

# ***Education / Outreach***

***SEUS Advisory Meeting***

***Roy Gould  
SEU Forum  
Feb 2004***

# Take-home messages

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MANY SEU education / outreach projects underway:  
high-quality, high-impact.

STRONG public interest in the SEU theme.

EINSTEIN centennial events will help leverage  
Beyond Einstein theme.

# Goals and strategies

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- Reach diverse audiences at diverse sites.
- Increase SEU presence in the classroom.
- Develop appealing stories for the SEU theme.
- Use Einstein centennial to leverage impact.
- Align to NASA's Code N goals.

# *Cosmic Questions* National Exhibition

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- Features SEU themes (big bang, black holes, dark energy).
- On tour through 2005+.
- > 1 million visitors after current venue.
- Ongoing host for public lecture series, demonstrations, other events for Beyond Einstein. (NASA network of “brokers” participating.)



# Cosmic Questions Exhibit



# Cosmic Questions Exhibit



# Does the public care about SEU?

From exit interviews and follow-up phone interviews (1 week and 6-9 weeks later):

- 90% of visitors could cite components that stood out for them. > One dozen components cited frequently -- and almost all components were cited by visitors.



# Does the public care about SEU?

“I used to think a black hole was one-dimensional, like a circle. But I learned that it’s a sphere. I learned about dark energy. I had no idea that it existed.”

G13: “I thought it was interesting in the [show] they talked about stars giving birth and what we’re made of... and that hit me. We’re made of the same thing as stars. I thought that was interesting because you never would think that.”



# Does the public care about SEU?

“God created the heavens and the Earth, how much clearer can that be? It had to start sometime, but that does not preclude the evolution, which is so beautifully demonstrated in your exhibit.”

“I thought it was really interesting...especially for my kids to see all this stuff. It gives them a better perspective than in school.”



# Does the public care about SEU?

F16: "I thought it was pretty amazing. My friend and I spent hours there... We talked about how we both want to be doctors... but after seeing this we thought, you know what, I'd like to go into space on the side. How it would be possible to do that as a career. It changed our thinking on how possible that is."



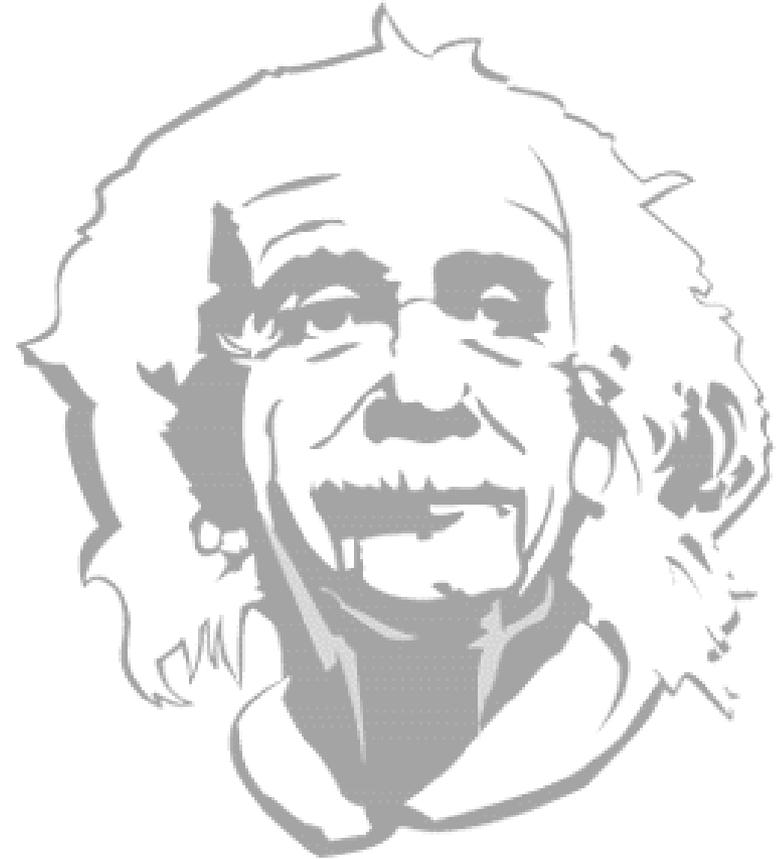
# *Einstein* Exhibition

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Missions (e.g. Gravity Probe-B) are working with host museums to develop materials, programs, events.

Events to be coordinated with the PBS mini-series, “Origins” this fall.

