

Welcome
to the
36th
Annual
Awards
Ceremony





**You Took the Challenge!
You Finished the Marathon!**

Los Alamos National Laboratory Welcomes You!

Kathy Keith
Director
Community Partnerships
Office



Consult Welcomes You!



**Alphabetical by first name:
David, Karen, Patty**



Congratulations to the 2025-2026 Finalists Teams!



The Finalists

Albuquerque Academy

**Understanding 3D Printing Through
Atomistic Polylactic Acid Segmental
Dynamics Analysis**

Team Member: Harrison Schiek

Sponsors: Jay Garcia

Mentor: Michael Chandros



The Finalists

Los Alamos High School

**Dust Busters: The Effects Of Dust Scattering
On Observations Of X-ray Binaries**

Team member:

Tate Plohr

Sponsor:

JeeYeon Plohr

Mentor:

Greg Salvesen



The Finalists

Los Alamos High School

**Collective Intelligence: Driving Lessons
from Ants**

Team Member: Linus Plohr



The Finalists

Santa Fe Preparatory School

Pacing Optimization for Cycling

Performance Through Neural Evolution

Team Member: Jaden Rand

Sponsor: Jocelyne Comstock



The Finalists

Santa Fe Preparatory School

Development of an Open-Source, High-Precision N-Body Solar-System Gravitational Simulation

Team: Marlow Lichty, Nik Szczepanski

Sponsor: Jocelyne Comstock



The Finalists

Welch Home School

Application of Game Theory to Analysis of Machine Versus Human Strategies

Team Members: Helena Welch
 Kalliope Luna Welch

Sponsor: Cindy Welch

Mentor: Paul Welch



NetLogo Agent Based Model

Presented
On Behalf of
Simtable



NetLogo Agent Based Model

New Futures

Fighting Shadows

Team Members: Nadia Montano, Jazmin Aquino

Teacher/Mentor: Rachel Kilman



Get out your badge number for a random prize drawing for finishing this marathon!



The winner is....



Excellence in Teamwork Award



Sponsored by New Mexico
Technology In Education

Presented by Kaley Woelfel



Excellence in Teamwork Award



Santa Fe Preparatory School

Development of an Open-Source, High Precision N-body Solar System Gravitational Simulation

Team: Marlow Lichty, Nik Szczepanski

Sponsor: Jocelyne Comstock



Excellence in Research Award



Sponsored by New Mexico
Technology In Education

Presented by Kaley Woelfel



Excellence in Research Award



New Mexico Academy for the Media Arts

When Will New Mexico Run out of Water?

Team: Eduardo Dorado, Anasofia Rodriguez, Zaaliyah Thomas

Sponsor: Tanya Muller



Human Computer Interaction Award

Sponsored by
Stephen Guerin
Simtable



Human Computer Interaction Award



**Justice Code
CommuniEats**

Team: Mekhi Bradford

Sponsor: Becky Campbell



Head Judges

Richard Barrett



Kaley Woelfel





Recognition of Expo Judges

Hats off to our 22 Expo and Finalist Judges from Challenge Alums, Grad Students, National Labs, Nonprofits, Small and Large Businesses.

Please stand up and take a bow!



Recognition of Expo Judges

Ed Angel

Melany Cordova

Clint Hubbard

Scott Levy

Paige Prescott

Lonnie Rednour

Gennie Barrett

Rusty Davis

Omar Ishak

Monique Morin

Mario Serna

Eleanor Walther

Richard Barrett

Umanga De Silva

Carene Larmat

James Overfelt

Lee Rand



Finalist Judges



Daniel Appel

USAF / MTSI

Joan Appel

Flatiron Health

Phil Jones

Los Alamos National Labs/Retired

Kasra “Kaz” Manavi

Simtable

Kaley Woelfel

AV



Environmental Modeling Award

Presented by Vangie Trujillo



Environmental Modeling Award

New Mexico Academy for the Media Arts

When Will New Mexico Run Out of Water

Team: Eduardo Dorado, Anasofia Rodriguez,
Zaaliyah Thomas

Sponsor: Tanya Mueller



Community Impact Award



Presented by Umanga De Silva



Community Impact Award



New Futures School Fighting Shadows

Team: Nadia A. Montano, Jazmin N. Aquino

Sponsor: Rachel Kilman, Kelly Lasater, Soni Buda-Thornburgh

Mentor: Richard Barrett



Creativity and Innovation Award

**Presented by
Tim Thomas
Sandia Laboratories**



Creativity and Innovation Award

Santa Fe Preparatory School

Identifying Piano Composers from MIDI Files Using Machine Learning

Team: Ari Chan-Chiu

Sponsor: Jocelyne Comstock



Middle School Award



Presented by Karen Glennon





Middle School Award

Albuquerque Academy

Do GLP1 agonists, a new weight loss drug, cost us muscle? A Python simulation study

