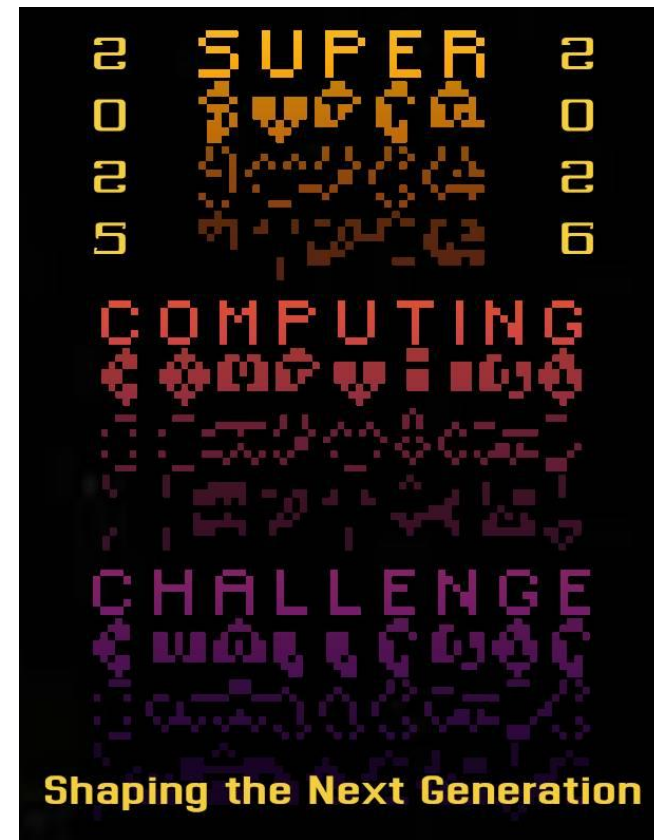


Welcome
to the
36th
Annual
Awards
Ceremony



FIRST PLACE

Los Alamos High School

Dust Busters

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

VERY NICE WORK!!



SECOND PLACE

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

Team Member: Jaden Rand
Sponsor: Jocelyne Comstock

WELL DONE!!



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!



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

New Futures

Fighting Shadows

Team Members: Nadia Montano, Jazmin Aquino

Teacher/Mentor: Rachel Kilman



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



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



**Justice Code
CommuniEats**

Team: Mekhi Bradford

Sponsor: Becky Campbell



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



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

Santa Fe Preparatory School

Identifying Piano Composers from MIDI Files Using Machine Learning

Team: Ari Chan-Chiu

Sponsor: Jocelyne Comstock





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

New Futures School Fighting Shadows

Team: Nadia Montano, Jazmin Aquino

Sponsor: Rachel Kilman, Kelly Lasater,

Soni Buda-Thornburgh

Mentor: Richard Barrett

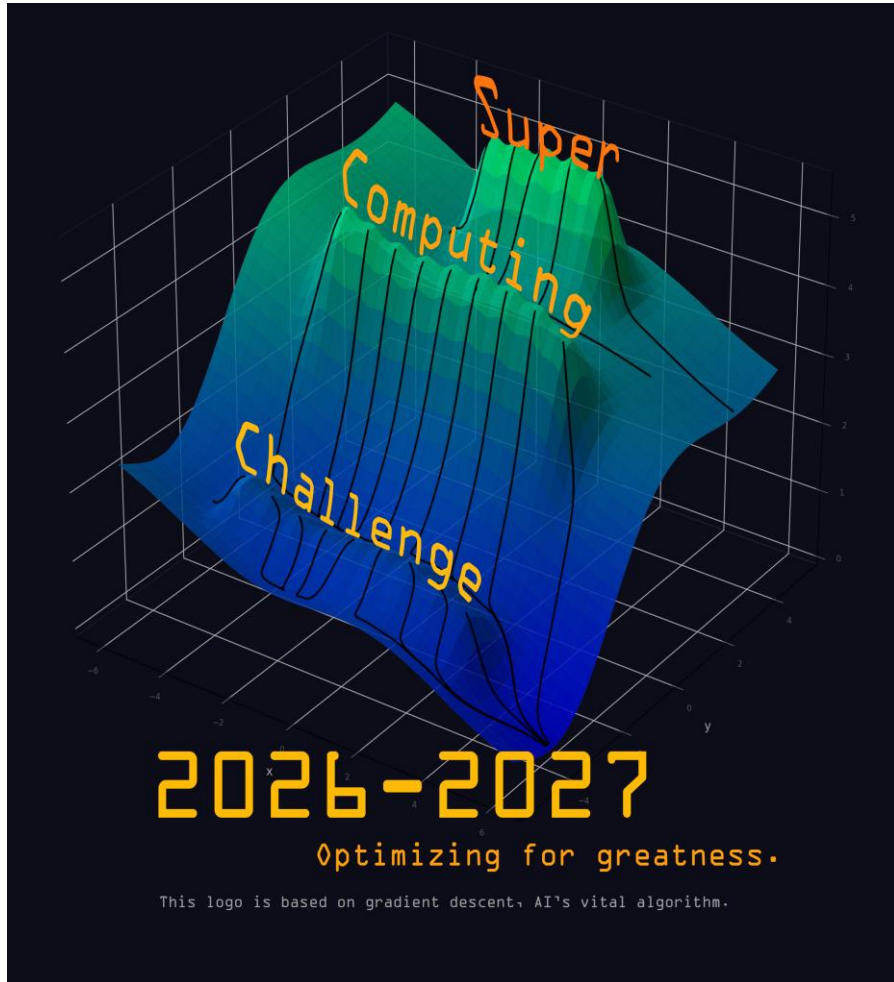


Teacher Appreciation Award

Mekhi Bradford please come to the stage.