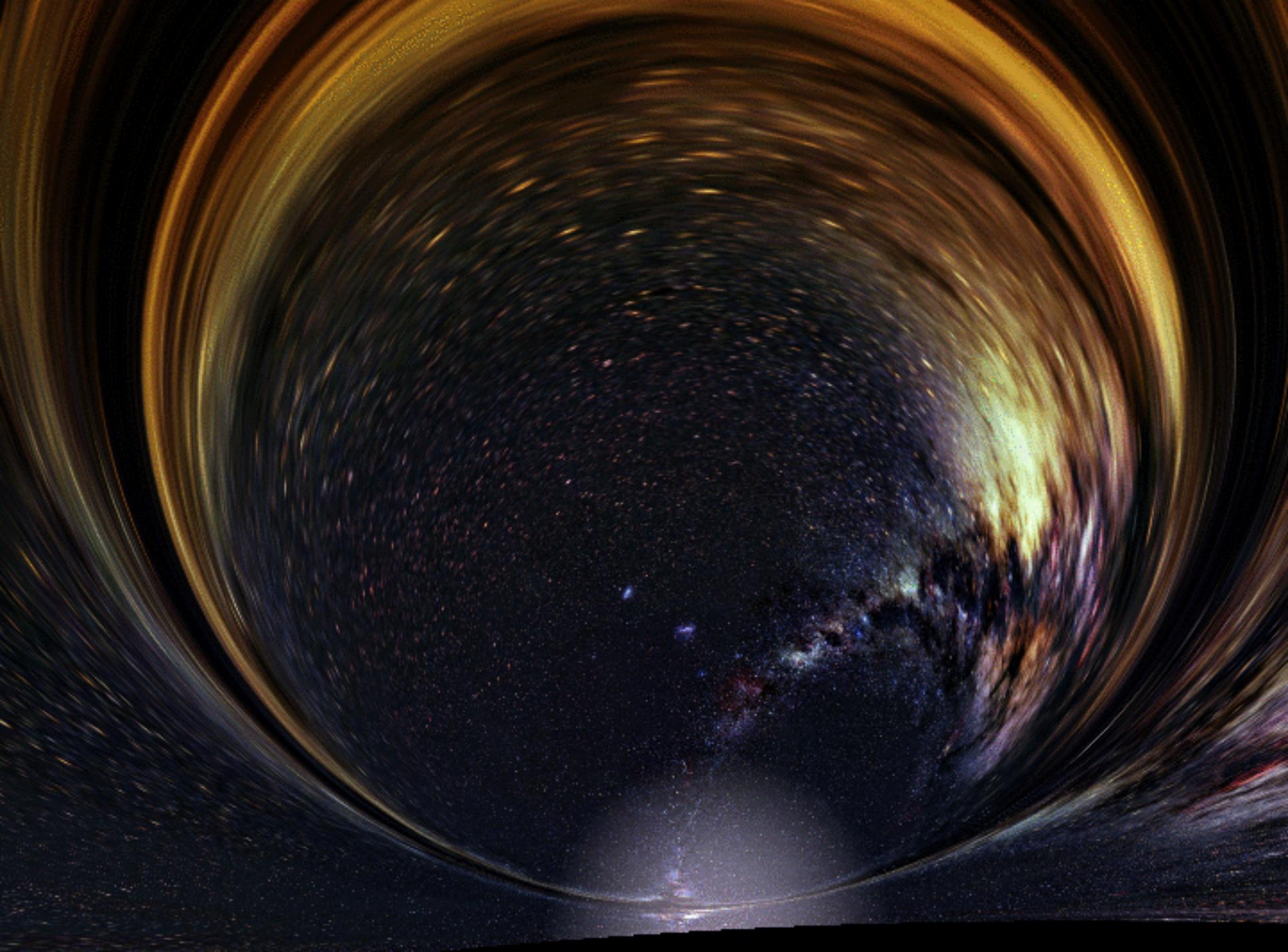


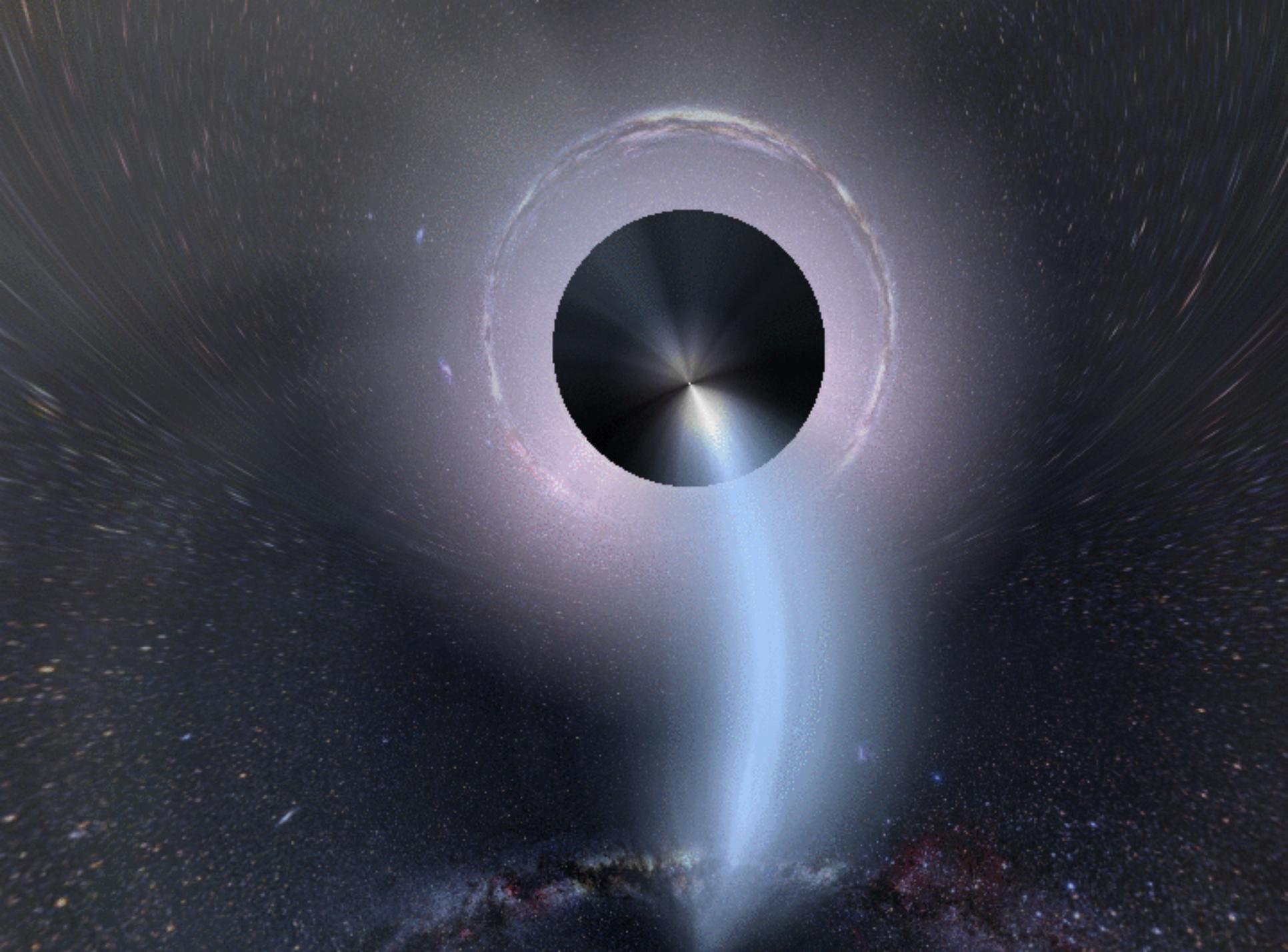
# ***NOVA* TV show on black holes**

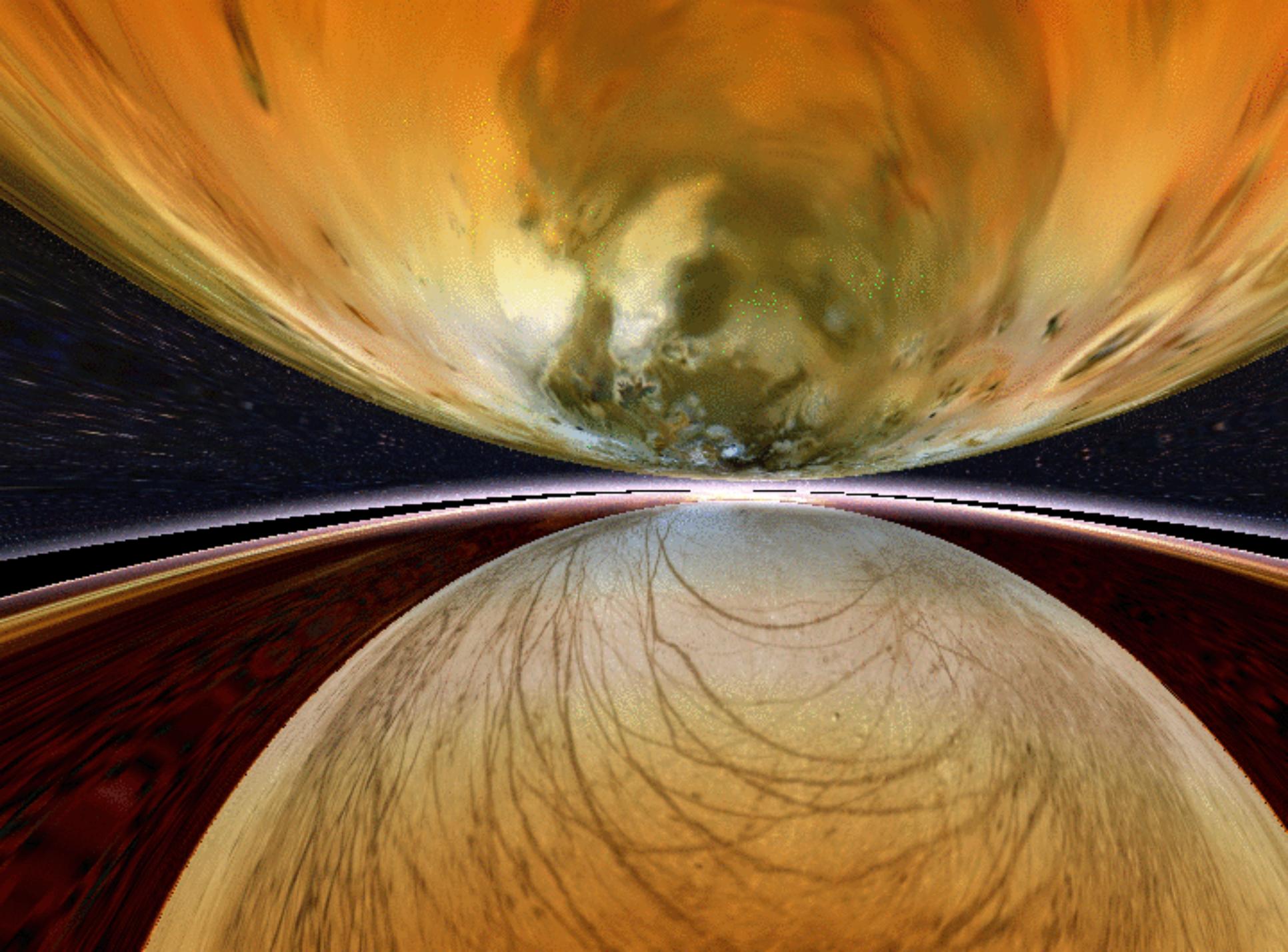
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- Seed support and science direction via GLAST / Sonoma State U.
- Premieres in 2005 on public television.
- Includes hi-resolution planetarium show.
- BH simulator graphics by Andrew Hamilton.







# IMAX Film: *Hawking's Beyond the Horizon*

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- To be released in 2005.
- SEU Forum to oversee E/PO with mission collaboration.
- Will reach 100+ science centers and IMAX sites.



# IMAX Film: *Hawking's Beyond the Horizon*

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# WMAP Webcast

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- Science centers & planetariums in Oakland, Chicago, Boston participated.
- Reached hundreds of kids in school groups at these sites.
- Q and A with Dave Spergel, others.



