogeneous Cluster for Cyber-Physical System Hybrid Analytics," TU, $180K
5. Grant No. OAC-1659235, "CC* Network Design: Multiple Organization Regional One Oklahoma Friction Free Network (MORe OFFN)", NSU/SWOSU/SE/RSU, $334K
6. **Grant No. OAC-1828567, "MRI: Acquisition of a Regional Reesource for Long-term Archiving of Large Scale Research Data Collections," OU, $968K**

TOTAL to OK under OCII/OneOCII: Sep 2008-Sep 2018:

$10M in 14 CI grants to 12 OK institutions (OU, OSU, TU, LU, UCO, OII, Noble, OneNet, NSU, SWOSU, SE, RSU):

Average of $1M per year in new CI grants to OK institutions

Comparison: 2001-2008: $722K (3 grants) TOTAL (1/11 as much per year)

Grants That Needed OCII/OneOCII

COMPLETED

- Grant No. EPS-0814361, “Building Oklahoma's Leadership Role in Cellulosic Bioenergy,” OU+OSU, $15M

ONGOING

- Grant No. EPS-1301789, “Adapting Socio-ecological Systems to Increased Climate Variability,” OU+OSU+TU+Noble, $20M

<u>TOTAL under OCII/OneOCII</u>: $35M in 2 grants that needed OCII/OneOCII to be fundable, to 4 OK institutions since Sep 2008

Papers About Pieces of OneOCII

1. S. P. Calhoun, D. Akin, B. Zimmerman and H. Neeman, 2018: "Large Scale Research Data Archiving: Training for an Inconvenient Technology." *Journal of Computational Science*. DOI: 10.1016/j.jocs.2018.07.005.
2. H. Neeman, A. Bergstrom, D. Brunson, C. Ganote, Z. Gray, B. Guilfoos, R. Kalescky, E. Lemley, B. G. Moore, S. K. Ramadugu, A. Romanella, J. Rush, A. H. Sherman, B. Stengel and D. Voss, 2016: "The Advanced Cyberinfrastructure Research and Education Facilitators Virtual Residency: Toward a National Cyberinfrastructure Workforce." *Proc. XSEDE'16*, article 57. DOI: 10.1145/2949550.2949584.
3. H. Neeman, K. Adams, J. Alexander, D. Brunson, S. P. Calhoun, J. Deaton, F. Fondjo Fotou, K. Frinkle, Z. Gray, E. Lemley, G. Louthan, G. Monaco, M. Morris, J. Snow and B. Zimmerman, 2015: "On Fostering a Culture of Research Cyberinfrastructure Grant Proposals within a Community of Service Providers in an EPSCoR State." *Proc. XSEDE'15*, article 19. DOI: 10.1145/2792745.2792764.
4. H. Neeman, D. Akin, J. Alexander, D. Brunson, S. P. Calhoun, J. Deaton, F. Fondjo Fotou, B. George, D. Gentis, Z. Gray, E. Huebsch, G. Louthan, M. Runion, J. Snow and B. Zimmerman, 2014: "The OneOklahoma Friction Free Network: Towards a Multi-Institutional Science DMZ in an EPSCoR State." *Proc. XSEDE'14*, article 49. DOI: 10.1145/2616498.2616542.
5. S. P. Calhoun, D. Akin, J. Alexander, B. Zimmerman, F. Keller, B. George and H. Neeman, 2014: "The Oklahoma PetaStore: A Business Model for Big Data on a Small Budget." *Proc. XSEDE'14*, article 48. DOI: 10.1145/2616498.2616548.
6. C. Carley, B. McKinney, L. Sells, C. Zhao and H. Neeman, 2013: "Using a Shared, Remote Cluster for Teaching HPC." *Proc. IEEE CLUSTER 2013*. DOI: 10.1109/CLUSTER.2013.6702630.
7. H. Neeman, D. Brunson, J. Deaton, Z. Gray, E. Huebsch, D. Gentis and D. Horton, 2013: "The Oklahoma Cyberinfrastructure Initiative." *Proc. XSEDE'13*, article 70. DOI: 10.1145/2484762.2484793.

HPC Capacity

- 2002: 1.2 TFLOPs statewide, 1 Service Provider
- 2005: 6.5 TFLOPs statewide, 1 Service Provider
- 2008: 40 TFLOPs statewide, 2 Service Providers
- 2012: 200+ TFLOPs statewide, 4 Service Providers
- 2015: 400+ TFLOPs statewide, 5 Service Providers
- 2016: 400+ TFLOPs statewide, 6 Service Providers
- **2018: 500+ TFLOPs statewide, 5 Service Providers**

External Funding Summary

- External research funding facilitated by OSCER (Fall 2001- Fall 2018): **$702M total, $317M to OU** (45%)
- Funded projects: **540**
- **230+** OU faculty and staff in **29** academic departments and **11** non-academic units
- Comparison: Fiscal Year 2002-18 (July 2001 – June 2018): OU Norman externally funded research expenditure: $1.38B

Since being founded in fall of 2001, OSCER has enabled research projects comprising **over 1 / 5 of OU Norman's total externally funded research expenditure**, with an **11-to-1 return on investment**.

External Research Grants

1. **H. Neeman, L. Bartley, K. Dresback, A. McGovern, H. Severini, M. Laufersweiler, "MRI: Acquisition of a Regional Resource for Long-term Archiving of Large Scale Research Data Collections," NSF, $968K**
2. S. Crowell, "The OCO-2 Model Intercomparison Project," NASA Science Team for the OCO-2 Missions, $123K
3. A. Duerfeldt, 'Hit to Lead Optimization of a Systemically Available Treatment for Diabetic Retinopathy," NIH, $275K
4. A. West, A. Duerfeldt et al, "Structure, Function, and Therapeutic Potential of Clostridium difficile Caseinolytic Protease P," NIH, $10.5M
5. G. Richter-Addo, "MRI: Acquisition of an X-ray Diffractometer for Research and Training in Chemical Structure-Function Studies," NSF, $217K
6. B. Uchoa Barboza, "Interactions and quantum effects in nodal materials," NSF, $402K
7. S. A. Shirazi, "Erosion/Corrosion Research Center (E/CRC)," Industrial, $540K
8. S. A. Shirazi, "Tulsa University Sand Management Projects (TUSMP)," Various Oil and Gas Producers, $150K
9. S. Schroeder, "Metal Ion Interactions in RNA Shapeshifters," Burroughs Wellcome Fund, $9K
10. A. Duerfeldt, "Hit to Lead Optimization of a Systemically Available Treatment for Diabetic Retinopathy Major Aim: To determine structure-activity relationships of NCI8, a novel PPARα agonist," NIH, $422K
11. N. Snook, M. Xue, Y. Jung, A. McGovern, M. Xue, "Improving Operational Hail Prediction through Machine Learning from HREF and CAPS Storm-Scale Ensemble FV3 and WRF ARW Forecasts including Advanced Microphysics," NOAA, $342K
12. W. Freeman, "Neuroepigenomics of Neural Stem Cell Aging.," OCASCR, $232K
13. W. Freeman, "Sex divergence and cell specificity of age-related hippocampal DNA modifications," NIH, $75K
14. W. Freeman, "Dynamics of the brain epigenome with aging," NIH, $960K
15. P. Skubic, J. Stupak, B. Abbott, M. Strauss, P. Gutierrez, "Experimental Physics Investigations using the ATLAS Detector at the LHC," DOE, $420K
16. P. Skubic, B. Abbott, J. Stupak, M. strauss, P. Gutierrez, "University of Oklahoma High Energy Physics: Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the Large Hadron Collider (LHC) (TASK A) 2013-2016," DOE, $500K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

17. P. Skubic, B. Abott, P. Gutierrez, M. Strauss, "OU
18. Contribution to the ATLAS Southwest Tier 2 Computing Center," DOE, $115K
19. T. Smith, A. Reinhart, K. Ortega, K. Calhoun, "Implementing convective storm statistics from a large reanalysis of WSR-88D data for model verification and forecasting probabilistic uncertainty," NOAA, $592K
20. J Gallant (Michigan State U), M. Markham (OU), Sawtell (Columbia U), Warren (Washington U St. Louis), Zakon (U Texas), "IOS EDGE: Enabling genotype-phenotype studies in weakly electric fish.," NSF, $1.5M (total), $279K (OU)
21. M. Markham, "CAREER: The energetic costs of active sensory and communication signals: Integrating research and education through organismal, cellular, and molecular approaches," NSF, $719K
22. D. Allen, T. Neeson, Y. Hong, "Collaborative Research: MSB-FRA: Scaling Climate, Connectivity, and Communities in Streams," NSF, $1.4M
23. S. Hussaini, (U Tulsa), F. Acquah, (OUHSC), B. Mooers (OUHSC), "HR18-049 Discovery of Indolizidine (–)-237D Analogs as Selective α6* Receptor Antagonists," OCAST, $135K (total), $13K (OU)
24. J. Salazar, N. Aboserwal, R. Palmer, "Shared Aperture Array Antenna for Multiband Radar Applications," Nanowave Technologies Inc, $130K
25. M. Yeary, R. Palmer, P. Chilson, "Development and Commercialization of a Ground-Based Radar to Enable the Next-Generation of Atmospheric Measurements via Unmanned Aircraft Systems (UAS)," OCAST, $300K
26. T.Yu, B.Cheong, R. Palmer, "Technical Support for the Procurement of an S-band Polarimetric Weather Radar," National Central University, Taiwan, $88K
27. R. Palmer, B. Cheong, C. Fulton, J. Salazar, H. Sigmarsson, M. Yeary, T. Yu, Y. Zhang, "Spectrum Efficient National Surveillance Radar (SENSR) - ARRC Risk Reduction Activates," NOAA, $2.22M
28. R. Palmer, C. Fulton, J. Salazar, H. Sigmarsson, "Spectrum Ef- ficient National Surveillance Radar (SENSR) - Development of the All-Digital Horus Demonstrator," NOAA, $2.9M
29. N. Goodman, J. Ruyle, H. Sigmarsson, C. Fulton, M. Yeary, R. Palmer, J. Salazar, "Technologies for Next-Generation Conformal and Reconfigurable Radar Systems," ONR, $3.5M
30. T. Yu, R. Palmer, B. Cheong, "Developing strategies for deploying a network of reflected-array radars," Weathernews Inc., $97K
31. B. Cheong, R. Palmer, T. Yu, "Technical Support for the Design and Test of an X-Band SSPA-Based Polarimetric Weather Radar," Novimet, $36K

OSCER-FACILITATED FUNDING TO DATE:
$702M total, $317M to OU

External Research Grants (cont'd)

32. R. Palmer, C. Fulton, J. Salazar, H. Sigmarsson, M. Yeary, "Development of the All-Digital Horus Radar for SENSR," NOAA, $3.3M
33. T. Yu and B. Cheong, "Phase II: SBIR A16-028:Miniature, Software-defined Man-Portable Doppler
34. Radar (MPDR) for Atmospheric Measurement," Helios Remote Sensing Systems Inc., $164K
35. M. Xue, K. Brewster, C. Zhang, F. Kong, Y. Jung, "Continued Enhancements to FV3 Model with Advanced Physics through CCPP and Convective-Scale Data Assimilation into GSI and JEDI for Convection-Allowing Forecasting and Evaluations through Hazardous Weather Testbed towards Accelerated Operational," NOAA, $200K
36. N. Kaib, "The Formation and Evolution of Multiple Protostar Systems," NSF, $288K
37. X. Wang, "Scale-dependent Covariance Localization for
38. FV3GDAS 4DEnVar Data Assimilation System to
39. Improve Global, Hurricane and Cloud Predictions," NOAA, $194K
40. L. Krumholz, K. D. Hambright, "Dimensions: Collaborative Research: Leveraging Biogeography and Seasonality to Explore Underlying Mechanisms in the Biodiversity of the Cyanobacterial Bloom Microbial Interactome," NSF, $2M (total), $810K (OU)
41. D. Blume, "Spin and Spatial Correlations of Few-body Systems," NSF, $95K
42. X. Wang, Y. Wang, "Development and Research of GSI based Dual Resolution EnVar Data Assimilation for Convective-Scale," NOAA, $106K
43. Y. Shao, "Rational Design of Pro-apoptotic Bax/Bak Inhibitors," OK-CAST, $45K
44. Y. Shao, "Accelerated Free Energy Calculations on the Catalytic Activity of Mercuric Reductase," ORAU, $5K
45. D. K. Walters, "Collaborative Research: Development of Low Order Modeling Methods for Oscillating Foil Energy Harvesting based on Experimental and Computational Fluid Dynamics," NSF, $160K
46. M. Xue, G. Zhang, X. Xue, "Development and Evaluation of an Ensemble Kalman Filter
47. (EnKF)-Based," Beijing Meteorological Service, $50K
48. S. Cavallo, "Tropopause polar vortices and multi-scale Arctic predictability," ONR, $60K
49. A. Johnson, X. Wang, "Understanding and Improving the Predictability of Arctic Meso- and Synoptic-scale Cyclones through Multi-scale Ensemble based Data Assimilation and Ensemble Forecast," ONR, $162K
50. J. Tobin, "NRAO Student Observing Support Award to Nickalas Reynolds: Are Close Binaries Formed Through Disk Fragmentation?" NRAO, $29K

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External Research Grants (cont'd)

