

Bringing the LHC and ATLAS to a regional planetarium

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Outline

- Planetarium
- Abrams planetarium at MSU
- Traditional show and clips
- Full-dome show and clips
- Summary

Planetarium outreach

- Important outreach tool in Astronomy
 - 110 Million visitors per year
- Science-literate audience
 - Geeks
 - College students
 - Families
- Service to community
 - K-12 classes on weekdays
 - Special events throughout the year
 - Connection to science museums and similar institutions
- On-campus planetarium: service to university
 - College courses
 - K-12 classes on weekdays
 - Connection to astronomy club and similar organizations

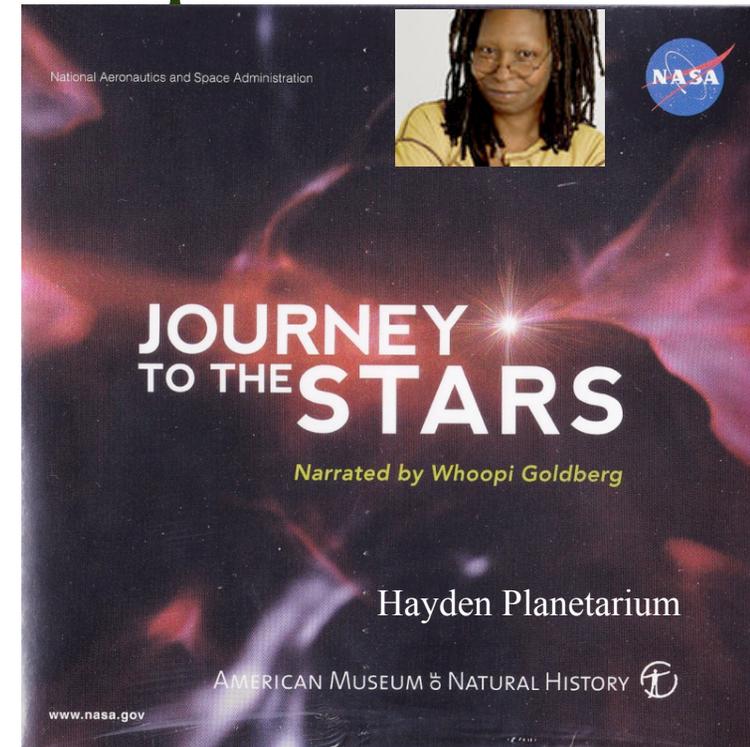


Planetarium shows

- On-campus or stand-alone planetariums:
 - Evening and weekend shows for general public
 - 20 to 30 minute show
 - Large catalog of shows available, many free, some for purchase
 - followed by 30 minute star-talk
 - Typically live presenter
 - Tonight's sky, constellations, planets, notable astronomical events
 - Weekday morning/afternoon show for school class
 - Specific shows or topics requested by teacher
 - Sometimes with star-talk, sometimes not
- Planetarium that is part of a science center or museum:
 - 20 to 30 minute show, scheduled several times during the day
 - Visitors attend the show as part of their afternoon-long visit
 - Sometimes thematically connected to other content
 - exhibits, flat-video shows, handouts, activities

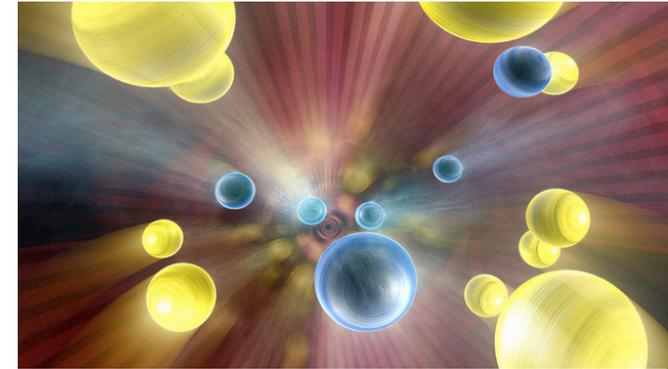
Planetarium show development

- Planetariums develop shows
 - Large US and international planetariums
 - National Space Center, UK
- Companies develop shows
 - Loch Ness productions
 - Traditional and full-dome video shows
- Financing and contributions from many sources
 - NASA
 - European Space Agency
 - Various government sources
 - Companies
 - Universities and Museums
- International planetarium society
 - Bi-annual meetings
 - Domefest