# Does the public care?: Chandra

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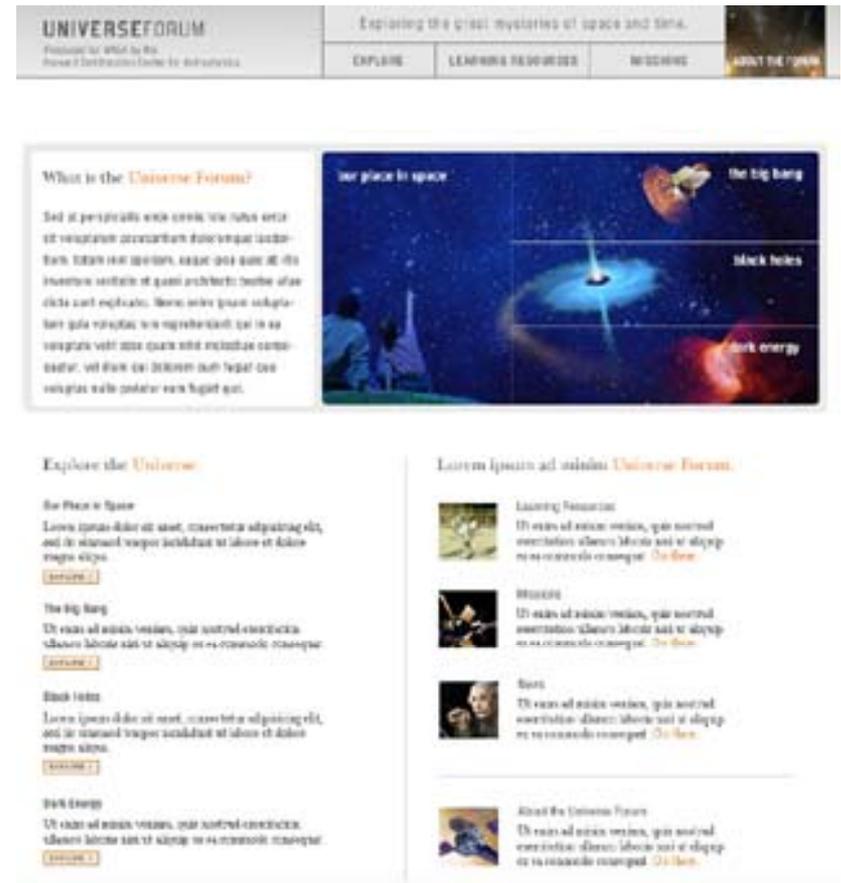
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- Last week's black hole update was carried by NYTimes, ABC, CBS and CNN + interview with Neil Tyson.
- >3,000,000 million hits / 1 million per hour!



# SEU Forum Website

- Redone to focus on *Beyond Einstein* theme.
- Launch to public April 19.
- Incorporates (and links to) educational materials for the SEU theme.



# Amateur astronomers

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- **Opportunity:** >100,000+ amateur astronomers who reach audience of millions
- **Challenge:** SEU topics and missions rated lowest of two dozen topics in astronomy.
- **Solution:** With Astronomical Society of the Pacific, we are developing an SEU “tour of the universe.”
- >100 clubs have signed up for ASP / NASA “Night Sky Network”



# Einstein in the classroom

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- Understand the challenge.
- Focus on professional development for teachers.
- Produce compelling scientific visualizations.
- Develop improved tools for learning.

# The challenge...

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- The SEU theme is part of the National Science Education Standards for high school...
- But most students take astronomy in a middle-school earth-science course.
- 40% of e.s. teachers did not have ANY in-depth science course in college, let alone astronomy or earth science (Weiss, 2002).



# The challenge...

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- 60% of teachers say they need more professional development...
- Yet fewer than 1/3 of teachers have had 35+ hrs. of professional development in the last 3 years.