Team: Zoheb Barrantes

Sponsor: Arfa Khan



Magellan Award

An Explorer and a Risk Taker





Magellan Award An Explorer and a Risk Taker

New Futures School Fighting Shadows

Team: Nadia Montano, Jazmin Aquino

Sponsor: Rachel Kilman, Kelly Lasater,

Soni Buda-Thornburgh

Mentor: Richard Barrett



Teacher Appreciation Award



**Teaching is the greatest
act of optimism**



Teacher Appreciation Award

Mekhi Bradford please come to the stage.



NUMBERS PLEASE!



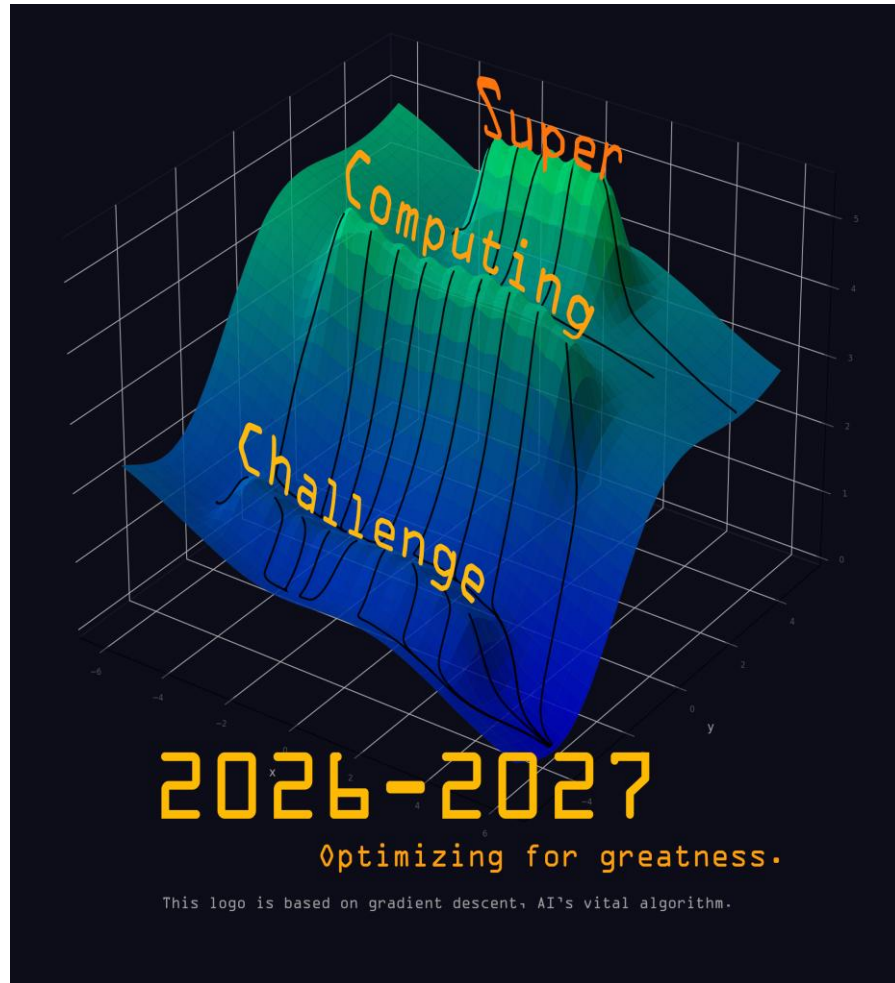
LOGO FOR NEXT YEAR! 2026-2027

Presented by
David Kratzer

And the LOGO is



LOGO for Year 2026-2027



Santa Fe Preparatory School

Team: Luke Rand, Isaac Olson

Sponsor: Jocelyne Comstock



Technical Poster Award



Technical Poster Award

Dust Busters

The Effects of Dust Scattering on Observations of X-ray Binaries

What are X-ray binaries?

An X-ray binary consists of two orbiting stars. One, called the donor star, gives off stars or accretes, which can be a neutron star or a black hole. The accreting matter's gravitational energy is transformed into thermal energy as it falls into the black hole. This supplements the accretion disk to reduce its radius and thereby re-emits X-rays.