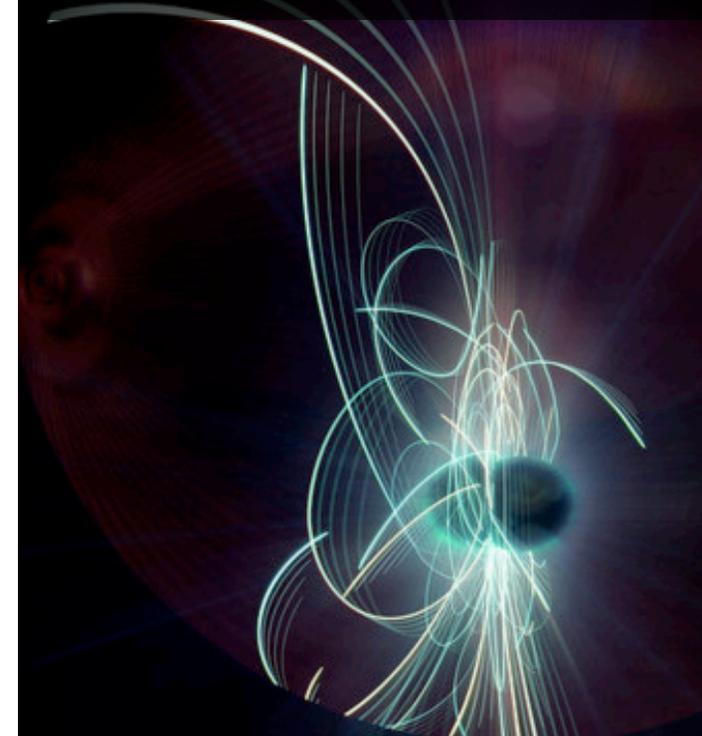


LHC at the planetarium

- No dedicated show yet
 - Smaller efforts ongoing
 - LHC and proton colliders appear in shows on other topics
- Particle physics presentations in planetariums
 - When LHC started up
 - In connection with Angels & Demons
 - In connection with Higgs discovery
- Many visitors are curious about LHC
 - Do you make black holes at the LHC?
 - What is the Higgs boson useful for?
 - How do you make protons?

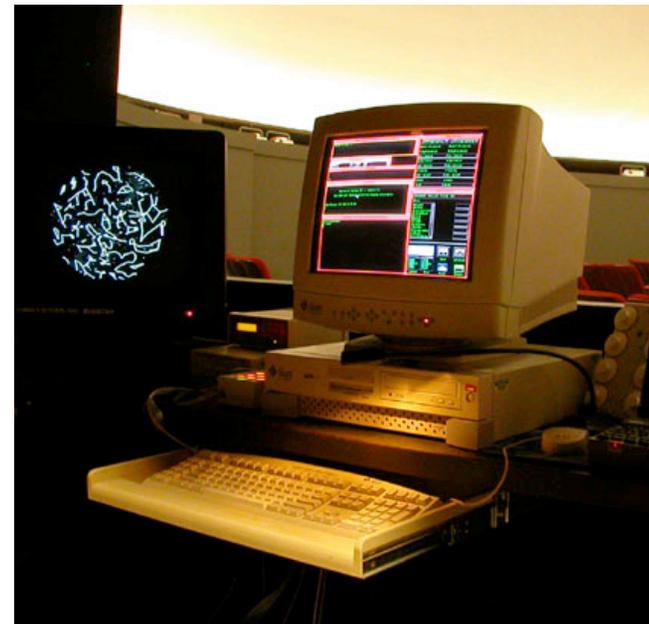


protons and collision
from We are Astronomers



Abrams planetarium at MSU

- Built in 1964
- 50 ft diameter dome
- 150 seats
 - > 5000 visitors per year
- Traditional setup
 - Digistar 2 b/w projector
 - Front/side fixed images
 - Fulldome fixed images
 - Front video