51. H. Moreno, "Human-scale surface energy budget and ground thermal responses to soil moisture and vegetation change in flat and complex terrain," ARO, $92K
52. G. Kosmopoulou, "(EAGER) Collaborative Research DCL: HBCU Network effects, competition and survival of small and minority owned firms in public procurement," NSF, $76K
53. E. Martin, C. Homeyer, M. Richman, R. McPherson, J. Furtado, "PREEVENTS Track 2: Collaborative Research: Developing a Framework for Seamless Prediction of Sub-Seasonal to Seasonal Extreme Precipitation Events in the United States," NSF, $1.8M
54. B. Moore, J. Basara, K. Brewster, K. Kloesel, B. Illston,
55. F. Carr, K. Brewster, P. Klein, "National Mesonet Program," Earth Networks Inc/Stinger Ghaffarian Technologies, $744K
56. P. Skubic, P. Gutierrez, M. Strauss, B. Abbott, "OU Contribution to the ATLAS Southwest Tier 2 Computing Center," DOE, $148
57. D. Papavassiliou, "Investigation of the effects of turbulent flow on energy and mass transfer close to solid surfaces," NSF, $326K
58. D. Papavassiliou, "Stability of Surfactant Systems for Oil Mobilization," ACS PRF, $110K
59. K. Brewster, F. Carr, "Prototyping and Evaluating Key Network-of-Networks Technologies: Project Extension," NOAA, $194K
60. K. Dresback, R. Kolar, "Steps Towards Automating River Connections and Addressing Precipitation in ADCIRC," NOAA, $101K
61. K. Calhoun, D. Kingfield, K. de Beurs, "Storms, Forms, and Complexity of Urban Canopy," NASA, $21K
62. K. Calhoun, D. MacGorman,"Storm Tracking and Lightning Cell Clustering Using Geostationary Lightning Mapping Data for Data Assimilation and Forecast Applications," NOAA, $110K
63. N. Kaib, "EW Step 2: Understanding the Evolution of the Primordial Kuiper Belt During the Solar System's Early Years," NASA, $315K
64. B. Wawrik, "Primer Validation and Design Project," Total S.A., $112K
65. B. L. Cheong, "The Weather Butler Project," Weathernews Americas Inc, $145K
66. D. Bodine, R. Palmer, S. Torres, B. L. Cheong, C. Fulton, "Understanding the Relationship Between Tornadoes and Debris Through Observed and Simulated Radar Data," NSF, $787K

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$702M total, $317M to OU

External Research Grants (cont'd)

67. J. White (OSU), S. Crossley, B. Wang, "Understanding an Active and Beneficial Role for Water in Solid-Acid Catalyzed Hydrocarbon Chemistry," $598K (OU)
68. M. Elwood Madden, "Raman Spectral Database of Aqueous Solutions for Planetary Science," NASA, $381K
69. M. Nanny, I. Sellers, J. Vogel, J. Kelly, R. Ramesh, "MRI: Acquisition of an Inductively Coupled Plasma Mass Spectrometer (ICP-MS) System to Enable Elemental Analysis in Research, Training and Education," NSF, $397K
70. A. McGovern, C. Homeyer, C. Potvin, T. Smith, "EAGER: Improving our Understanding of Supercell Storms through Data Science," NSF, $169K
71. F. Wang, U. Hansmann, "Efficient and Accurate Force Fields for Computer-Aided Drug Design," NIH, $448K
72. U. Hansmann, "Structural Transitions in Proteins and Protein Assemblies," NIH, $1.18M
73. E. Bridge, J. Kelly, X. Xiao, "Enhancing and disseminating miniaturized tracking technology for widespread use on small migratory songbirds," NSF, $303K
74. M. A. Terr (U New Orleans), R. Schmehl (Tulane U), A. V. Callaghan (OU), J. M. Suflita (OU), "Effect of Photochemistry on Biotransformation of Crude Oil," BP, $1.47M
75. M. Xue, A. Fierro, E. Mansell, D. MacGorman, G. Zhao, "Assimilation of High-Frequency GOES-R Geostationary Lightning Mapper (GLM) Flash Ex-tent Density Data in GSI-Based EnKF and Hybrid for Improving Convective Scale Weather Predictions," NASA, $599K
76. A. Fierro, J. Gao, A. Clark, E. Mansell, C. Ziegler, D. MacGorman, Y. Wang, A. Lai, "Real time assimilation of GOES-16 total lightning into the NSSL 3DVAR code to improve 0-12h forecasts of high impact weather events at cloud resolving scales," NOAA, $250K
77. N. Yussouf, M. Erickson (NWS), P. Skinner, A. Fierro, K. Wilson, ""Development and NWS Forecaster Evaluation of a Convective-scale Ensemble System for Probabilistic Heavy Rainfall and Severe Weather Forecasts, NOAA, $417K
78. A. Moore, "Preliminary study of genetic diversity in Grindelia ciliata, a promising biofuel crop native to Oklahoma," OCAST, $100K
79. D. Resasco, B. Wang, "Hydrophobic enclosures in bio-inspired nanoreactors for enhanced phase selectivity. A combined experimental/theoretical approach," DOE, $650K

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External Research Grants (cont'd)

80. M. Xue, G, Zhang, "Assimilation of High Frequency GOES-R Geostationary Lightning Mapper (GLM) Flash Ex-tent Density Data in GSI-Based EnKF and Hybrid for Improving Convection Scale Weather Predictions," NOAA, $581K
81. Y. Jung and M. Xue, "Impact of Assimilating Polarimetric Phased Array Radar Observations on Convective-scale Numerical Weather Prediction Model for Severe Weather Forecasts", NOAA, $346K

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External Research Grants (cont'd)

82. R. Palmer, B. Cheong, C. Fulton, J. Salazar, H. Sigmarsson, M. Yeary, T. Yu, Y. Zhang, "," NOAA NSSL, $2.51M
83. T. Yu, J. Salazar, C. Fulton, H. Bluestein, R. Palmer, B. Cheong, M. Biggerstaff, B. Isom, J. Kurdzo, R. Doviak, X. Wang, M. Yeary, "MRI: Development of C-band Mobile Polarimetric Imaging Radar," NSF, $3.1M
84. R. Palmer, B. Cheong, C. Fulton, J. Salazar, H. Sigmarsson, M. Yeary, T. Yu, G. Zhang, Y. Zhang, "ARRC Demonstrator Development Activities for the MPAR Program: CPPAR and Horus," NOAA NSSL $2.42M
85. R. Palmer, B. Cheong, "Electromagnetic Sensor Research & Development," Nanowave Technologies, $1.5M
86. S. Wolff, J. Bottum, D Atkins, H. Neeman, "EAGER: Fact-Gathering and Planning for a National-Scale Cyberpractitioner Program," NSF, $41K
87. G. Monaco et al, "The Role of Regional Organizations in Improving Access to the National Computational Infrastructure," NSF, $50K
88. J. Towns et al, "XSEDE: eXtreme Science and Engineering Discovery Environment (supplement)," NSF $3.7M
89. J. Bottum, M. Livny, H. Neeman, N. Tsinoremas, "RCN: Advancing Research and Education Through National Network of Campus Research Computing Infrastructures – The CaRC Consortium," NSF, $748K
90. J. Towns et al, "XSEDE 2.0: Integrating, Enabling and Enhancing National Cyberinfrastructure with Expanding Community Involvement," NSF, $110M
91. J. Neeman, J. Bottum, D. Atkins, D. Brunson, S. Wolff, "Cyberinfrastructure Leadership Academy," NSF, $49K
92. F. Kong, M. Xue, "Technical Support to the Storm-Scale Numerical Weather Prediction Capability for Shenzhen Meteorological Bureau," Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, $173K
93. B. Wawrik, Z. Yang, L. Atkinson, "Collaborative Research: Creatine Cycling in Marine Bacterial and Phytoplankton Assemblages," NSF, $362K
94. E. Bridge, "Life history, kinship, and the evolution of alternative female reproductive strategies," $3K
95. M. Biggerstaff;, "Optimizing radar guidance for triggered lightning," DARPA, $200K

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External Research Grants (cont'd)

96. C. Ziegler, M. Biggerstaff, M. Coniglio., "Measurement and analysis of nocturnal mesoscale convective systems and their stable boundary layer environment during PECAN," NSF,. $583K
97. M. Biggerstaff;,"Impact of cloud dynamics on chemical and electrical properties of storms observed during DC3," NSF, $661K
98. K. Nicholas, "Deoxygenation and Reductive Coupling of Alcohols Catalyzed by Oxo-Metal Complexes," NSF. $405K
99. S. Schroeder, N. Sloat, "Blue Water Student Internship Program," $5K
100. S. Schroeder, "Protein and Metal Ion Binding in Viral RNA, HIV Accessory and Regulatory Complexes (HARC)," NIH, $25K
101. L. Ding, "RII Track-2 FEC: Innovative, Broadly Accessible Tools for Brain Imaging, Decoding, and Modulation," NSF, $6M
102. L. Ding, "Development of Imaging and EEG Biomarkers to Refine Neuromodulation Treatment Targets in MdDS," LIBR via NdDS, subaward PI, $55K
103. L. Ding, "Development of the EEG Neuroergonomics Toolbox or EEGNT," FAA, $243K
104. J. P. Shaffer, "Atom Surface Interactions and Hybrid Quantum Systems for Quantum Engineering Applications," AFOSR, $750K
105. J. P. Shaffer, "High Sensitivity Absolute Electric Field Sensing with Atoms," National Reconnaissance Office, $309K
106. J. P. Shaffer, "Control of Rydberg Interactions and Exotic States of Matter," NSF, $472K
107. M. J. Wenger, "Building a unified theory methodology for identification of elementary cognitive systems," NSF, $364K
108. B. Wang et al, "High Efficiency Flexible Dilute Nitrides Solar Cells for Space Applications," NASA EPSCoR, $750K
109. D. LaDue, "REU Site: Real-World Research Experiences at the National Weather Center," NSF, $885K
110. K. Marfurt, "3D Seismic Attribute Analysis using AASPI Prestack Technology," Korea Institute of Geoscience Mineral Resources, $35K
111. B. Moore, "National Mesonet Program 2015-2018," Global Science Technology Inc, $473K
112. S. Cavallo, "Multi-scale Predictability with a New Coupled Non-hydrostatic global model over the Arctic," DOD-ONR, $273K

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External Research Grants (cont'd)

113. X. Chen, "Multi-scale validation of earthquake source parameters to resolve any spatial, temporal or magnitude-dependent variability at Parkfield, CA, "NSF, $224K
114. J. Ruyle, "Electrically Small Antenna Design Tool," U.S. Federal Govt, $110K
115. J. Ruyle, "Two-Dimensionality for Conformal Multi-Platform Use," DARPA, $499K
116. X. Wang, "Ensemble Kalman Filter and Hybrid Data Assimilation for Convective-Scale," $73K
117. X. Wang, "Developing and Evaluating GSI-based EnKF-Variational Hybrid Data Assimilation for NCEP NAMRR to Improve Convection-Allowing Hazardous Weather Forecast," NOAA, $123K
118. X. Wang, "Hybrid Data Assimilation for Convective-Scale," NOAA, $99K
119. X. Wang, "Improving Global and Hurricane Prediction b Using Minimum-Cost Large Ensemble in GFS 4DEnVar Hybrid Data Assimilation System," NOAA, $389K
120. X. Wang, "Tzero Revolution," Weathernews Americas, Inc., $59K
121. X. Wang, "Improving the Understanding and Prediction of Nocturnal Convection through Advance Data Assimilation and Ensemble Simulation in PECAN," NSF, $602K
122. J. Dyer, "Heart Rate Variability Assessment as an Indicator of Health," OUHSC, $121K
123. M. Zaman, "Southern Plains Transportation Center (SPTC)," USDOT, $7.7M
124. M. Zaman, "Matching Support for The Southern Plains Transportation Center," State of Oklahoma, Dept of Transportation, $3M
125. K. De Beurs, "Storms, Forms, and Complexity of the Urban Canopy: How Land Use, Settlement Patterns, and the Shapes of Cities Influence Severe Weather," NASA, $437K
126. E. Baron, "Models of Interacting Supernovae: Probing the Circumstellar Environment," NASA, $381K
127. A. Fierro, K. Calhoun, E. Mansell, C. Ziegler, D. MacGorman, J. Gao, "Assimilation of GOES-R total lightning into GSI to improve short-term forecasts of high impact weather events at cloud resolving scales," NOAA, $230K
128. M. Xue, K. Brewster, Y. Jung, , "Advanced Data Assimilation and Prediction Research for Convective-Scale 'Warn-on-Forecast'," NOAA, $450K
129. M. Xue, F. Kong, Y. Jung, N. Snook, "mproving Initial Conditions and their Perturbations through Ensemble-Based Data Assimilation for Optimized Storm-Scale Ensemble Prediction in Support of HWT Severe Weather Forecasting," NOAA, $249K

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External Research Grants (cont'd)

130. M. Xue, K. Brewster, F. Kong, "Storm-Scale Ensemble Prediction Optimized for Heavy Precipitation Forecasting in Support of the Hydrometeorological Testbed (HMT)," NOAA, $236K
131. J. Kelly, E. Bridge, P. Chilson, A. McGovern, K. deBeurs, J. Reedy, L. Jervis, "NRT: Aeroecology as a testbed of interdisciplinary STEM training," $2.95M
132. F. Carr, J. Brotzge, "National Mesonet Program", GST and Earth Networks, $50K
133. F. Carr, K. Brewster, "National Mesonet Program," $100K
134. F. Carr, J. Brotzge, K. Brewster, "Network of Networks: Preliminary Study," NOAA/NWS Office of Science and Technology, $210K