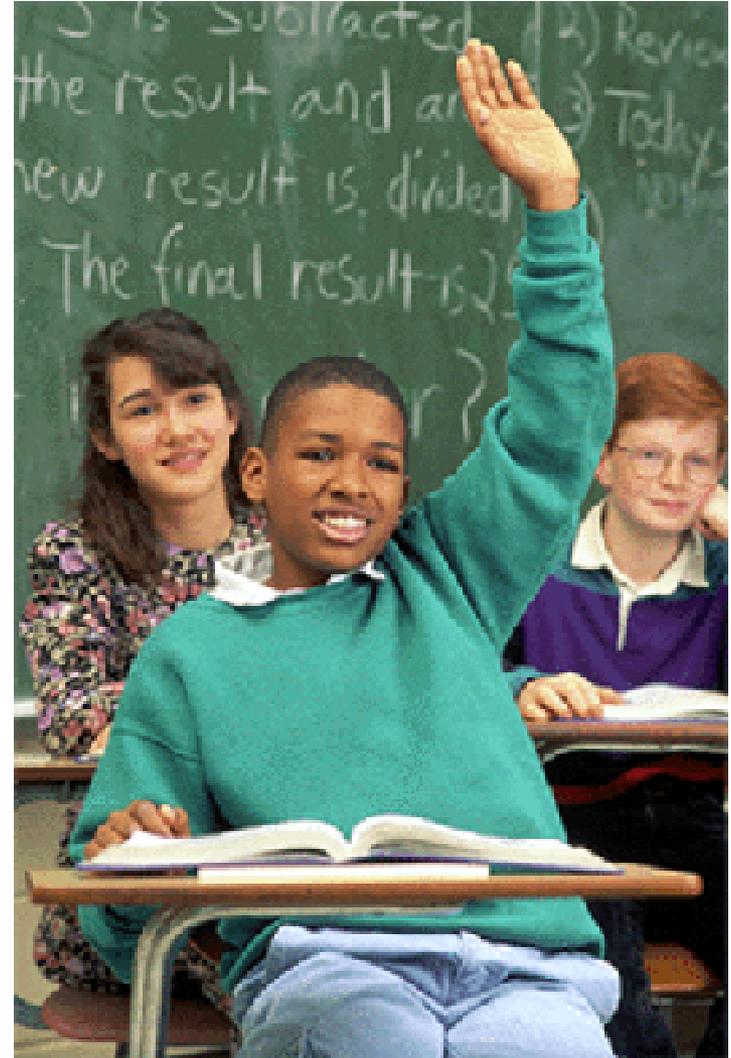
# SEU survey: Big Bang in the classroom

- Do you cover the Big Bang? What are the chief classroom issues? Needs?
- 600+ teachers from 45 states responded.
- Middle- / high-school teachers, including earth sci, phys sci, physics and astronomy courses.



# SEU survey: Big Bang in the classroom

- 87% of teachers reported covering the big bang and early universe. (Figure is high!)
- Top reported needs: graphic visualizations, explanations of bb cosmology, answers to FAQ's from students (including about black holes).

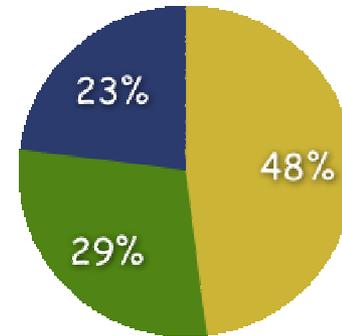


# Big Bang avoiders...

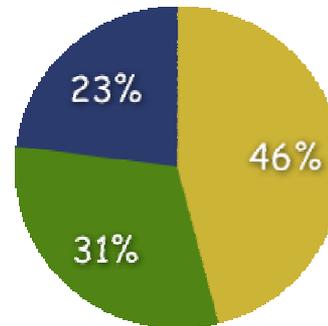
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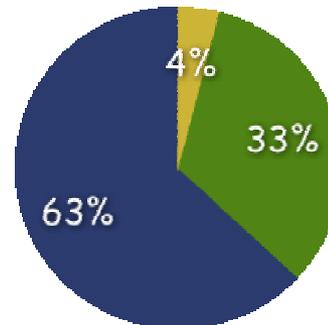
- “I would need more content knowledge.”



- “Not enough time.”



- “Lack of student interest.”