Disk Continuum Model

The radius of the ISCO is dependent only on the spin of the black hole. It is actually the ISCO since it is a theoretical construct of the Kerr model of black holes but we expect the accretion disk extends to the ISCO when the X-ray binary is in the high state. Therefore we find out the spin of the black hole from the inner radius of the accretion disk, which is manifested in the spectrum. This is the task of the accretion disk fitting (Chiang et al. 1997) a method that assumes we had the black hole spin by measuring the position of the iron line.

How we infer spin from spectrum
spectrum is at higher energy level → hotter disk
spectrum is at lower energy level → smaller ISCO
→ disk closer to the black hole → faster spin

SWIFT Spectral Data

The SWIFT X-ray Telescope (SWIFTXRT) is a prime source of spectral data. SWIFTXRT has unique advantages: it provides 1) an energy range well-suited to disk-dominated spectra in the high-state state, and 2) dense temporal coverage through frequent monitoring, which enables studies of disk continuum evolution across multiple high-soft state observations and can help reduce the uncertainty in spin estimation.

Swift operates under two modes: the Photon Counting (PC) mode and the Windowed Timing (WT) mode. In PC mode, SWIFTXRT takes 2D X-ray images with its full SOXSI00 pixel grid but refreshes slowly. This occasionally leads to two photons hitting the same pixel within one refresh and being incorrectly registered as only one photon with the combined energy of the two. This phenomenon is called 'pileup' and is common for bright sources, like X-ray binaries. To combat pileup, SWIFTXRT was designed with the WT mode which increases the refresh rate at the cost of losing information about which pixel the X-ray hit.

SWIFT WT	FERI-Aurora	NICER	
Time (Upper limit)	1000	4000	
Number of spin bins in high-soft state (disk continuum)	100	100	
Refresh rate (refreshing interval)	1.8 ms	75 ms	100 ms
Imaging	1D	2D	No imaging
Measure of extraction region geometry with dust scattering model	Yes	Yes (uses for Chandra as well)	Without an image

Research Goal

SWIFTXRT is typically used for monitoring X-ray binaries rather than for black hole spin estimation with disk-continuum fitting, because of the mismatch between the 1D Windowed Timing (WT) mode and the 2D xspec extraction geometry.

This project aims to develop an improved dust scattering model, called **xscatXY**, for SWIFTXRT data by

- making the dust scattering correction consistent with the WT rectangular extraction geometry
- removing the region containing pileup

Methodology

xscat, tbabs, and keffrb are models implemented in XSPEC (Arnaud 1996, HEASoft), an X-ray spectral analysis program, developed by NASA that is standard for disk-continuum modeling. We are using the latest version of XSPEC, version 12.15.1. The procedure is to load in each dataset, remove the low quality sections of the data, define the model in terms of xscatXY, tbabs, and keffrb, and fit the model to the data. XSPEC then gives us the best fit parameters, most importantly, the spin of the black hole. We infer the black hole spin of GRO J1655-40 using three SWIFTXRT datasets.

$$xscatXY: F = F_0 \exp(-\sigma_0 N_H) + F_2 \int d\Omega \int d\tau \frac{I(r(x,y))M_0}{2\pi r(x,y)} \exp(-\sigma_0(x,y)N_H) \quad \text{with } \Sigma(r) \equiv \left[\frac{\partial \Sigma(r_{max})}{\partial r_{max}} \right]_{r=r_{max}}$$

Model spectrum(E) = (xscatXY(E): pileup) * tbabs(E) * keffrb(E)

Our New Model

We fix the extraction geometry by first transforming xscat from spherical to Cartesian coordinates and integrating the flux density function in the rectangular extraction region. These calculations are implemented in C++, xspec's native language and also in Python with a wrapper. Then we build a pipeline to integrate this new correction function into the NASA-managed spectral data analysis package, XSPEC (see the right panel).

As a proof of concept, we will apply the standard model (xspec) and our new model (xscatXY) to datasets of a bright X-ray binary (GRO J1655-40) and compare the estimates of black hole spin.

Mass	Inclination	Distance	Hardening factor	Magnetic field	
value	6.3 M _⊙	85°	2.0 kpc	1.7	0

Results

First, we illustrate how the model spectrum changes as the successive components (keffrb, tbabs, xscat, and xscatXY) are added (figure below: Attribution of flux for extraction models).

Second, we demonstrate the systematic correction by comparing the flux multipliers of xscatXY to those of xscat (left figure).