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External Research Grants (cont'd)

135. J. van de Lindt, B. Ellingwood, A. Cerato, N. Wang, C. Nicholson et al, "NIST Center for Risk-Based Community Resilience Planning," $1.37M
136. J. van de Lindt, A. Cerato, N. Wang, "A Risk-Informed Decision Framework to Achieve Resilient and Sustainable Buildings that Meet Community Objectives," NSF, $380K
137. J. Straka, K. Kanak, "Challenges in understanding tornadogenesis and associated phenomena," NSF, $750K
138. J. Straka, "Challenges in understanding tornadogenesis and associated phenomena (supplement)," NSF, $29K
139. P. Kirstetter, B. L. Cheong, T.-Y. Yu, "Deployment of a Novel Solid-state Polarimetric Weather Radar for Hydrology," NSF, $87K
140. B. L. Cheong, R. D. Palmer, "Development of a Novel Solid-State Polarimetric Weather Radar PX-10,000," Nanowave Technologies, Inc., $550,000,
141. K. Nicholas, "Catalytic Deoxydehydration," DOE, $438K
142. M. Libault, "CAREER: Exploring the Transcriptional Regulatory Networks Controlling the Early Stages of Legume Nodulation," NSF, $1.1M
143. B. Shiau, D. Papavassiliou, J. Harwell, "Interfacially active SWNT/silica nanohybrids," Advanced Energy Consortium, $419K
144. S. Crowell, B. Moore, Y. Luo, "Improved Parameterization of Carbon Cycle Models Across Scales Using OCO-2 Measurements of XCO2 and SIF," NASA, $477K
145. B. Wawrik, "MGMIC: Metagenome Analysis for Corrosion Tracking," OU Biocorrosion Center, $131K
146. B. Wawrik, A. Callaghan, "Development of Techniques for the Quantification of Functional Gene Expression Associated with Biocorrosion," OU Biocorrosion Center, $37K
147. B. Wawrik, D. Bronk, "Collaborative Research: Determining Rates of Group-specific Phytoplankton and Bacterial Uptake of Inorganic and Organic Nitrogen by means of Stable Isotope Techniques," NSF, $770K
148. A. Callaghan, B. Wawrik, J. Suflita, "Biochemistry and Genetics of Anaerobic Alkane Metabolism: Interrogation of Sulfate-Reducing Isolates and Enrichments Using Genome-Enabled and Proteomic Approaches," NSF, $725K
149. B. Wawrik, "Determining Rates of Group-specific Phytoplankton and Bacterial Uptake of Inorganic and Organic Nitrogen by Means of Stable Isotope Techniques," NSF, $10K

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External Research Grants (cont'd)

150. B. Wawrik, G. Sinclair, "Transcriptomic Response to Nutrient Depletion of Marine Dinoflagellates," Gordon and Betty Moore Foundation, $70K in-kind
151. Joseph M. Suflita. Co-PIs: A. Callaghan, L. Gieg, Z. He, B. Wawrik, J. Zhou, "Extending Knowledge of Anaerobic Hydrocarbon Metabolism: Linking Metabolism, Functional Gene Molecular Markers and the GeoChip," ConocoPhillips, $999K
152. A. Striolo, "Anti-Agglomerants Performance in Hydrates Management: Fundamental Insights," EPSRC, £330K
153. A. Striolo et al, "ShaleXenvironmenT," European Commission, €3M
154. A. Striolo, "Flow Transport in Shale Rocks," Halliburton, £69K
155. A. Striolo, D. Cole, "Nanopore Confinement of C-H-(O) Mixed-Volatile Fluids Relevant to Subsurface Energy Systems," DOE, £60K
156. A. Striolo, "Hydrates Inhibitor Research," Halliburton, £69K
157. A. Striolo, "Fraccing Fundamentals," Marie Curie Career Integration Grant, €100K
158. J. Li, "Targeting Mosquito FREP1 Protein for Malaria Control," NIH, $424K
159. J. Li, "CAREER: Genetic and Molecular Mechanisms of Parasite Infection in Insects," NSF, $783K
160. D. Atkins, J. Li, "Memory T cell-mediated protecting against malaria," NIH, $76K
161. J. Li, "Genomics analysis of Anopheles gambiae mosquitoes to Plasmodium falciparum parasite Infection," OCAST, $135K
162. P. Klein, P. B. Chilson, E. Fedorovich, A. Shapiro, D. Turner, "Low-level jets in the nocturnal stable boundary layer: structure, evolution, and interactions with mesoscale atmospheric disturbances," NSF, $984K
163. E. Bridge, "The Electronic Transponder Analysis Gateway (ETAG): An Animal Behavior Observatory," NSF, $315K
164. B. Capogrosso-Sansone, "Multi-Worm Algorithm for Path Integral Quantum Monte Carlo in Ultracold Dipolar Gases, NSF, $293K
165. K. Dresback, R. Kolar, "Performance Optimization of the Advanced Circulation (ADCIRC) Model," Intel Parallel Computing Center, $300K
166. U. Hansmann, "Modeling the molecular mechanism of amyloid oligomer and fibril self assembly," OCAST, $90K

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External Research Grants (cont'd)

167. J. Wicksted, A. Knoedler et al, "Adapting Socio-ecological Systems to Increased Climate Variability," NSF, $20M + $4M Regents (total), $7.0M + $1.9M Regents (OU)
168. M. Engle et al, "Resilience and vulnerability of beef cattle production in the Southern Great Plains under changing climate, land use and markets," $9.5M (total), $1.9M (OU)
169. R. Palmer, G. Zhang, Y. Zhang, T. Yu, M. Yeary, S. Karimkashi, C. Fulton, B. Cheong, "Multi-Mission Phased Array Radar Risk Reduction: A Collaborative Effort with the ARRC at the University of Oklahoma," NOAA, $1.5M
170. R. Palmer, G. Zhang, Y. Zhang, T. Yu, M. Yeary, Y. Hong, J. Crain, P. Chilson, "Next Generation Weather Radar Technology," NOAA, $900K
171. R. Palmer, D. Bodine, S. Torres, B. Cheong, C. Fulton, "Understanding Polarimetric Radar Tornadic Debris Signatures Using Modeling, Simulations, and Field Measurements,," NSF, $860K
172. A. Callaghan, "Elucidation of Alkene Metabolism in Two Sulfate-reducing Isolates via Metabolite Profiling and Transcriptomics," NSF, $848K
173. D. LaDue, K. Kloesel, "REU Site: Research Experiences for Undergraduates at the National Weather Center," NSF, $822K
174. J. Brotzge, M. Xue, N. Snook, Y. Jung, A. McGovern, "The Severe Hail Analysis, Representation, and Prediction (SHARP) Project," NSF, $819K
175. L. Krumholz, J. Zhou, M. McInerney, J. Wall, "Characteristics of H2 Producing Biological Systems Operating at 1 nM H2 Concentration," DOE, $819K (total), $693K (OU)
176. P. Chilson, E. Fedorovich, R. Palmer, "Studies of the Atmospheric Boundary Layer Using Numerical Simulations Coupled With Radar/Sodar-Based Field Experiments," NSF, $757K
177. M. Xue, K. Brewster, F. Kong, "Establishment of Precision Weather Analysis and Forecasting Systems (PWAFS) for the Jiangsu Province Meteorological Bureau (JSMB)," NRIET, $505K
178. H. Neeman, D. /Brunson, J. Deaton, S. Radhakrishnan et al, "CC-NIE: OneOklahoma Friction Free Network," NSF, $500K
179. F. Kong, M. Xue, "Further Development of the Storm-Scale Numerical Weather Prediction Capability for Shenzhen Meteorological Bureau," Shenzhen, $479K
180. E. Bridge, J. Kelly, "Optimizing Grassland Bird Conservation in an Era of Biofuel Production," USDA, $466K

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External Research Grants (cont'd)

181. R. Kolar, "Dynamic Integration of Natural, Human, and Instructure Systems for Hurricane Evacuation and Sheltering," NSF, $456K
182. L. Ding, "Neuroimaging Study of Mental Fatigue," FAA, $430K
183. U. Hansmann, "Development of Generalized-Ensemble Algorithms and their Application in Protein Studies," NSF, $410K
184. L. Ding, "Large-Scale Computational Neuroimaging of Brain Electrical Activity," NSF CAREER, $400K
185. P. Attar, "Optimal Spatiotemporal Reduced Order Modeling for Nonlinear Structural Dynamics," NSF, $360K
186. B. L. Cheong, Y. Jung, G. Zhang,, "Support for X-band Solid-state Weather Radar Development," WeatherLink, $334K
187. P. Vedula, P. J. Attar, "Fast simulations of turbulent flows based on spatiotemporal statistical information," NSF, $330K
188. M. Xue, K. Brewster, F. Kong, "Development of a Short-Range Realtime Analysis and Forecasting System based on the ARPS for Taiwan Region Year 3 (IA#24) and Year 4 (IA #25)," NOAA, $310K
189. E. Bridge, J. Kelly, X. Xiao, "Enhancing and disseminating miniaturized tracking technology for widespread use on small migratory songbirds," NSF, $302K
190. J. Kelly, L. Gruenwald, P. Chilson, V. Lakshmanan, E. Bridge, "Advancing Biological Interpretations of Radar Data," NSF EAGER, $299K
191. L. Ding, "High-Resolution Noninvasive Computational Neuroimaging," OCAST, $283K
192. F. Kong, "Further Development to the Storm-Scale Numerical Weather Prediction Capability for Shenzhen Meteorological Bureau," SIATCAS, $251K
193. R. Slatt, Consortium from 14 oil and gas company, $245K
194. J. Brotzge, F. Carr, "Protyping and Evaluating Key Network-of-Networks Technologies: Project Extension," NOAA, $210K
195. Y. Jung, M. Xue, G. Zhang, "Development of a Polarimetric Radar Data Simulator for KLAPS," KMA, $176K
196. J. Ruyle, "BRIGE: Investigation of Slot Antenna Recon figuration Mechanisms," NSF, $175K
197. J. Brotzge, F. Carr, "CASA Warning System Innovation Institute," U Mass, $160K

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External Research Grants (cont'd)

198. J. Kelly, "Developing Innovative Tools to Use Weather Radar Data to Assess and Monitor Impacts of Existing and Future Energy Facilities on Aerial Faunas in California," CIEE, $150K (total), $49K (OU)
199. J. Brotzge, F. Carr, "Prototyping and Evaluating Key Network-of-Networks Technologies," NOAA, $145K
200. T. Yu, Y. Wang, R. Palmer, B. Cheong, „Algorithm development for solid-state polarimetric weather radars," Toshiba, $130K
201. M. Xue, K. Brewster, F. Kong, "Establishment of an Urban-Scale Weather Forecasting System (USWFS) for the Su Zhou Meteorological Bureau (SZMB)," $127K
202. L. Ding, "Neurophysiological Assessment of Mental Fatigue and Cognitive Performance," FAA, $115K
203. K. Dresback, R. Kolar, "Next Generation ADCIRC Tidal Database: Phase 2 - West Coast," DOD, $75K
204. K. Dresback, R. Kolar, "Next Generation ADCIRC Tidal Database," NOAA, $75K
205. P. Risser, J. Duckles, J. Bratton, NSF I-Corps, $50K
206. R. Palmer, M. Yeary, "System and Software Engineering Support Services for CGI," CGI, $46K
207. M. Yeary, M. Xue, "GRDS: Request to support a Native American Indian graduate student beginning his PhD within the CASA Engineering Research Center," NSF, $32K

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External Research Grants (cont'd)

208. I.Y. Akkutlu, J. Callard, C. Rai, C. Sondergeld, "OU Shale Gas and Unconventional Reservoir Research Cooperative," $2.8M per year
209. J. P. Shaffer, T. Pfau, "A Rydberg Atom Electric Field Sensor," DARPA-ARO, $1.18M (total),$1.06M (OU)
210. Y. Luo, "Data Synthesis and Data Assimilation at Global Change Experiments and Fluxnet toward Improving Land Process Models," DOE, $1.05M
211. F. Kong, M. Xue, K. Brewster, "Establishment of an Improved Numerical Weather Forecasting System for Chongqing Meteorological Service," Chongqing Institute of Green and Intelligent Technology, China, $852K
212. G. Zhang, M. Xue, B. L. Cheong, T. J. Schurr, "Advanced Study of Precipitation Microphysics with Multi-Frequency Polarimetric Radar Observations and Data Assimilation," NSF, $637K
213. J. P. Shaffer, "A Quantum Hybrid System for Linking Rydberg Atom Quantum Gates. NSF, $465K
214. J. P. Shaffer, "Rydberg Atom Interactions and Collective Behavior," NSF, $436K
215. J. P. Shaffer, "Interactions in Cold Rydberg Gases," NSF, $422K
216. J. Cruz, "CIF: Small: Two-Dimensional Channel Modeling, Detection and Coding for Shingled Magnetic Recording," NSF, $418K
217. M. Yuan, "Supplement to Developing and Evaluating the Effectiveness of the Location-based Offender Monitoring System for Offender Supervision," National Institute of Justice, $396K
218. X. Wang, M. Xue, F. Kong, "Optimal Design of Multi-scale Ensemble Systems for Convective-Scale Probabalistic Forecasting," NSF, $359K
219. F. Kong, M. Xue, "Further Development of the Storm-Scale Numerical Weather Prediction Capability for Shenzhen Meteorological Bureau," Shenzhen Institute of Advanced Technology, China, $251K
220. J. Snow & F. Fondjo Fotou (Langston U), "MRI: Acquisition of a High Performance Computing Cluster for Research and Education," NSF, $250K
221. M. Xue, K. Brewster, Y. Jung, "Advanced Data Assimilation and Prediction Research for Convective-Scale Warn-on-Forecast," NOAA, $243K
222. I.Y. Akkutlu, "Multi-scale Characterization of Transport Phenomena in Shales for Improved Gas Recovery," Devon Energy, $200K
223. M. Xue, R. McPherson, J. Brotzge, B. Moore, "Very High-Resolution Dynamic Downscaling of Regional Climate and Hydrology," USG, $24K
224. J. Brotzge, F. Carr, "CASA DFW Testbed Enchancement: Task B of National Mesonet Program (NWP)," Earth Networks Inc., $25K