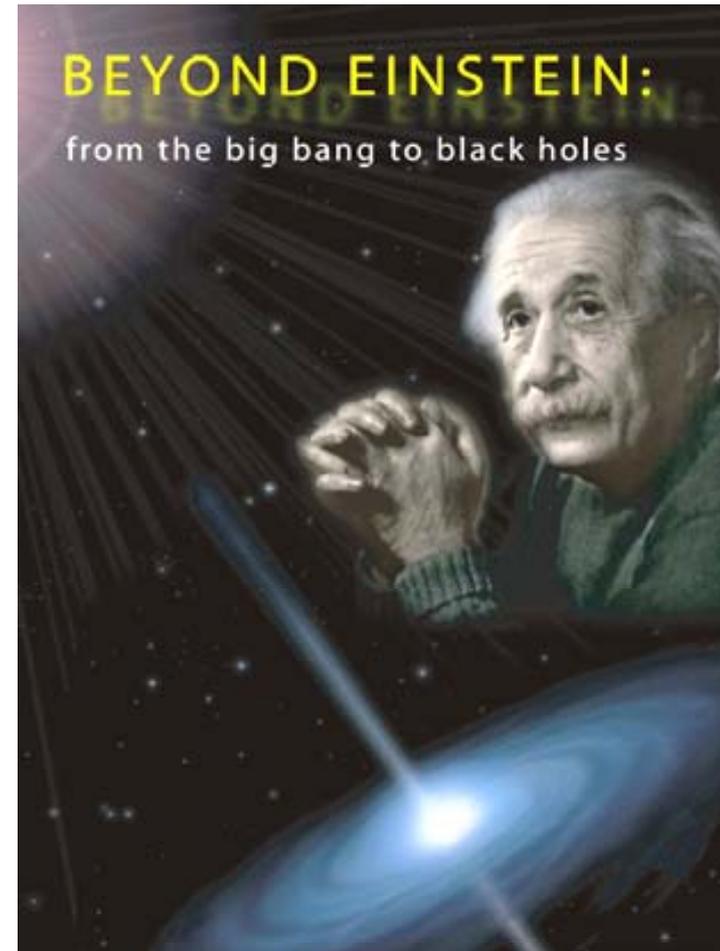


# Professional development for teachers

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- Short Course for teachers, on modeling the universe, via SEU missions and Forum.
- SEU Ambassadors Program, via Sonoma State University. (100+ workshops reached 14,512 teachers in 2002-3).
- Workshops on EM spectrum and the elements, via LHEA at Goddard SFC.

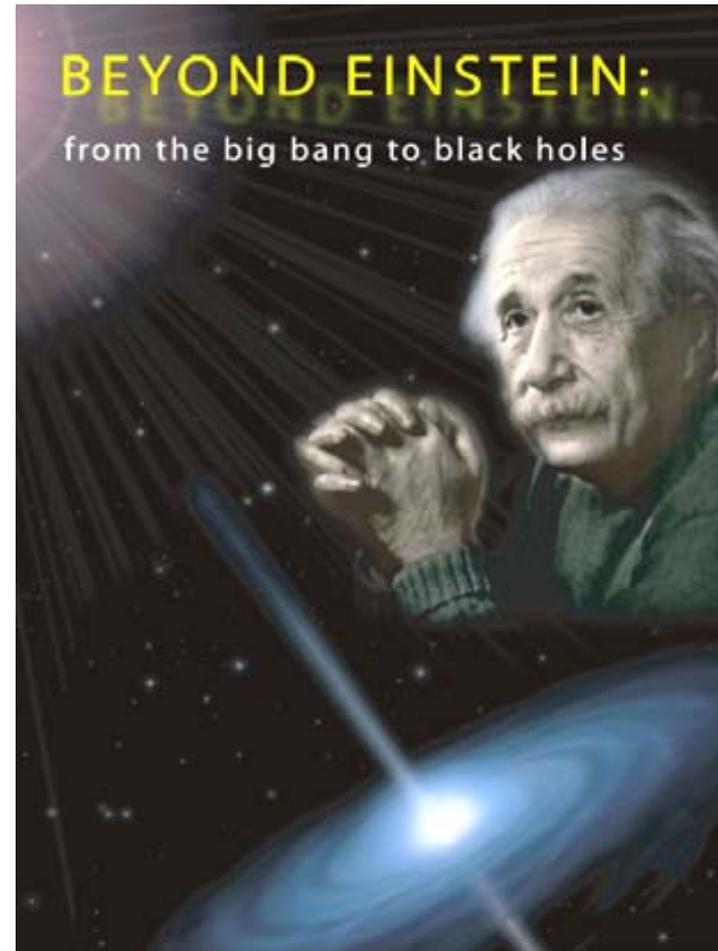


# Professional development for teachers

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- SEU Forum is producing DVD-based professional development videos to encourage teaching of SEU in middle- and high-school.
- Collaborating with Science Media Group at Center for Astrophysics, which produced “Private Universe” series.



# National space science assessment

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- SEU Forum and CfA have created a National Space Science Assessment.
- 13,000 students, G5-12, will take the test this spring.
- Used to assess pre-college and college students & to guide new materials via NASA Frameworks.