Attribution by extraction models, successive applications show lower overall intensity of light (right figure).

We can see how the xscatXY model attenuates the light as a function of energy, given that the light is higher (lower) than the xscat model at a comparable amount of intermediate (higher) dust, most low energy light passes unattenuated. However, high energy light is unattenuated at both low and high N_H .

Third, we calibrate Spin, N_H (amount of dust), X_{ps} (dust screen position), and accretion rate using xscat and xscatXY for J1655-40.

Spin	N_H	X_{ps}	Reduced Chi-squared		
xscat	0.486447	0.737678	0.602599	4.53796	0.8459
xscatXY	0.440729	0.737996	0.641829	5.02142	0.8442

Black Hole Spin parameter: $a = \frac{cJ}{GM}$ $0 = 0$ non-rotating
 $a = 1$ maximally rotating $0.5 < a < 0.998$ $0.2 < a < 0.9$ rotating
 (Spin parameter a is defined above.)
 Calibrated spin from using xscatXY is about 10% lower than spin from xscat.
 Higher attenuation by xscatXY reduces the photon flux and therefore predicts lower spin.

XSPEC/xscatXY Workflow

Calibration process in XSPEC using xscatXY in order to interface xscatXY (written in Python) with XSPEC (C++), a wrapper was used.

Significance of Black Hole Spin

Black holes are major architects of the cosmos. They shape spacetime through their intense gravity and play crucial roles in the dynamics of galaxies, stars, and planetary systems. Studying black holes helps us understand general relativity, whose effects are already incorporated into some astrophysical jets can be a source for star formation. Black holes also serve as a testbed for general relativity. In particular, particles near a black hole are stretched and sheared, preserving clues about how it formed and evolved through accretion and mergers.

GRO J1655-40, for instance, is a bright source in our galaxy, well-suited for X-ray observation, and has been extensively studied. It has been used to probe the innermost regions of the accretion disk, such as the innermost stable circular orbit (ISCO), which is sensitive to the black hole's spin. The light structure is sensitive to the geometry and the accretion rate, which are key parameters for understanding the black hole's spin.

Conclusions

- We verified that a systematic application of the extraction models for the xscatXY model accounts for the data geometry and the pileup effect. It is a systematic difference in the model spectrum compared to the standard model (xspec) and a lower spin value for GRO J1655-40.
- We modified an internal model for fitting SWIFTXRT data by addressing the extraction geometry and pileup effect. The new model, xscatXY, is implemented in XSPEC and is available for all XSPEC datasets.
- xscatXY will be incorporated into the NASA-managed spectral data analysis package, XSPEC, with a wrapper for all XSPEC datasets.
- More broadly, this work demonstrates how improvements in spectral data analysis can lead to better understanding of the physical processes in the universe.

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Los Alamos High School Dust Busters: The Effects of Dust Scattering on Observations of S-Ray Binaries

Team: Tate Plohr Sponsor: Jee Yeon Plohr



Crowd Favorite



**Presented by
Karen Glennon**



Crowd Favorite Award

Truman Middle School Sentinel Guard: Rover + AI for Rapid Wildlife Identification

Team: Brian Rios, Abraham
Montijo, Karin Urbina

Sponsor: Natali Barreto Baca



New Mexico Network for Women in Science and Engineering



Presented by Cheri Burch NMNWSE



New Mexico Network for Women in Science and Engineering

Albuquerque Academy

**Low-Cost Raspberry Pi & Molecular Simulations for
Microplastic-Drug Classification via LF**

Team Member: Ahana Koushik

Sponsor: Jay Garcia



Longevity Award

Presented by David Kratzer



Longevity Award

Congratulations to

Mekhi Bradford



Professional Presentation

Presented by Tim Thomas



Professional Presentation

Congratulations to

Albuquerque Academy

Understanding 3D Printing Through Atomistic

Polylactic Acid Segmental Dynamics Analysis

Team: Harrison Schiek

Sponsor: Jay Garcia



Technical Writing Award

Presented by Kaley Woelfel



Technical Writing

Congratulations to

Welch Home School

**Application of Game Theory to Analysis of
Machine Versus Human Strategies**

Team Members: Helena Welch
Kalliope Luna Welch

Sponsor: Cindy Welch

Mentor: Paul Welch



High Performance Computing Award

Presented by Mario Serna



High Performance Computing

Congratulations to

Albuquerque Academy

**Understanding 3D Printing Through Atomistic Polylactic Acid
Segmental Dynamics Analysis**

Team member: Harrison Schiek

Sponsor: Jay Garcia



Judges' Special Awards

**Presented by
Richard Barrett and Kaley Woelfel**



Judges' Special Award Shark Tank

Santa Fe Preparatory School

**Pacing Optimization for Cycling Performance
Through Neural Evolution**

Team Members: Jaden Rand

Sponsor: Jocelyne Comstock



Judges' Special Award Best Agent Based Modeling

Los Alamos High

Collective Intelligence:

Driving Lessons from Ants

Team: Linus Plohr

Mentor: JeeYeon Plohr



Judges' Special Award Health Awareness

Capital High School

PFAS Chemicals in School Water

Team: Dafne Ramirez Guajardo, Briana Ramirez

Sponsor: Irina Cislaru



Judges' Special Award Science Rocks

Santa Fe Preparatory School

**SCORAV: Single-Camera Off-Road
Autonomous Vehicle**

Team: Luke Rand, Isaac Olson

Sponsor: Jocelyne Comstock



Judges' Special Award Significant Engineering Efforts

Capital High

**AVALANCHERS: Detection Device for Finding
People After an Avalanche**

Team: David Chavez, Raul Alvarado Villalobos, Angel
Vega, Antonio Baca

Sponsors: Barbara Teteryez, Irina Cislaru



Sponsor Recognition

Kudos for our sponsors!!

**The people in these businesses
and companies helped us
reach the Finish Line!!**



Primary Partners

- Los Alamos National Laboratory
- Triad National Security, LLC
- NMSU STEM Innovation Network

Gold Partners

- Sandia National Laboratories



Silver Partners

- * Gulf Stream Group and bigbyte.cc
- * Westwind

Bronze Partners

- * New Mexico Technology in Education (NMTIE) in conjunction with NMCHECS
- * Simtable/Redfish Group



Educational Partners

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- Central New Mexico Community College
- CNM Ingenuity, Inc.
- Eastern New Mexico University
- MIT Starlogo Nova
- New Mexico Highlands University



Educational Partners Continued

- New Mexico Institute of Mining and Technology
- New Mexico Public Education Department
- New Mexico State University
- Northern New Mexico College
- San Juan College
- Santa Fe Community College
- University of New Mexico
- UNM CARC, Center for Advanced Research Computing



Friends of the Challenge

- Computer Science Alliance
- Creighton Edington
- Daniel and Mel Fuka
- Clint Hubbard
- David Janecky



Friends of the Challenge, Continued

- Hugo Rivera Calzadillas
- Dave Ritter
- Maximo Lazo
- NM Network for Women in Science and Engineering



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Scholarship Recipients



Scholarship Committee

Hope Cahill, Creighton Edington,

And Anneliese Ward



Scholarship Recipients

NAME

COLLEGE

HIGH SCHOOL

Jazmin Aquino

CNM & UNM

New Futures HS

Antonio Baca Archuleta

SFCC/NMTech

Capital HS

Nevaeh Birner

CNM

New Futures HS

Dafne Ramirez-Guarjardo NMTech

Capital HS



Scholarship Recipients

NAME

COLLEGE

HIGH SCHOOL

Marlow Lichty

Harvey Mudd

Santa Fe Prep

Briana Ramirez

UNM

Capital HS

Helena Welch

Out of State

Welch Home School



**And the moment we
have ALL been
waiting for**

**Another
Drum roll,
Please!!**



BUT FIRST -----



For Real this Time.....

Our Third Place Winner is



**Another
Drum roll,
please!**



THIRD PLACE

Albuquerque Academy

**Understanding 3D Printing Through Atomistic
Polylactic Acid Segmental Dynamic Analysis**

Team Member:	Harrison Schiek
Sponsors:	Jay Garcia
Mentor:	Michael Chandros

CONGRATULATIONS!



Our Second Place Winner is.....



**DRUM ROLL
PLEASE!**

SECOND PLACE

Santa Fe Preparatory School
Pacing Optimization for Cycling
Performance Through Neural Evolution

Team Member: Jaden Rand
Sponsor: Jocelyne Comstock

WELL DONE!!



The moment we've all been waiting for
Our First Place Winner is



FIRST PLACE

Los Alamos High School

Dust Busters

Team member: Tate Plohr
Sponsor: JeeYeon Plohr
Mentor: Greg Salvesen

VERY NICE WORK!!



FIRST PLACE WINNERS

Brief overview of their project!

Go for it!!





Closing Comments from our Executive Director David Kratzer