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External Research Grants (cont'd)

225. R. Voronov, "Intra-Thrombus Chemo-Transport and Local Stress Mechanics under Flow," American Heart Association Postdoctoral Fellowship, $150K
226. X. Wang, M. Xue, "Improving High Resolution Tropical Cyclone Prediction using GSI-based Hybrid Ensemble-Variational Data Assimilation System for HWRF," NOAA, $150K
227. I. Y. Akkutlu, "Molecular Theory of Capillarity in Kerogen - A Multi-component Approach to Predict Shale Gas/Liquid In-place and Transport in Nanopores," Devon Energy, $150K
228. S. Dhall, L. Gruenwald, "Autonomous Database Partitioning using Data Mining for High End Computing," NSF, $150K
229. M. Xue, K. Brewster, F. Kong, "Ensemble Simulation of GOES-R Proxy Radiance Data from CONUS Storm-Scale Ensemble Forecasts, Product Demonstration and Assessment at the Hazardous Weather Testbed GOES-R Proving Ground," NOAA, $126K
230. M. Xue, K. Brewster, F. Kong, "Ensemble Simulation of GOES-R Proxy Radiance Data from CONUS Storm-Scale Ensemble Forecasts, Product Demonstration and Assessment at the Hazardous Weather Testbed GOES-R Proving Ground," NOAA, $94K
231. K. Brewster, M. Xue, "High Resolution Data Assimilation for Trajectory Improvement," DOD-Air Force, $79K
232. F. Kong, "CAPS support to the WRF Lightning Forecast Algorithm for the NOAA R3 effort," NOAA GOES-R/Universities Space Research Assn, $48K
233. R. McPherson, M. Shafer, Y. Hong, "Utilization of Regional Climate Science Programs in Reservoir and Watershed Impact Assessments," OSU Water Resources Responses to Climate Change: Pilot Study, $43K
234. P. Attar, "Numerical Simulation of a Membrane Micro Air Vehicle in a Gust Field, Ohio Aerospace Institute, $35K
235. J.R. Cruz, "Signal Processing for Magnetic Recording Channels," Hitachi Global Storage Technologies, Inc., Director, $30K
236. J.R. Cruz, "Equalization, Detection, and Coding Algorithms for Bit Patterned Media Recording," Advanced Storage Technology Consortium, $17K
237. L. Sells, J. Goulden, H. Aboudja, "LittleFe grant," LittleFe project, $2.5K
238. L. Sells, J. Goulden, "Early Adopter Grant," NSF/TCPP, $2.5K

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External Research Grants (cont'd)

239. B. Moore III et al, "Department of the Interior South-Central Regional Climate Science Center," US Dept of the Interior, $3.5M (total), $1.4M (OU)
240. A. Striolo, D. Resasco et al, "Center for Application of Single-Walled Carbon Nanotubes," DOE, $1M
241. J. K. Shen, "CAREER: Electrostatic Mechanisms in Protein Stability and Folding, NSF, $773K
242. Y. Kogan, "Parameterization of cumulus convective cloud systems in mesoscale forecast models," ONR, $594K
243. X. Wang, M. Xue, F. Kong, "Optimal Design of Multi-scale Ensemble Systems for Convective-Scale Probabilistic Forecasting," NSF, $395K
244. R. D. Palmer, T.-Y. Yu, "NMQ and WDSS-II for the KMA radar network: Real-time, effective, and integrated weather products," Space Environment Laboratory, Inc., $361K
245. B. Grady, A. Striolo, "Novel Supramolecular Structures of Laterally Confined Amphiphilic Molecules," NSF, $335K
246. D. Resasco, D. Papavassiliou et al, "Interfacially active SWNT/silica nanohybrids," Advanced Energy Consortium, $331K
247. C. Y. Tang , R. Ramakumar, N. Jiang , "Control and Operation of Large-Scale Wind Farms in the Power System", NSF, $231K
248. J. Shen, "Electrostatic Modulationof Protein Stability and Folding," NIH, $1.4M
249. Y. Wang, "Theoretical Tools for Measuring Dark Energy from Galaxy Clustering," DOE, $230K
250. F. Kong, M. Xue, "Further Enhancement to the Hourly Assimilation and Prediction System (HAPS) for Shenzhen Meteorological Bureau." Shenzhen Institute of Advanced Technology, Chinese Academy of Science, $228K
251. P. Attar, P. Vedula, "Multi-fidelity Modeling and Simulation (M&S) Tool for Nonlinear Aeroelasticity," Advanced Dynamics, $160K
252. B. Eskridge, "CDI-TYPE I: RUI: Emergent Hierarchies of Leaders in Multi-Robot Systems," NSF, $159K
253. A. Striolo, "Mixed-Volatile Fluids Relevant to Subsurface Energy Systems," DOE, $120K
254. P. Skubic, M. Strauss, "OU Contribution to the ATLAS Southwest Tier 2 Computing Center (Supplement)," NSF, $110K
255. P. Attar, "High-Fidelity Computational Aeroelastic Solver Research," Ohio Aerospace Institute, $53K
256. P. Skubic, M. Strauss, "OU Contribution to the ATLAS Southwest Tier 2 Computing Center (Supplement)," NSF, $50K

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External Research Grants (cont'd)

257. P. Skubic, M. Strauss, "University of Oklahoma Contribution to OSG Software Development," Brookhaven National Laboratory, $50K.
258. P. Attar, "Computational Model Development and Experimental Validation Measurements for Membrane-Batten Wing," Ohio Aerospace Institute, $43K
259. A. Striolo, "Reduced Carbon in Earth's Crust and Mantle I," Alfred P. Sloan Foundation, $39K.
260. J. Gao, "Advancing Research on Realtime Weather-Adaptive 3DVAR Analyses with Automatic Storm Positioning and On-demand Capability," NOAA, $36K
261. M. Xue, "Probabilistic Forecasting for Aviation Decision Aid Applications," Impact Technologies,$20K
262. P. Attar, P. Vedula, "Towards Better Modeling and Simulation of Nonlinear Aeroelasticity On and Beyond Transonic Regimes," Advanced Dynamics, $20K
263. P. Attar, P. Vedula, "High-Fidelity Computational Aeroelastic Models in Support of Certification Airworthiness of Control Surfaces with Freeplay and Other Nonlinear Features," Advanced Dynamics, $9K

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External Research Grants (cont'd)

264. H. Neeman, D. Brunson (OSU), J. Deaton (OneNet), J. He (Noble Foundation), D. Schoenefeld (TU), J. Snow (Langston U), M. Strauss (OU), X. Xiao (OU), M. Xue (OU), "Oklahoma Optical Initiative," NSF, $1.17M
265. H. Neeman, M. Jensen, M. Strauss, X. Xiao, M. Xue, E. Baron, K. Dresback, R. Kolar, A. McGovern, R. Palmer, D. Papavassiliou, H. Severini, P. Skubic, T. Trafalis, M. Wenger, R. Wheeler (Duquesne U), "MRI: Acquisition of Extensible Petascale Storage for Data Intensive Research," NSF, $793K
266. D. Resasco, J. Harwell, F. Jentoft, K. Gasem, S. Wang, "Center for Interfacial Reaction Engineering (CIRE)," DOE EPSCoR, $2.4M ($1.97M OU)
267. P. Skubic, M. Strauss, B. Abbott, P. Gutierrez, "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the Large Hadron Collider (LHC) (TASK A) 2010-2013 Renewal," DOE, $2.8M
268. R. Palmer, Y. Zhang, G. Zhang, T. Yu, M. Yeary, Y. Hong, J. Crain, P. Chilson, "Next Generation Phased Array," NSSL, $2M
269. P. Skubic, M. Strauss, B. Abbott, P. Gutierrez, "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the Large Hadron Collider (LHC) (TASK A) 2010-2013 Renewal-Revision," DOE, $1.52M
270. D. Cole, Alberto Striolo, "Structure and Dynamics of Earth Materials, Interfaces and Reactions," DOE, $1.5M ($90K OU)
271. R. Sigal, F. Civan, D. Devegowda, "Simulation of Shale Gas Reservoirs Incorporating the Correct Physics of Capillarity and Fluid Transport," Research Partnership to Secure Energy for America (RPSEA), $1.05M
272. M. Biggerstaff , J. Straka, L. Wicker, Zrnic, Zahari, "MRI Development of C-Band Mobile Polarimetric Weather Radars," NSF, $989K ($439K OU)
273. D. Resasco, D. Papavassiliou et al, "Carbon Nanotube Technology Center," DOE, $925K
274. M. Saha, D. Papavassiliou, A. Striolo, K. Mullen, B. Grady, C. Altan, D. Resasco, "Experimental and theoretical studies of carbon nanotube hierarchical structures in multifunctional polymer composites," DoD-EPSCoR, $897K
275. E. Mansell , J. Straka, C. Ziegler, D. MacGorman, "Numerical modeling studies of storm electrification and lightning," NSF, $817K
276. E. Rasmussen, J. Straka, K. Kanak, "Collaborative Research: Challenges in understanding tornadogenesis and associated phenomena, $755K ($489K OU)
277. J. Straka, K. Kanak, "Challenges in tornadogenesis and associated phenomena," NSF, $584K

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External Research Grants (cont'd)

278. M. Xue, F. Kong, "Advanced Multi-Moment Microphysics for Precipitation and Tropical Cyclone Forecast Improvement with COAMPS," ONR, $592K
279. J. Straka, K. Kanak, "Collaborative Research: Challenges in Understanding Tornadogenesis and Associated Phenomena," NSF, $515K
280. D. MacGorman, E. Mansell, C. Ziegler, A. Fierro, M. Xue, "Techniques for Assimilating Geostationary Lightening Mapper Data and Assessment of the Resulting Impact on Forecasts," NOAA, $415K
281. M. Xue, F. Kong, K. Brewster, X. Wang, "A Partnership to Develop, Conduct, and Evaluate Realtime High-Resolution Ensemble and Deterministic Forecasts for Convective-scale Hazardous Weather: Moving to the Next Level," NOAA CSTAR, $375K
282. M. Xue, K. Brewster, J. Gao, X. Wang, "Advanced Data Assimilation and Prediction Research for Convective-Scale 'Warn-on-Forecast,'" $500K, NOAA
283. X. Wang, "Improving satellite radiance data assimilation using a hybrid ensemble-Gridpoint Statistical Interpolation (GSI) method for global numerical weather prediction," NASA, $276K
284. X. Wang, M. Xue, "Improving NOAA operational global numerical weather prediction using a hybrid-ensemble Kalman filter data assimilation and ensemble forecast system," NOAA, $207K
285. D. Resasco, D. Papavassiliou et al, "Interfacially active SWNT/silica nanohybrids," Advanced Energy Consortium (AEC), $333K
286. D. Oliver, "Data analysis and inversion for mobile nanosensors," AEC, $320K
287. R. Palmer, T. Yu, G. Zhang, M. Yeary, P. Chilson, Y. Zhang, J. Crain, "Advancements in Phased Array Weather Radar Research at OU," NOAA National Severe Storms Laboratory (NSSL), $270K
288. A. Striolo, "The Emergent Behavior of Solid Nanoparticles at Oil-Water Interfaces: A Multi-Scale Thermodynamic Approach to Enable Bio-Oil Upgrade," NSF, $238K
289. M. Xue, K. Brewster, F. Kong, "Development of a Short-Range Realtime Analysis and Forecasting System based on the ARPS for Taiwan Region," NOAA, $200K
290. J. Straka, K. Kanak, "Formative dynamics of the mammatus clouds in thunderstorm cirrus," NSF, $318K
291. M. Yeary, C. Tang, "Computationally Efficient Linear Transforms for Remote Sensing Systems," NSF, $299K
292. A. Striolo, "Probing regular solution theory for mixed amphoteric/ionic surfactant systems by molecular dynamics simulations," ACS, $100K

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External Research Grants (cont'd)