LOGO for Year 2026-2027



Santa Fe Preparatory School

Team: Luke Rand, Isaac Olson

Sponsor: Jocelyne Comstock



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 spin and thereby reduces X-ray.

Disk Continuum Model

The radius of the ISCO is dependent only on the spin of the black hole. It can actually be 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 radius 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
 spectrum is at higher energy level → faster spin

Extension by Dust

The key limitation of using the standard model for accretion disk is that it does not account for scattering. This extension to the standard model is the extension by dust. This extension is implemented in the XSPEC software package. The extension by dust is implemented in the XSPEC software package. The extension by dust is implemented in the XSPEC software package.

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 deconvolved spectra in the high-soft 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 SOX500 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 a concern for bright sources. In 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.

Comparison of Telescopes

SWIFT WT	FERMI-ANISECR	NICER	
Time (Upper limit)	1000	4000	
Time (Lower limit)	20	100	
Time (Upper limit)	20	100	
Time (Lower limit)	20	100	
Imaging	10	20	No imaging
Imaging	10	20	No imaging
Imaging	10	20	No imaging

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 xscaXY, for SWIFTXRT data by

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

Methodology

XSPEC, tbabs, and keffrbn 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 xscaXY, tbabs, and keffrbn, and fit the model to the data. XSPEC then gives us the best fit parameters, most importantly, the spin of the black hole spin of GRO J1655-40 using three SWIFTXRT datasets.

$$I_{\text{total}}(E) = I_{\text{direct}}(E) + I_{\text{scattered}}(E) = I_{\text{direct}}(E) + \int d\Omega \int d\tau \frac{I_{\text{source}}(E')}{4\pi r^2} \exp(-\sigma_T n_H r) \exp(-\sigma_T n_H r) \exp(-\sigma_T n_H r)$$

Our New Model

We fix the extraction geometry by first transforming xscaXY 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 (xscaXY) and our new model (xscaXY) to datasets of a bright X-ray binary (GRO J1655-40) and compare the estimates of black hole spin.

Calibration Process of xscaXY Model

Fixed Parameters for GRO J1655-40

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

Calibration Parameters for GRO J1655-40

Spin	NI	Xpec	Reduced Chi-squared
0.48447	0.737678	0.692599	4.53796
0.440729	0.737996	0.641829	5.02142

XSPEC/xscaXY Workflow

Calibration process in XSPEC using xscaXY in order to interface xscaXY (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 of our most advanced technologies. In particular, particles near a black hole are stretched and torn apart. Black holes have a long history of being preserved, preserving clues about their formation and evolution through accretion and mergers.

Black holes are also important in our galaxy, well-suited for studying the innermost regions of our galaxy, well-suited for studying the innermost regions of our galaxy, well-suited for studying the innermost regions of our galaxy.

Conclusions

We verified that a complete application of the extension models for the XSPEC X-ray data analysis package, XSPEC, for GRO J1655-40 data. The XSPEC model accounts for the scattering geometry and the extension by dust. We found a systematic difference in the estimated black hole spin and finding a lower spin value than the standard model.

More broadly, this work demonstrates how improvements in the XSPEC software package can be used to study the innermost regions of our galaxy, well-suited for studying the innermost regions of our galaxy.

Select References

Chiang, J., & Rudek, J. (2015). The effects of dust scattering on the observed X-ray spectra of black holes. *Monthly Notices of the Royal Astronomical Society*, 451(1), 1117-1127.

Arnaud, K. A. (1996). XSPEC: A software package for X-ray spectral analysis. *ASP Conference Series*, 101, 17-20.

Arnaud, K. A., & Fabbiano, G. (1985). XSPEC: A software package for X-ray spectral analysis. *ASP Conference Series*, 101, 17-20.

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 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

Albuquerque Academy

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

Team Member: Ahana Koushik

Sponsor: Jay Garcia



Longevity Award

Congratulations to

Mekhi Bradford



Professional Presentation

Congratulations to

Albuquerque Academy

Understanding 3D Printing Through Atomistic

Polylactic Acid Segmental Dynamics Analysis

Team: Harrison Schiek

Sponsor: Jay Garcia



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

Congratulations to

Albuquerque Academy

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

Team member: Harrison Schiek

Sponsor: Jay Garcia



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



Scholarship Recipients

NAME

COLLEGE

HIGH SCHOOL

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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

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Out of State

Welch Home School





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Please stand up and take a bow!



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Mario Serna

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Closing Comments from our Executive Director David Kratzer