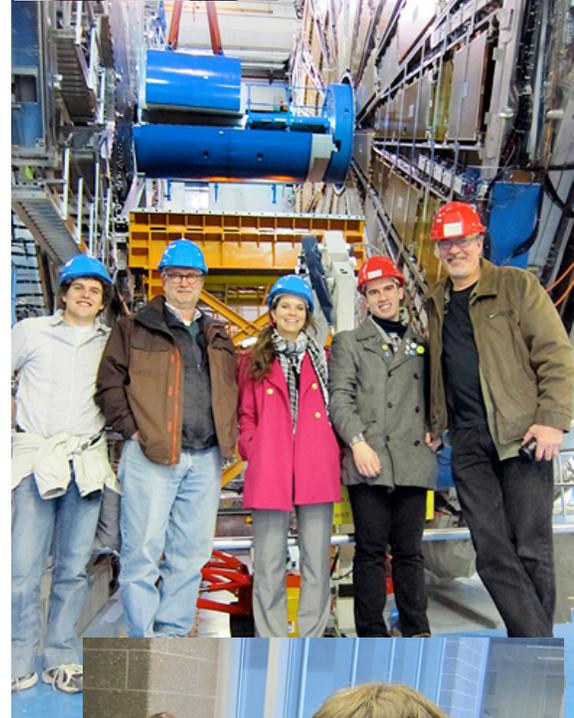


Planetarium outreach project

- Outreach component of NSF CAREER grant PHY 0952729
 - Bring ATLAS, LHC, energy frontier to a regional planetarium
 - In close cooperation with Abrams Planetarium at MSU
 - Initial goal: produce a few short clips
- Traditional show production
 - 2011 Spring: 5 minute clip on MSU and ATLAS
 - 2011 Spring/Summer: 30 minute show
 - 2012 Summer: 5 minute video on Higgs discovery
 - Many live presentations
- Full-dome show production
 - 2013 Spring/Summer: 5 minute clip on MSU, HAWC, SOAR
 - 2013-2014: 30 minute show on Dark Matter, cosmology, direct detection, ATLAS

Designed and produced by MSU students

- 2 undergraduate graphic designer
 - Still images and posters and promotional material
- 3+3 undergraduate animators
 - Recruited with help from CommArts Professor
 - Communication graphics program
 - 3D design and animation
- 2+2 undergraduate professional writers
 - Help from Professional Writing Professor
 - With feedback from everyone involved in the project
- 1 undergraduate music writer/producer/artist
- 1 graduate, 1 undergraduate physics student
- With support from experts:
 - Professional writing professor
 - Communication graphics and design professor
 - Planetarium show developer
- 20-node render farm
- Small 1k pixel development dome



Show development resources

- Render farm
 - 20 nodes, 3.5 GHz i7
 - Each 24 GB memory
- Development dome
 - 2k by 1k