293. K. Brewster, M. Xue, F. Kong, meteorology project, $211K
294. M. Xue, meteorology project, $120K
295. A. McGovern, "Learning to guide search in large state spaces," IBM DARPA, $95K
296. J. Straka, K. Kanak, "Supplement: Challenges in tornadogenesis and associated phenomena (VORTEX2)," NSF, $87K
297. F. Kong, M. Xue, "Establishment of an Experimental Real-Time Short-Term Storm Prediction System for Shenzhen Meteorological Bureau," $58K
298. J. Straka, "Improved Understanding/Prediction of Severe Convective Storms and Attendant Phenomena through Advanced Numerical Simulation," NSF, $58K
299. M. Xue, "Assimilation of NEXRAD Radial Winds in a Regional Mesoscale Model," Miss State U, $79K
300. J. Cruz, R. Todd, "Medium-Density Parity-Check Codes for Tape Systems," INSIC, $36K
301. M. Xue, D. Stensrud, J. Gao, "Advancing Warn on Forecast – Storm-scale Analysis of Vortex 2 Thunderstorms," NSSL, $70K
302. P. Attar, "High-Fidelity Computational Aeroelastic Solver Research," Ohio Aerospace Institute, $60K
303. J. Straka, K. Kanak, "Development of Unmanned Aircraft System for Research in a Severe Storm Environment and Deployment within the VORTEX 2," NSF, $44K
304. J. Cruz, "Equalization, Detection, and Coding Algorithms for Bit Patterned Media Recording Channels," International Storage Industry Consortium (INSIC), $35K
305. J. Cruz, R. Todd, "Signal Processing for Magnetic Recording Channels," private company, $30K
306. P. Attar, P. Vedula, "Deterministic and Statistical Characterization of the Impact of Control Surface Freeplay on Flutter and Limit-Cycle Oscillation (LCO) using Efficient Computational Modeling," Advanced Dynamics, $30K
307. P. Attar, P. Vedula, "Novel Reduced Order in time Models for Problems in Nonlinear Aeroelasticity," Advanced Dynamics, $29K
308. F. Carr, J. Straka, "Severe storm research," Jonathon Merage Foundation, $21K
309. F. Carr, J. Straka, "Severe storm research," Jonathon Merage Foundation, $20K

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External Research Grants (cont'd)

310. A. Striolo, "Electrolytes at Solid-Water Interfaces: Theoretical Studies for Practical Applications," DOE EPSCoR, $450K
311. A. Striolo, Saha, "Experimental and Theoretical Studies of Carbon Nanotube Hierarchical Structures in Multifunctional Polymer Composites," DOD EPSCoR, $450K
312. D. Cole (ORNL), A. Striolo, "Structure and Dynamics of Earth Materials, Interfaces and Reactions," DOE, $1.5M ($75K OU)
313. D. Papavassiliou, A. Striolo, "Effects of Hydrophobicity-Induced Wall Slip on Turbulence Drag and Turbulence Structure," NSF, $230K
314. A. Striolo, D. Resasco, U. Nollert, "Understanding the Interactions between Carbon Nanotubes and Cellular Membranes," NSF, $380K
315. M. Xue, Y. Hong, X. Hu (GSU), "Integrated Weather and Wildfire Simulation and Optimization for Wildfire Management," NSF, $997K ($483K OU)
316. Y. Hong, "Next Generation QPE: Toward a Multi-Sensor Approach for Integration of Radar, Satellite, and Surface Observations to Produce Very High-resolution Precipitation Data," NOAA/OAR/NSSL via CIMMS, $83K
317. R. Palmer, Y. Hong, "Phased Array Technology for Weather Radar Applications," NOAA/OAR/NSSL via CIMMS, $426K
318. Y. Hong, Baski (OSU), "Proactive approach to transportation resource allocation under severe winter weather emergencies," OK-DOT/OTC, $261K ($101K OU)
319. R. Palmer, Y. Hong, "Atmospheric Observations using PhasedArray Technology," $340K
320. Y. Hong, "Toward Improved Flood Prediction and Risk Mitigation: Capacity Building for Africa," NASA, $87K
321. Y. Hong, "Improving NASA Global Hazard System and Implementing SERVIR-Africa," NASA, $272K
322. Y. Hong, "Link SERVIR-Africa Work to NASA Land Information System: Workshop Training and Data Assimilation of GRACE to NASA-OU Hydrologic Model," NASA, $10K
323. R. Adler (NASA), Y. Hong, "Global Hazard (Flood-Landslide) Decision-Support System," NASA, $900K
324. S. Schroeder, "CAREER: Advancing Viral RNA Structure Prediction," NSF, $750K

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External Research Grants (cont'd)

325. P. Attar, "High Fidelity Computational Aeroelastic Analysis of a Flexible Membrane Airfoil Undergoing Dynamic Motion," Ohio Aerospace Institute, $35K
326. P. Attar, "Computational Model Development and Experimental Validation Measurements for Membrane-Batten Wing" Flexible Membrane Airfoil Undergoing Dynamic Motion," Ohio Aerospace Institute, $43K
327. K. Droegemeier, F. Kong, P. Attar, "A Partnership to Develop, Conduct, and Evaluate Realtime High-Resolution Ensemble and Deterministic Forecasts for Convective-scale Hazardous Weather," NOAA, $375K
328. M. Xue, G. Zhang, K. Brewster, F. Kong, "Prediction and Predictability of Tropical Cyclones over Oceanic and Coastal Regions and Advanced Assimilation of Radar and Satellite Data for the Navy Coupled Ocean-Atmosphere Mesoscale Prediction System," ONR/DOD EPSCoR, $476K; OK Board of Regents $100K
329. S. Ahalt, A. Apon, D. Lifka, H. Neeman, "NSF Workshop High Performance Computing Center Sustainability," NSF, $49K ($0 OU)
330. Y. Luo, S. Lakshmivarahan, "Development of a Data Assimilation Capability towards Ecological Forecasting in a Data-Rich Era," NSF, $1.08M
331. Y. Luo, D. Schimmel (NEON), J. Clark (Duke U.), Kiona Ogle (U. Wyoming), S. LaDeau (Cary Institute of Ecosystem Study), "RCN: Forecasts Of Resource and Environmental Changes: Data Assimilation Science and Technology (FORECAST)," NSF, $500K
332. J. Straka, K. Kanak, Davies-Jones, H. Neeman, "Challenges in understanding tornadogenesis and associated phenomena," NSF, $854K
333. P. Risser et al, "A cyberCommons for Ecological Forecasting," NSF, $6M ($2.78M OU)
334. M. Xue, X. Wang, X. Li (OSU), R. Barnes, S. Sanielevici (PSC), H. Neeman, "Enabling Petascale Ensemble-Based Data Assimilation for the Numerical Analysis and Prediction of High-Impact Weather," NSF, $1.2M ($902K OU)
335. P. Skubic, B. Abbott, P. Gutierrez, M. Strauss, "ATLAS Southwest Tier 2 Computing Center," NSF, $600K/year ($60K/year OU)
336. Y. Hong, "Evaluation of NASA Global Hazard System," NASA, $45K

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External Research Grants (cont'd)

337. J Wicksted, F. Waxman et al, "Building Oklahoma's Leadership Role in Cellulosic Bioenergy," NSF EPSCoR, $15M ($5.7M OU)
338. D.S. Oliver, software, $16.7M
339. K.K. Muraleetharan, G. Miller, and A. Cerato, "Understanding and Improving the Seismic Behavior of Pile Foundations in Soft Clays," NSF, $1.15M ($500K OU)
340. K. Droegemeier, F. Kong, "Multisensor Studies of Precipitation for Model Verification and Data Assimilation," U Minn, ($7K OU)
341. K. Droegemeier, M. Xue, F. Kong, "Observing System Simulation Experiments for Airborne Weather Sensors," HRL, ($33K OU)
342. M. Nollert, Scholarship, FD-OMRF, $12K
343. R. Sigal, R. Philp, C. Rai,, S. Shah, R. Slatt, C. Sondergeld, D. Zhang, energy company, $1.9M
344. B. Grady, D. Schmidtke, A. Striolo, A. Cheville, D. Teeters, "Polymer Nanostructures on Solid Surfaces,"$208K ($125K OU)
345. T. Conway, "E. coli Model Organism Resource," UN-Purdue, ($685K OU)
346. R. Kolar, "Storm Surge Modeling in SE Liousiana - 2006," ARCADIS, ($37K OU)
347. D. Cole (ORNL), A. Striolo, "Rates and Mechanisms of Mineral-Fluid Interactions at the Nanoscale," DOE, $1.65M (total), ($55K OU)
348. R. Kolar, "A Prototype Operational Modeling System for Waves, Coastal Currents, Inundation and Hydrologic Flooding for Eastern North Carolina," UN-UNC-CH, ($209K OU)
349. R. Kolar, "A Coupled Regional-Coastal Ocean Model: HYCOM/CG-ADCIRC," DOD-NRL, ($333K OU)
350. M. Xue, "Contribution to WRF Model Development by the Center for Analysis and Prediction of Storms," DOC-NOAA, $821K
351. K. Marfurt, "Improving Geologic and Engineering Models of Midcontinent Fracture and Karst Modified Reservoirs Using 3-D Seismic Attributes," UKCRINC, ($61K OU)
352. P. Attar, P. Vedula, "Novel, Optimal, Physics-based Reduced Order Models for Nonlinear Aeroelasticity," Advanced Dynamics, $49K
353. S. Dhall, "Autonomous Data Partitioning using Data Mining for High Performance Computing," NSF, ($125K OU)

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External Research Grants (cont'd)

354. M. Xue, K. Brewster, J. Gao, "Ensemble-based Data Assimilation for Tropical Storms, and Realtime 3DVAR Analysis for Initial Proof of 'Warn-on-Forecast' Concept: Collaborative Research between CAPS and NSSL," DOC-NOAA, $100,000
355. M. Xue, "Contribution to Model Development and Enhancement Research Team by the Center for Analysis and Prediction of Storms," DOC-NOAA, $620K
356. M. Xue, K. Brewster, "Ensemble-based Data Assimilation for Convective Storms and Hurricanes," DOC-NOAA, $100,000
357. S. Schroeder, "Discovering Satellite Tobacco Mosaic Virus Structure," OCAST, $85K
358. S. Schroeder, "Computational Advacnes Toward Predicting Encapsidated Viral RNA Structure," Pharmaceutical Research and Manufactuerer's Association of America, $60K
359. R. Kolar, "Outer Boundary Forcing for Texas Coastal Models," Texas Water Development Board, $20K
360. K. Milton, "Collaborative Research: Quantum Vacuum Energy", NSF, $250K
361. A. McGovern, "Developing Spatiotemporal Relational Models to Anticipate Tornado Formation," NSF, $500K
362. Y. Kogan, "Midlatitude Aerosol-Cloud-Radiation Feedbacks in Marine Boundary Layer Clouds", ONR, $638K
363. J. Straka, K. Kanak, Davies-Jones, "Challenges in understanding tornadogenesis and associated phenomena," NSF, $854K (total), $584K (OU)
364. Y. Hong, "Improvement of the NASA Global Hazard System and Implement Server-Africa," NASA, $272K
365. J. Antonio, S. Lakshmivarahan, H. Neeman, "Predictions of Atmospheric Dispersion of Chemical and Biological Contaminants in the Urban Canopy." Subcontract No. 1334/0974-01, Prime Agency DOD-ARO, Subcontract through Texas Tech University, Lubbock, TX, Sep. 29, 2000 to Nov. 3, 2001, $75K
366. A. Striolo, "Electrolytes at Solid-Water Interfaces: Theoretical Studies for Practical Applications," OSRHE Nanotechnology, $15K
367. D. Papavassiliou, "Turbulent transport in non-homogeneous turbulence, " NSF, $320K

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External Research Grants (cont'd)

368. K. Droegemeier et al., "Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere," NSF, $17M (total), $5.6M (OU)
369. K. Droegemeier et al., "Linked Environments for Atmospheric Discovery (LEAD)," NSF, $11.25M (total), $2.5M (OU)
370. M. Strauss, P. Skubic et al., "Oklahoma Center for High Energy Physics", DOE EPSCoR, $3.4M (total), $1.6M (OU)
371. M. Richman, A. White, V. Lakshmanan, V. DeBrunner, P. Skubic, "Real Time Mining of Integrated Weather Data," NSF, $950K
372. D. Weber, K. Droegemeier, H. Neeman, "Modeling Environment for Atmospheric Discovery," NCSA, $435K
373. H. Neeman, K. Droegemeier, K. Mish, D. Papavassiliou, P. Skubic, "Acquisition of an Itanium Cluster for Grid Computing," NSF, $340K
374. J. Levit, D. Ebert (Purdue), C. Hansen (U Utah), "Advanced Weather Data Visualization," NSF, $300K
375. D. Papavassiliou, "Turbulent Transport in Wall Turbulence," NSF, $165K
376. L. Lee, J. Mullen (Worcester Polytechnic), H. Neeman, G.K. Newman, "Integration of High Performance Computing in Nanotechnology," NSF, $400K
377. R. Wheeler, "Principal mode analysis and its application to polypeptide vibrations," NSF, $385K
378. R. Kolar, J. Antonio, S. Dhall, S. Lakshmivarahan, "A Parallel, Baroclinic 3D Shallow Water Model," DoD - DEPSCoR (via ONR), $312K
379. R. Luettich (UNC), R. Kolar, B. Vieux, J. Gourley, "The Center for Natural Disasters, Coastal Infrastructure, and Emergency Management," DHS, $699K
380. D. Papavassiliou, M. Zaman, H. Neeman, "Integrated, Scalable MBS for Flow Through Porous Media," NSF, $150K
381. Y. Wang, P. Mukherjee, "Wavelet based analysis of WMAP data," NASA, $150K
382. E. Mansell, C. L. Ziegler, J. M. Straka, D. R. MacGorman, "Numerical modeling studies of storm electrification and lightning," $605K