# Frontiers and Priorities

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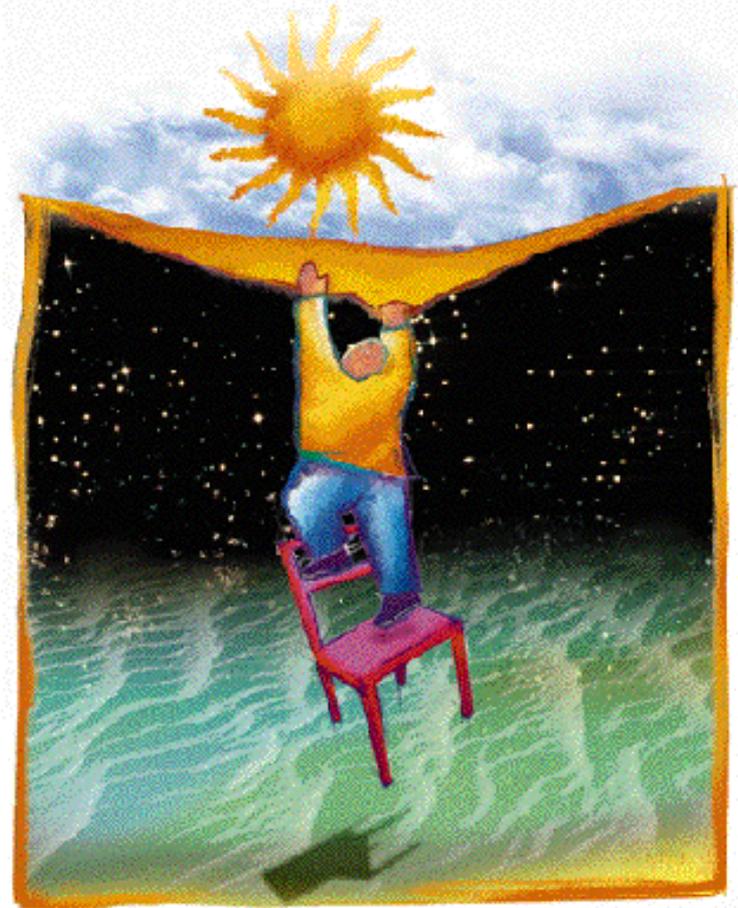
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## Develop better tools for students to access astrophysical data

- Educational interface for HEASARC data at Goddard;
- Educational interface for NVO;
- Interface to high-Z supernova data at CfA.

## Students gather their own data, e.g. through online telescopes.

- MicroObservatory telescope network;
- Global Telescope Network, etc.



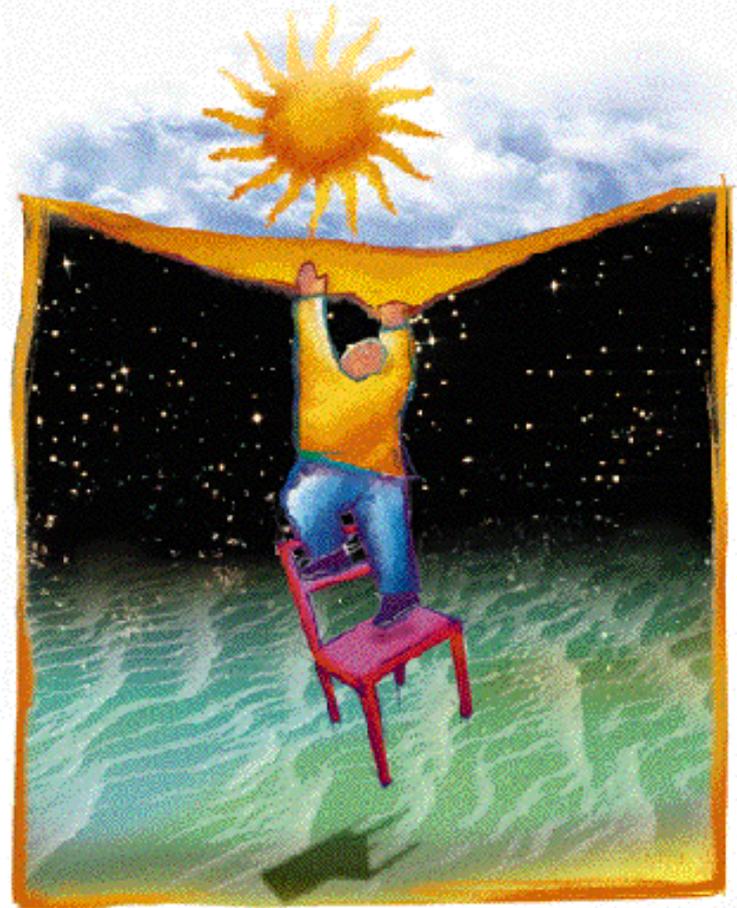
# Frontiers and Priorities

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**Develop the SEU story and unify with the other science themes.**

- “New discoveries are made every day, but new physics comes once a century.”
- “The cosmic conditions for life began before the big bang.”
- “You are as old as the universe itself.”
- “Why is the universe so hospitable to life?”



# Conclusion

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- The SEU E/PO program is robust.
- The public is eager to be involved in the excitement of your work!