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External Research Grants (cont'd)

383. K. Brewster, J. Gao, F. Carr, W. Lapenta, G. Jedlovec, "Impact of the Assimilation of AIRS Soundings and AMSR-E Rainfall on Short Term Forecasts of Mesoscale Weather," NASA, $458K
384. R. Wheeler, T. Click, "National Institutes of Health/Predoctoral Fellowships for Students with Disabilties," NIH/NIGMS, $80K
385. K. Pathasarathy, D. Papavassiliou, L. Lee, G. Newman, "Drag reduction using surface-attached polymer chains and nanotubes," ONR, $730K
386. D. Papavassiliou, "Turbulent transport in non-homogeneous turbulence, " NSF, $320K
387. C. Doswell, D. Weber, H. Neeman, "A Study of Moist Deep Convection: Generation of Multiple Updrafts in Association with Mesoscale Forcing," NSF, $430K
388. D. Papavassiliou, "Melt-Blowing: Advance modeling and experimental verification," NSF, $321K
389. R. Kol,ar et al., "A Coupled Hydrodynamic/Hydrologic Model with Adaptive Gridding," ONR, $595K
390. D. Papavassiliou, "Scalar Transport in Porous Media," ACS-PRF, $80K
391. M. Xue, F. Carr, A. Shapiro, K. Brewster, J. Gao, "Research on Optimal Utilization and Impact of Water Vapor and Other High Resolution Observations in Storm-Scale QPF," NSF, $880K.
392. J. Gao, K. Droegemeier, M. Xue, "On the Optimal Use of WSR-88D Doppler Radar Data for Variational Storm-Scale Data Assimilation," NSF, $600K.
393. K. Mish, K. Muraleetharan, "Computational Modeling of Blast Loading on Bridges," OTC, $125K
394. V. DeBrunner, L. DeBrunner, D. Baldwin, K. Mish, "Intelligent Bridge System," FHWA, $3M
395. D. Papavassiliou, "Scalar Transport in Porous Media," ACS-PRF, $80K
396. Y. Wang, P. Mukherjee, "Wavelet based analysis of WMAP data," NASA, $150K
397. R. Wheeler et al., "Testing new methods for structure prediction and free energy calculations (Predoctoral Fellowship for Students with Disabilities)," NIH/NIGMS, $24K
398. L. White et al., "Modeling Studies in the Duke Forest Free-Air CO2 Enrichment (FACE) Program," DOE, $730K

OSCER-FACILITATED FUNDING TO DATE:
$702M total, $317M to OU

External Research Grants (cont'd)

399. Neeman, Severini, "Cyberinfrastructure for Distributed Rapid Response to National Emergencies", NSF, $132K
400. Neeman, Roe, Severini, Wu et al., "Cyberinfrastructure Education for Bioinformatics and Beyond," NSF, $250K
401. K. Milton, C. Kao, "Non-perturbative Quantum Field Theory and Particle Theory Beyond the Standard Model," DOE, $150K
402. J. Snow, "Oklahoma Center for High Energy Physics", DOE EPSCoR, $3.4M (total), $169K (LU)
403. M. Xue, F. Kong, "OSSE Experiments for airborne weather sensors," Boeing, $90K
404. M. Xue, K. Brewster, J. Gao, A. Shapiro, "Storm-Scale Quantitative Precipitation Forecasting Using Advanced Data Assimilation Techniques: Methods, Impacts and Sensitivities," NSF, $835K
405. Y. Kogan, D. Mechem, "Improvement in the cloud physics formulation in the U.S. Navy Coupled Ocean-Atmosphere Mesoscale Prediction System," ONR, $889K
406. G. Zhang, M. Xue, P. Chilson, T. Schuur, "Improving Microphysics Parameterizations and Quantitative Precipitation Forecast through Optimal Use of Video Disdrometer, Profiler and Polarimetric Radar Observations," NSF, $464K
407. T. Yu, M. Xue, M. Yeay, R. Palmer, S. Torres, M. Biggerstaff, "Meteorological Studies with the Phased Array Weather Radar and Data Assimilation using the Ensemble Kalman Filter," ONR/Defense EPSCOR/OK State Regents, $560K
408. B. Wanner, T. Conway, et al., "Development of the www.EcoliCommunity.org Information Resource," NIH, $1.5M (total), $150K (OU)
409. T. Ibrahim et al., "A Demonstration of Low-Cost Reliable Wireless Sensor for Health Monitoring of a Precast Prestressed Concrete Bridge Girder," OK Transportation Center, $80K
410. T. Ibrahim et al., "Micro-Neural Interface," OCAST, $135K
411. J. Snow, "Langston University High Energy Physics," $155K (LU)

OSCER-FACILITATED FUNDING TO DATE:
$702M total, $317M to OU

External Research Grants (cont'd)

412. L.M. Leslie, M.B. Richman, C. Doswell, "Detecting Synoptic-Scale Precursors Tornado Outbreaks," NSF, $548K
413. L.M. Leslie, M.B. Richman, "Use of Kernel Methods in Data Selection and Thinning for Satellite Data Assimilation in NWP Models," NOAA, $342K
414. J. Gao, K. Brewster, M. Xue, K. Droegemeier, "Assimilating Doppler Radar Data for Storm-Scale Numerical Prediction Using an Ensemble-based Variational Method," NSF, $200K
415. E. Chesnokov, "Fracture Prediction Methodology Based On Surface Seismic Data," Devon Energy, $1M
416. E. Chesnokov, "Scenario of Fracture Event Development in the Barnett Shale (Laboratory Measurements and Theoretical Investigation)," Devon Energy, $1.3M
417. M. Xue, K. Brewster, J. Gao, "Study of Tornado and Tornadic Thunderstorm Dynamics and Predictability through High-Resolution Simulation, Prediction and Advanced Data Assimilation," NSF, $780K
418. A. Striolo, "Heat Transfer in Graphene-Oil Nanocomposites: A Molecular Understanding to Overcome Practical Barriers." ACS Petroleum Research Fund, $40K
419. D.V. Papavassiliou, "Turbulent Transport in Anisotropic Velocity Fields," NSF, $292.5K
420. D. Oliver, software license grant, $1.5M
421. R. Broughton et al, "Assembling the Eutelost Tree of Life – Addressing the Major Unresolved Problem in Vertebrate Phylogeny," NSF, $3M ($654K to OU)
422. A. Fagg, "Development of a Bidirectional CNS Interface or Robotic Control," NIH, $600K
423. M. Xue, J. Gao, "An Investigation on the Importance of Environmental Variability to Storm-scale Radar Data Assimilation," NSSL, $72K
424. JV. Sikavistsas and D.V. Papavassiliou , "Flow Effects on Porous Scaffolds for Tissue Regeneration," NSF, $400K
425. P. Skubic, M. Strauss, et al., "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the LHC," DOE, $503K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

426. Y. Wang, "Science for the Euclid Mission", NASA/JPL, $52K (2018)
427. D. LaDue, K. Kloesel, "EPSCoR Funded Participant in the National Weather Center Research Experiences for Undergraduates Program," Oklahoma EPSCoR, $9K
428. V. Sikavitsas, D. Papavassiliou, "The influence of fluid shear forces, oxygen and nutrient mass transport in the development of bone grafts in perfusion bioreactors," OCAST,, $45K
429. D. Schmidtke, D. Papavassiliou, "Development of a Miniature Right Heart Support Device," NIH, $347K
430. D. Resasco, D. Papavassiliou, "Interfacially active SWNT/silica nanohybrids," Advanced Energy Consortium, $688K
431. B. L. Cheong, T.-Y. Yu, R. .D. Palmer, "Instrumental Support for the Winter Experiment Campaign," SELab Inc, $215K
432. E. Bridge, "CAREER: Unwrapping the Migratory Gene Package," NSF, $760K
433. E. Bridge, "The Electronic Transponder Analysis Gateway (ETAG): An Animal Behavior Observatory," NSF, $315K
434. E. Bridge, "An Open-Source Radio Frequency Identification System for Animal Monitoring," NSF, $331K
435. R. McPherson, E. White, M. Shafer, D. Rosendahl, M. Richman, "Trends in cold temperature extremes and winter weather for the SPTC region," USDOT, $132K
436. R. Palmer, B. Cheong, C. Fulton, J. Salarzar, M. Yeary, T.-Y. Yu, Y. Zhang,. "Meeting the Technical Challenges of the Multi-Mission Phased Array Radar," NOAA, $1.65M
437. M. J. McInerney, L. Krumholz, Bioremediation of Chromium and Arsenic from Industrial Wastewater," Nat'l Academies of Science, $162K
438. M. Coniglio (PI), C. Doswell III, R. J. Trapp
439. "Improved understanding of convective-storm predictability and environment feedbacks from observations during the Mesoscale Predictability Experiment (MPEX)," NSF, $272K
440. Y. Kogan, "Parameterization of Cumulus Convective Cloud Systems in Mesoscale Forecast Models," ONR, $267K
441. S. Schroeder, "Predicting Viral RNA Structures, Function, and Drug Targets from Sequence," OCAST, $145K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

442. L. Ding, "NRI-Small: Robot Assistants for Promoting Crawling and Walking in Children at Risk of Cerebral Palsy," NSF, $1.135M
443. E. Baron, "Collaborative Research: Three-Dimensional Simulations of Type Ia Supernovae Constraining Models with Observations," NSF, $26K
444. H. Neeman, K. Brewster, A. McGovern, H. Severini, T. Yu, M. Atiquzzaman, G. Creager, B. George, Z. Gray, S. Radhakrishnan, P. Skubic, M. Strauss, X. Xiao, M. Xue, "A Model for Advanced Cyberinfrastructure Research and Education Facilitators," NSF, $400K
445. E. Lemley, G. Qian, "MRI: Acquisition of a High Performance Computing Cluster for Research at a Predominantly Undergraduate Institution," NSF, $305K
446. R. Floyd, J. Pei, "Understanding the Behavior of Prestressed Concrete Girders after Years of Service," OK DOT, $327K
447. G. Zhang, S. Arani, "Polarimetric Phased Array Radar Research in Support for MPAR Strategy," NOAA, $438K
448. A. Fierro, M. DeMaria, E. Mansell, C./ Ziegler, D. MacGorman, A.Schumacher, R. Brummer. "Using total lightning data from GLM/GOES-R to improve real-time tropical cyclone genesis and intensity forecasts," NOAA, $268K ($123K to OU)
449. U. Hansmann, "Folding, Mis-folding and Aggregation of Proteins," NIH, $887K
450. G. R. Keller, S. Holloway, D. Devegowda, K. Crain, A. Holland, A. Ghassemi, "4D Integrated Study Using Geology, Geophysics, Reservoir Modeling and Rock Mechanics to Development Assessment Models for Potential Induced Seismicity Risk,." $1.478M
451. J. Gao, D. Stensrud, X. Wang, "Assimilation of Doppler Radar Data with an Ensemble-based Variational Method for Storm-scale NWP," NSF, $481K
452. M. Soe (RSU), "Unitary Qubit Lattice Algorithms for Quantum Turbulence with Non-Abeliam Vortices," NSF, $75K
453. J. Cruz, "Two-Dimensional Channel Modeling, Detection and Coding for Shingled Magnetic Recording," NSF, $419K
454. J. Shaffer, "Laser Stabilization System for Rydberg Atom Physics," Army Research Office, $75K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

455. R. Sani (SDSMT), L. Krumholz, "Building Genome-to-Phenome Infrastructure for Regulating Methane in Deep Environments (BuG ReMaDE)," NSF, $6M (total), $1.4M (OU)
456. A. Striolo (U College London), "Science 4 Clean Energy," European Commission, €12M (not to OU)
457. A. Striolo, D. Blankschtein, "Hydrates Growth and Coalescence: From Molecular Understanding to Useful Models," Royal Society, £12K (not to OU)
458. A. P. Khain (Hebrew U), A. V. Ryzhkov, "Coupling of polarimetric radar and cloud model," BSF, $102K
459. A. V. Ryzhkov, A. P. Khain (Hebrew U), "Investigation of hazardous weather events using polarimetric radar and cloud model," BSF, $111K
460. I. Jirak, H. Brooks, M. Pyle, "Information Extraction and Verification of Numerical Weather Prediction for Severe Weather Forecasting," NOAA, $430K
461. I. Jirak, "Information Extraction and Verification of Convection-Allowing Models for Severe Hail Forecasting," NOAA, $209K
462. I. Jirak, H. Brooks, M. Pyle, "Information Extraction and Verification of Convection-Allowing Models for Tornado Forecasting," NOAA, $297K
463. X. Wang, "OU/WNI Collaborative Work on Assimilation of MURON and Himawari-8 Clear Sky Radiances to Improve Tropical Cyclone Forecast Over the West Pacific," WeatherNews Inc, $136K
464. X. Wang, "GSI based Dual Resolution EnVar Data Assimilation for Convective-Scale 'Warn-on-Forecast'," NOAA, $100K
465. X. Wang, ""MPAR targeting observation research for WoF," NOAA, $362K
466. X. Wang, A. Johnson, A. Clark, "Improving NWS Convection Allowing Hazardous Weather Ensemble Forecasts through Optimizing Multi-Scale Initial Condition (IC) Perturbations," NOAA, $277K
467. X. Wang, A. Johnson, T. Jones, "Assimilation of high resolution GOES-R ABI infrared water vapor and cloud sensitive radiances using the GSI-based hybrid ensemble-variational data assimilation system to improve convection initiation forecast," NOAA, $368K
468. X. Wang, "Further Advancement of HWRF Self-Consistent Ensemble-Variational Hybrid Data Assimilation System to Improve High Resolution Hurricane Vortex Initialization," NOAA, $377K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

469. X. Wang, "Advancing the Assimilation of Airborne Hurricane Observations using the GSI-based Hybrid Ensemble-Variational Data Assimilation System for HWRF," NOAA, $294K
470. X. Wang, L. Leslie, "Understanding the Impact of Outflow on Hurricane Intensification through Ensemble-based Data Assimilation and Ensemble Simulation with Multiple Models," ONR, $376K
471. J. P. Shaffer, "Atom Surface Interactions and Hybrid Quantum Systems for Quantum Engineering Applications," AFOSR, $750K
472. J. P. Shaffer, "SBIR," DARPA-SBIR, $15K
473. J. P. Shaffer, "High Sensitivity Absolute Electric Field Sensing with Atoms," NRO, $309K
474. J. P. Shaffer, "US -Brazil Professorship and Lectureship," American Physical Society, $4K
475. J. P. Shaffer, "Control of Rydberg Interactions and Exotic States of Matter," NSF, $473K
476. L. Ding, "Neurophysiological Assessment of Thresholds of Audibility and Loudness in Healthy Persons and Cochlear Implants Users," Hearts for Hearing, $100K
477. D. Myers (ECU), C. Crittell (ECU), "STEM-Double Bridge," NSF via UCO, $335K
478. B. Moore, S. Crowell, "(EVM-2) The geoCARB Mission, NASA, $161M (total), $39M (OU)
479. M. Kaspari, C. Siler, M. Weiser, K. Marshall, M. Miller, "Testing abiotic drivers of activity, abundance, and diversity of ground-dwelling arthropod communities at a continental scale," NSF, $1.5M
480. T. Gamble (Marquette U), C. Siler (OU), J. Daza (Sam Houston State U), M. Heinicke (U Michiga - Dearborn), "From Exaptation to Key Innovation - Evolutionary Insights from Gliding Geckos," NSF, $1.1M (total), $323K (OU)
481. F. Kong, M. Xue, K. Brewster, X. Hu, "Development of a Storm-Scale Ensemble Numerical Weather Prediction System for Chongqing Meteorological Service," Chongqing Inst of Green &Intelligent Tech, Chinese Academey of Sciences, $643K
482. K. Brewster, X. Wang, F. Carr, "Prototyping and Evaluating Key Network-of-Networks Technologies," NOAA, $192K
483. B. Moore, K. Brewster, F. Carr, "CASA DFW Testbed Operations and Data Impacts," Global Science Technology, $97K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

484. M. Xue, X. Hu, Y. Jung, K. Brewster, "Assessment and Optimization of YSU-Type Non-Local PBL Scheme for the Prediction of Day- and Night-Time Storm Environment and Tornadic Storms during VORTEX-SE," NOAA, $3M
485. M. Xue, N. Snook, K. Brewster, Y. Jung, F. Kong, "A Partnership to Develop and Evaluate Optimized Realtime Convective-Scale Ensemble Data Assimilation and Prediction Systems for Hazardous Weather: Toward the Goals of a Weather-Ready Nation," NOAA. $450K
486. M. Xue, K. Brewster, Y. Jung, F. Kong, "A Partnership to Develop, Conduct, and Evaluate Realtime Advanced Data Assimilation and High-Resolution Ensemble and Deterministic Forecasts for Convective-scale Hazardous Weather: Towards the Goals of Weather Ready Nation," NOAA, $375K
487. y. Jung, M. Xue, G. Zhang, "Development of a Polarimetric Radar Data Simulator for KLAPS," IN-KMA, $188K
488. K. Brewster, F. Carr, X, Wang, "Protyping and Evaluating Key Network-of-Networks Technologies: Project Extension," ?, $192K
489. B. Moore, M. Xue, A. Bamzai, R. McPherson, "Very-high resolution dynamic downscaling of regional climate for use in long-term hydrologic planning along the red river valley system," DOI-USG, $127K
490. X. Hu, "Collaborative Research: Studies of Chlorine, Bromine and Iodine Chemistry in the Artic, and its Impacts," NSF/U Michigan, $47K
491. N. Snook, M. Xue, Y. Jung, A. McGovern, "Development and Implementation of Ensemble Hail Forecast Products using Multi-moment Microphysics and Machine Learning Algorithms," NOAA, $335K
492. B. Moore, X. Hu, M. Xue, "Atmospheric Carbon and Transport – America," NASA, $168K
493. M. Xue, G. Zhang, "Assessment of the Performance of Beijing Meteorological Service (BMS) X-band Polarimetric Radars and Data Quality Control and Assimilation for the BMS X-band Radar Network," IN-BMS, $120K
494. M. Xue, F. Kong, Y. Jung, C. Liu, "Development and Optimization of Radar-Assimilating Ensemble-Based Data Assimilation for Storm-Scale Ensemble Prediction in Support of HWT Spring Experiments," NOAA, $291K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

495. M. Xue, F. Kong, K. Brewster, N. Snook, "Convection-Allowing Ensemble Prediction for Heavy Precipitation in Support of the Hydrometeorology Testbed (HMT): New QPF Products, Data Assimilation Techniques and Prediction Model," NOAA, $290K
496. M. Xue, Y. Jung, F. Kong, K. Brewster, "Enhancement and Evaluation of NGGPS Model FV3 at Convection-Allowing Resolutions through Hazardous Weather Testbed Spring Experiment towards Accelerated Operational Implementation of FV3 for Mesoscale Applications," NOAA, 194K
497. M. Xue, Y. Jung, "Advanced Data Assimilation and Prediction Research for Convective-Scale 'Warn-on-Forecast," NOAA, $208K
498. L. Gruenwald, "Cost- and Energy-Aware Spatio-Temporal Query Processing in Mobile Clouds," NSF, $200K
499. T. Neeson, H. Moreno, "A Return on Investment Approach to Restoring Natural Flow Regimes in the Red River," Great Plains Landscape Conservation Cooperative, $195K
500. T. Neeson, H. Moreno, "Balancing water usage and ecosystem outcomes under drought and climate change: enhancing an optimization model for the Red River, USGS-SCCSC, $213K
501. D. K. Walters, "Implementation and Validation of Advanced Turbulence Modeling Methods for Liquid Metal Flow in Nek5000," DOE, $756K
502. D. K. Walters, "Multiphysics Simulations of Multi-Component, Off-Design Aircraft Engine Operation Using Dynamic Hybrid RANS/LES," DoD HPC Modernization Program, $164K
503. X. Chen, "Rapid Response for the M5.1 Fairview Earthquake - Detailed Understanding of the Fault Systems in Western Oklahoma," NSF, $14K
504. J. Zhao, L. Xiang, "Photoacoustic Imaging of Myeloproliferative Neoplasms and Associated Vascular Complications," PHF Team Science, $100K
505. L. Xiang, K. Stratton, "Photoacoustic Imaging for Prostate Cancer Detection," OU COE, $10K
506. J. Suflita, K. Duncan, J. Sunner, I. Davidova, "Managing Microbial Corrosion in Canadian Offshore & Onshore Oil Production Operations," U Calgary, $363K

OSCER-FACILITATED FUNDING TO DATE:
$702M total, $317M to OU

External Research Grants (cont'd)

507. A. Ryzhkov (OU), A. Khain (Hebrew U), M. Kumjian (Penn State U), "Investigations of Microphysical Processes in Clouds Using Spectral Cloud Models Coupled with Polarimetric Radar Measurements at Multiple Frequencies," DOE, $431K (total), $231K (OU)
508. A. Ryzhkov (OU), A. Khain (Hebrew U), "Microphysical and Thermodynamic Retrievals in Deep Convective Clouds Using Polarimetric Radar Measurements and Spectral Cloud Models with Explicit Treatment of Aerosol Impact on Convective Processes," DOE, $433K (total), $230K (OU)
509. K. Duncan, J. Suflita, R. Tanner, "BHP/Nalco/OU MIC Project," bhpBilliton, $310K
510. K. Duncan, B. Wawrik, J. Suflita, "Amendment 2 to the Research Agreement FR00008538, Primer Validation and Design Project and RPA Project," TOTAL S.A, $95K
511. W. Freeman, A. Richardson, "High throughput single cell analysis of hippocampus with Alzheimer's Disease," National Institute on Aging. $148K
512. X. Wang, D. Parsons, D. Stensrud, "Improving the Understanding and Prediction of Nocturnal Convection through Advance Data Assimilation and Ensemble Simulation in PECAN," NSF, $708K
513. D. Parsons, H. Bluestein, "Investigation into the mechanisms for the maintenance of nocturnal convective systems," NSF, $599K
514. L. Bumm, L. Huang, "Advanced Real-Space Measurements with STM: Application to Molecular Monolayers, Monolayer Defects, and Surface Chemistry," NSF, $442K
515. F. Kong, K. Brewster, X. Hu, M. Xue, "Development of a Storm-Scale Ensemble Numerical Weather Prediction System for Chongqing Meteorological Service," Chongqing Inst of Green and Intelligent Tech, Chinese Academey of Sciences, $212K
516. N. Nakata, "Ambient Field Analysis of Earthquake Ground Motion at Groningen Gas Field, Stanford University & Shell Oil Company, $47K
517. B. Moore III, K. Brewster, F. Carr, B. Illston, K. Kloesel, "National Mesonet Program," Earth Networks Inc. & Stinger Ghaffarian Technologies, $446K
518. D. K. Walters, "Aerodynamic Flow Deflector for Current and Future Wind Turbines to Increase the Annual Energy Production by 10% and Reduce the Levelized Cost of Energy by 8%," XPEED Turbine Technology & NSF, $131K

OSCER-FACILITATED FUNDING TO DATE:
$702M total, $317M to OU

External Research Grants (cont'd)

519. P. Skubic, B. Abbott, P. Gutierrez, M. Strauss, "OU Contribution to the ATLAS Southwest Tier 2 Computing Center," U Texas Arlington, $30K
520. S. Schroeder, "Metal Ion Interactions in RNA Shapeshifters," Burroughs Wellcome Fund Collaborative Research Travel Grant, $9K
521. E. Baron, "Modeling the Atmosphere of Solar and Other Stars Radiative Transfer with PHOENIX/3D," NASA, $478K
522. U. Hansmann, "Efficient and Accurate Force Fields for Computer-Aided-Drug Design," U Arkansas/NIH, $73K
523. C.-H. Lee, "Computer-Assisted Management and Treatment of Functional Tricuspid Regurgitation," American Heart Association, $30K
524. C. Lewis, P. Lawson, C. Warinner, "Microbial Ecologies of Indigenous Communities," NIH, $743K
525. J. Ruyle, E. Bridge, M. Stacy, "Collaborative Research: IDBR: Type B: An Open-Source Radio Frequency Identification System for Animal Monitoring (NonDeclination; routing ATF)," NSF, $344K
526. X. Wang, "Further Advancement of HWRF Self-Consistent Ensemble-Variational Hybrid Data Assimilation System to Improve High Resolution Hurricane Vortex Initialization,' NOAA, $292K
527. X. Wang, "Development of NWS convective scale ensemble forecasting capability through improving GSI-based hybrid ensemble-variational data assimilation and evaluating multi-dynamic core approach," NOAA, $449K
528. B. Holt, "NF-Y Transcription Factor Roles in Far Red Light Signaling - A First Look," OCAST, $100K
529. M. Xue, Y. Jung, "Advanced Data Assimilation and Prediction Research for Convective-Scale ...," NOAA, $200K
530. S. Cavallo, "Polar predictability and dynamics through multi-scale atmospheric vortices," DOD-ONR, $105K
531. G. Richter-Addo, "Redox Behavior and Chemical Reactivity of Heme-HNOx Complexes," NSF, $516K
532. J. Suflita, K. Duncan, J. Sunner, B. Wawrik, "Continued Studies of the OUBC with Total," Total S.A., $222K

OSCER-FACILITATED FUNDING TO DATE: $702M total, $317M to OU

External Research Grants (cont'd)

533. M. Xue, K. Brewster, N. Snook, Y. Jung, F. Kong, "A Partnership to Develop and Evaluate Optimized Realtime, Convective-Scale Ensemble Data Assimilation and Prediction, Systems for Hazardous Weather: Toward the Goals of a Weather-Ready Nation," NOAA, $450K
534. J. Abbas, S. Huskey, C. Weaver, "Digital Latin Library Implementation," Andrew Mellon Foundation, $1M
535. C. Warinner, C. Lewis, K. Sankaranarayanan, "Evolution and Ecology of the Human Oral Microbiome," NSF, $101K
536. T. Fritz, C. Miller, R. Munoz, C. Hellman, "Oklahoma SBIRT Training Collaborative," Health and Human Services, Substance Abuse Mental Health Services Admin, $622K
537. D. Bodine,A. Reinhart, "Exploration of Terrain Effects, on Tornado and Supercell Dynamics in the Southeast United States," NOAA, $192K
538. N. Kaib, "Numerical Studies of the Dynamical Interplay Between the Inner and Outer Planets," NSF, $227K
539. N. Kaib, "The Influence of Stellar Companions on Fomalhaut's Planetary System, NASA, $59K
540. N. Kaib, "Exploring the Evolution and Characterizing the Chaos of the Terrestrial Planets," U Illinois at Urbana-Champaign Blue Waters Grad Fellowship, $50K
541. A. Shapiro, C. Potvin, "Improving vertical velocity retrievals from Doppler radar observations of convection," NSF, $599K
542. M. Richman, L. Leslie, C. Doswell, "Objective Probabilistic Guidance for Severe Weather Outbreaks," NOAA, $51K
543. M. Nanny, C. Mao, P. Hardre, S. Wu, A. Burgett, U. Hansmann,
544. L. Krumholz, S. Liu, L. Bartley, "RET Site: Rural Educators Engaged in Bioanalytical Engineering Research and Teaching," NSF, $600K

OSCER-FACILITATED FUNDING TO DATE:
$702M total, $317M to OU

External Funding Summary

- External research funding facilitated by OSCER (Fall 2001- Fall 2018): **$702M total, $317M to OU** (45%)
- Funded projects: **540**
- **230+** OU faculty and staff in **29** academic departments and **11** non-academic units
- Comparison: Fiscal Year 2002-18 (July 2001 – June 2018): OU Norman externally funded research expenditure: $1.38B

Since being founded in fall of 2001, OSCER has enabled research projects comprising **over 1 / 5 of OU Norman's total externally funded research expenditure**, with an **11-to-1 return on investment**.

Publications Facilitated by Research IT

- Publications facilitated by Research IT resources
  - **2019: 1 (so far)**
  - **2018: 255 (so far)**
  - 2017: 219
  - 2016: 331
  - 2015: 266
  - 2014: 253
  - 2013: 275
  - 2012: 356
  - 2011: 223
  - 2010: 159
  - 2009: 115
  - 2008: 116
  - 2007: 85
  - 2006: 109
  - 2005: 84
  - 2004: 50
  - 2003: 26
  - 2002: 10
  - 2001: 3

TOTAL SO FAR: 2936 publications

http://www.oscer.ou.edu/publications/

Includes 40 MS theses, 56 PhD dissertations.

How Did We Get This Data?

- We e-mailed over 200 faculty and staff, and a few students, and asked them to send us whatever they had new.
  - For each one, we gave them the list of grants and publications of theirs that we already had.
  - The labor cost was on the order of 40 hours.
- We also asked OU Research Services for all 2017-18 new grants that had pressed the OSCER button on the web form for starting the internal paperwork for a new proposal.

Ongoing, Current and New Initiatives

Virtual Residency

- "Everyone complains about the weather, but no one ever does anything about it."
- We created a program to teach people how to be research computing facilitators, and ultimately to be institutional CI leaders.
- No one had ever been dumb enough to try to teach this until we decided to.
- Workshops: Introductory 2015, 2016, 2017; **Intermediate 2018**
- Biweekly conference calls
- Proposal writing apprenticeship

Virtual Residency

- The Virtual Residency has now taught 493 people from 245 institutions in every US state plus 2 US territories and 6 other countries, including
  - 53 participants from 33 Minority Serving Institutions;
  - 60 participants from 47 non-PhD-granting institutions;
  - 145 participants from 73 institutions in 24 of 26 EPSCoR jurisdictions (all except US Virgin Islands and Guam);
  - 393 participants from 169 of 263 Campus Champion institutions.

Henry Neeman, PI

Cyberinfrastructure Leadership Academy

University of Oklahoma
Norman, Oklahoma
http://www.oscer.ou.edu/
hneeman@ou.edu

- **Senior Cyberinfrastructure leaders** are retiring and taking their knowledge, experience and wisdom with them. We need to capture this quickly.
- **Emerging midcareer CI leaders** are excellent at responding to national needs and serving their institutions' researchers, but need to learn how to **shape the national CI agenda**.
- **Goals** of this workshop in **bringing these two groups together**:
  - **Transfer knowledge, experience and especially wisdom** from senior CI leaders to emerging CI leaders, in order to enable emerging CI leaders to shape the national research CI landscape.
  - **Initiate mentoring relationships** between senior CI leaders and emerging CI leaders, in order to foster longer term professional development.
  - **Establish peer mentoring** among emerging CI leaders, in order to prepare and position them for national leadership, as senior CI leaders reduce their day to day engagement.
- **National Strategic Computing Initiative**: This workshop focus is a key aspect of the NSF's **workforce development** mission within NSCI.

New Supercomputer Open Design Sessions

New Supercomputer Open Design

- We're planning to purchase our next supercomputer in summer 2019.
- We meet weekly to discuss the design of the supercomputer, in an open, public meeting that any US academic can attend (and we have a few from outside OU).
- We've had a couple dozen users attend, most one or a few times, but a few over and over.
- This has helped us enormously in planning for the new supercomputer!

A Business Model for Physical Management of Big Data

Business Model

OURRstore

- **Grant**: hardware, software, multi-year extended warranties on everything
- **Institution (CIO)**: space, power, cooling, labor, maintenance after the initial extended warranty period
- **Researchers**: media (tape cartridges)
- Compared to roll-your-own disk, for researchers OURRstore tape is:
  - cheaper
  - more reliable
  - less labor
  - requires less training (~1 hour)
  - slower (moderate bandwidth, very high latency)

OURRstore Technology Strategy

- Distribute the costs among a research funding agency, the institution, and the research teams.
- Archive, not live storage: “Write once, read seldom if ever.”
- Independent, standalone system; not part of a cluster.
- Spend grant funds on many slots but few tape cartridges.
- Media slots are available on a first come first serve basis.*
- Software cost should be a modest fraction of total cost.
- Maximize media longevity.
- Globus for file transfers, file sharing, file publishing, discoverability etc.
- LTFS (tiny file catalog on each tape cartridge): Ship secondary copies to the data owner -- if anything goes wrong, it’s under $3K to buy an LTO tape drive, and the software is free.

NSF MRI Grant

"MRI: Acquisition of a Regional Resource for Long-term Archiving of Large Scale Research Data Collections"

National Science Foundation grant no. OAC-1828567

9/1/2018 - 8/31/2021

Grant is 3 years -- archive is 8+ years.

Who's Eligible? Who's In?

- Institutions in Great Plains Network states (AR,KS,MO,NE,OK,SD)
- Institutions in EPSCoR jurisdictions
- Institutions (and consortia) in non-EPSCoR jurisdictions, if they buy an expansion cabinet
- So far, 85 research teams at 27 institutions in 17 states, including 27 research teams at OU.
  - Just voted to start actively recruiting more!
- 16 teams will each need at least 1 PB: 8 at OU, 1 in another GPN state, and 7 in non-GPN EPSCoR states. By contrast, the original PetaStore proposal included only 12 teams *total*, regardless of capacity need.

How Much Need?

Per the proposal:

- Capacity needed: 134 PB
  - $25M+ in on-premise RAID, OR
  - $15M+ in cloud, OR,
  - $8M in USB disk drives (Good luck managing that!), OR
  - $2.4M in tape cartridges
    - If we bought the full 134 PB today.
- Current funding of these projects: $162M
- Pending/planned funding: $140M
- Faculty: 250+
- Staff: 150+
- Postdocs: 100+
- Graduate students: 500+
- Undergraduate students: 500+

Yeah, But Tape Sucks!

- Well, yes, tape does suck:
  - Retrieval has very high latency (typically 1 minute per file).
  - Tape medium inside a tape cartridge can break!
- How to resolve?
  - Only store large files (OURRstore minimum is 1 GB).
    - So, you have to create Zip files or compressed tar files.
  - Offline storage: download file to disk before using.
  - Think hierarchically:
    - Small amount of very fast disk
    - Medium amount of “slow” disk
    - Large amount of tape

Investment Protection

- PetaStore (current archive) will reach end-of-life when OURRStore gets to full production.
- Faculty may not have funds for purchasing new media in the next archive for their old data (that's not relevant to their current grants).
- Need to provide for buying up front instead of recurring charges.
- How to handle the tape?

Longevity Strategy

- OURRstore has to be backward-compatible with the PetaStore, in the sense of allowing LTO, including LTO-5 and LTO-6.
  - Tape cartridges are good for the earliest of:
    - 15 years
    - 5000 load/unload cycles
    - 200 complete tape read/writes
  - So far, only 6 PetaStore tape cartridges (<< 1%) are in danger of wearing out in less than 15 years.
- OURRstore must include some LTO-6 drives, which can read and write both LTO-6 and LTO-5, but new tapes will be LTO-7 Type M (9 TB).
- Unlike disk drives, tape cartridges can migrate from system to system.

Longevity Mechanism

Once OURRstore is in full production:

- Set PetaStore to read-only.
- On the PetaStore, for a small number of tape cartridges, identify all the files on them.
- Copy all those tape cartridges to OURRstore.
- Export those tape cartridges from the PetaStore.
- Import them into OURRstore and reformat.
- Repeat, copying the new files onto the newly imported cartridges.
- When all files are copied (months, maybe a year), decommission the PetaStore.

We'll use this same procedure at OURRstore's end of life.

Lead, Follow or Get Out of the Way

Taking Leadership

- Statewide
- Regional
- National

Statewide Leadership Examples

- The OneOklahoma Cyberinfrastructure Initiative is a volunteer, ad hoc collaboration among CI providers and users across our state.
- We've grown to 5 CI providers.
- We're on e-mail multiple times a week and on a weekly phone call every Friday at 2:00pm CT, working together on a wide variety of projects.
- It's helped us get CI grants, start a statewide HPC contest, help each other help our researchers, and so much more.

Regional Leadership Examples

- Within the Great Plains region, we've been building our leadership across the 6 member states of the Great Plains Network (Arkansas, Kansas, Missouri, Nebraska, Oklahoma and South Dakota).
- That's now culminated with our former OneNet CTO being selected as the Executive Director of the GPN.

National Leadership Examples

- OneOCII institutional CI leads have, or have had, the following leadership roles:
  - XSEDE Campus Engagement joint co-managers (the umbrella over Campus Champions)
  - Founded the ACI-REF Virtual Residency
    - Trained 493 CI Facilitators so far
    - Proposal writing apprenticeship
    - Coming soon: Paper writing apprenticeship
  - Linux Clusters Institute steering committee
  - SC10-11 Education Program leadership
  - NSF Advisory Committee for Cyberinfrastructure

Acknowledgements

Portions of this material are based upon work supported by the National Science Foundation under the following grants:

- Grant No. EPS-0814361, “Building Oklahoma's Leadership Role in Cellulosic Bioenergy”
- Grant No. EPS-1006919, “Oklahoma Optical Initiative”
- Grant No. OCI-1039829, “MRI: Acquisition of Extensible Petascale Storage for Data Intensive Research”
- Grant No. OCI-1126330, “Acquisition of a High Performance Compute Cluster for Multidisciplinary Research”
- Grant No. ACI- 1229107, “Acquisition of a High Performance Computing Cluster for Research and Education”
- Grant No. EPS-1301789, “Adapting Socio-ecological Systems to Increased Climate Variability”
- Grant No. ACI-1341028, “OneOklahoma Friction Free Network”
- Grant No. ACI-1429702, “Acquisition of a High Performance Computing Cluster for Research at a Predominantly Undergraduate Institution”
- Grant No. ACI-1440774, “Leveraging Partnerships Across the Great Plains to Build Advanced Networking and CI Expertise”
- Grant No. ACI-1440783, “A Model for Advanced Cyberinfrastructure Research and Education Facilitators”
- **Grant No. OAC-1828567, “MRI: Acquisition of a Regional Reesource for Long-term Archiving of Large Scale Research Data Collections,” OU, $968K**

Acknowledgements

Dell provided seed systems for the OU Research Cloud (“OURcloud”) and the OU Science DMZ.

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Thank you all! Without you, the Symposium couldn't happen.

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Thanks!

- OU IT
  - OU Interim CIO/VPIT Eddie Huebsch
  - Symposium committee: Dana Brunson (OSU), Debi Gentis (OU)
  - Symposium coordinator: Debi Gentis
  - Sponsorship coordinators: Chance Grubb, Katie Schott
  - OSCER Operations Team: Dave Akin, Patrick Calhoun, Kali McLennan, Jason Speckman
  - OSCER Research Computing Facilitators: Jim Ferguson, Horst Severini
  - OSCER Assoc Dir Research Strategy Advisor: George Louthan
  - All of the OU IT folks who helped put this together
- CCE Forum
  - Jake Maurer, Kristin Livingston
  - The whole Forum crew who helped put this together

Thanks: Plenary Speakers

- Mike Norman, San Diego Supercomputer Center, University of California San Diego
- Bob Panoff, Shodor Education Foundation
- Dan Stanzione, Texas Advanced Computing Center, University of Texas at Austin

Thanks: Gold Sponsor Speakers

- Adnan Khaleel, DellEMC
- Rob Peglar, Formulus Black

Thanks: Breakout Speakers

1. Dan Andresen, Kansas State University
2. Shady Boukhary, Midwestern State University
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4. Eduardo Colmenares, Midwestern State University
5. Brady Deetz, Laureate Institute for Brain Research
6. Kyle Hutson, Kansas State University
7. Mark Laufersweiler, University of Oklahoma
8. BJ Lougee, Federal Reserve Bank of Kansas City
9. George Louthan, University of Oklahoma
10. Chongle Pan, University of Oklahoma
11. Dimitrios Papavassiliou, University of Oklahoma

Thanks!

To all of your for participating, and to those many of you who've shown us so much loyalty over the past 16 years.

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Thanks for your attention!

Questions?