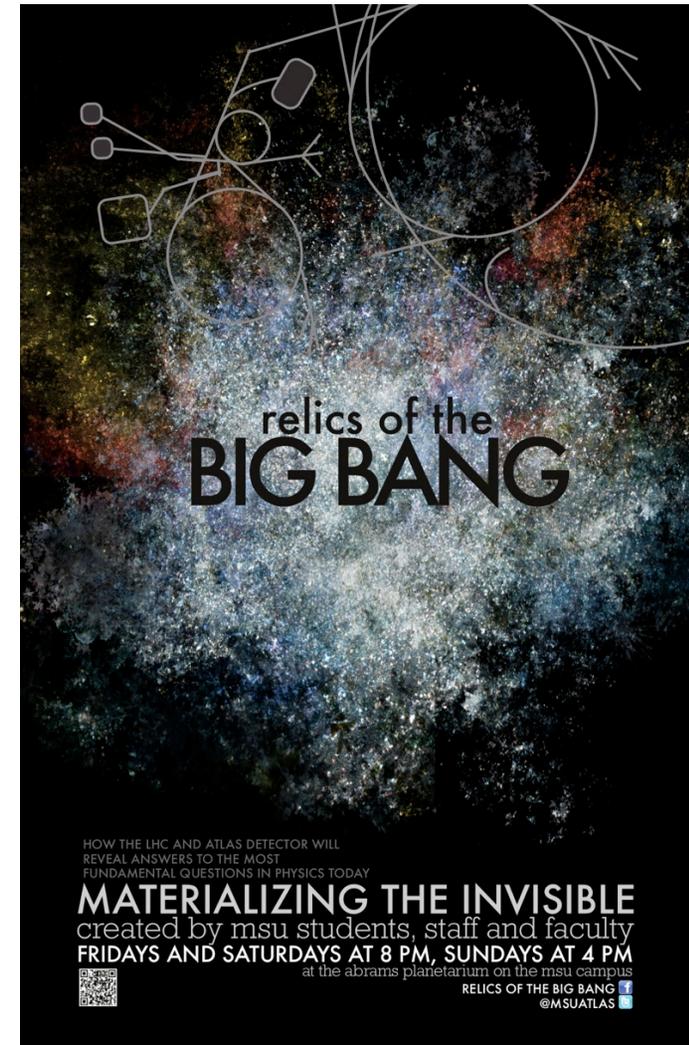


2011 Traditional planetarium show

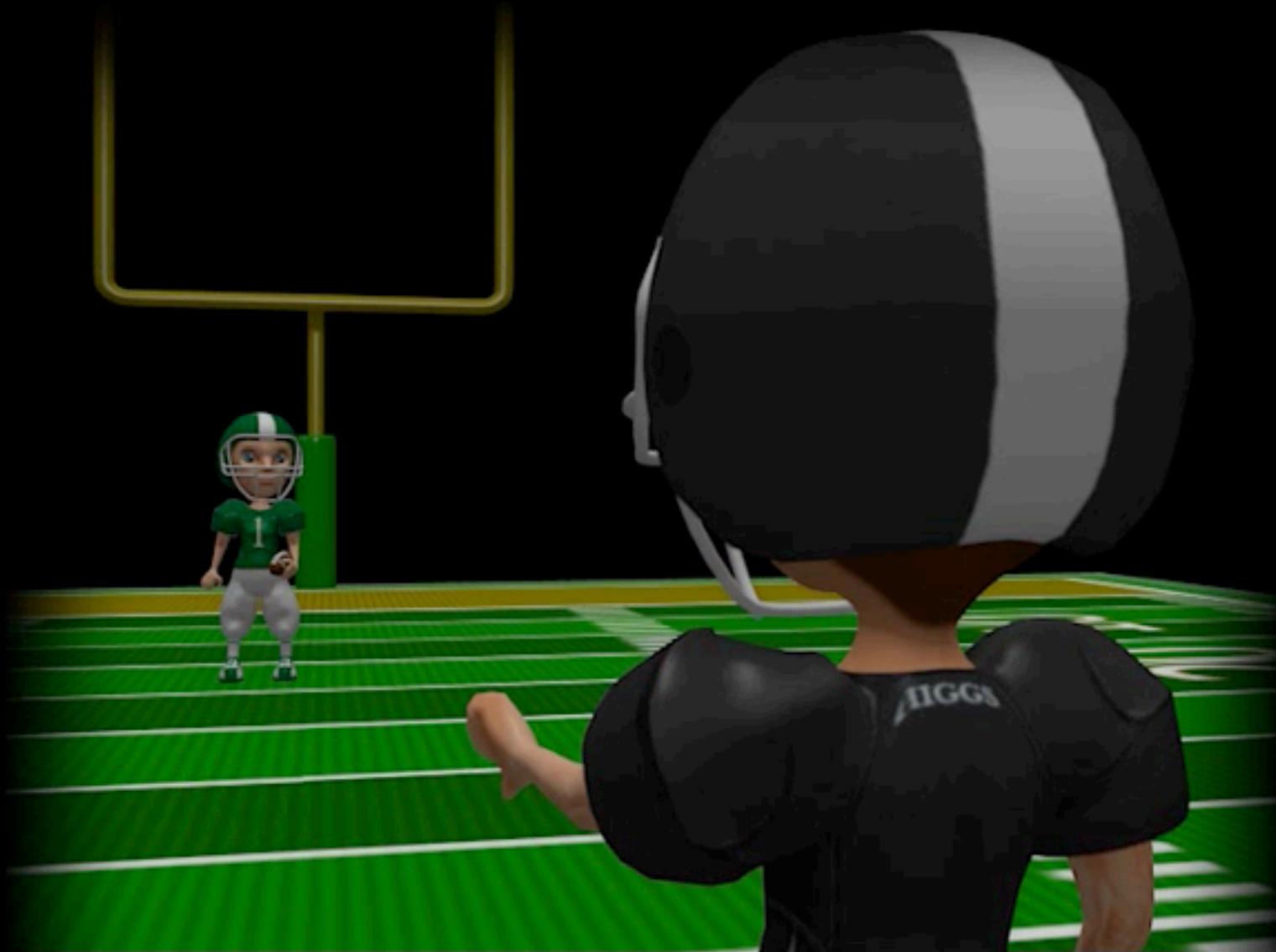
- Higgs, dark matter, LHC, ATLAS
 - FRIB - nuclear physics at MSU
- Story about people and connections
- Interviews with students, postdocs, faculty



- Many images
 - All-sky images
 - Many slides
 - Animations and interviews as videos
 - Digistar 2 for stars and LHC and events



Massless and massive particles in Higgs field





Allsky image

Feedback, Focus groups

- On-campus planetarium ideal for getting feedback
 - Students for focus groups
 - On-campus and off-campus science organizations for focus groups
 - General public for feedback after regular shows
- Focus groups
 - Questionnaire and discussions after the show
 - Questions on viewer background
 - Questions on show educational and entertainment content
- General public
 - Encourage audience questions after showing a clip
 - Informal feedback from audience members

Relics of the Big Bang: Materializing the Invisible
Focus Group Questionnaire

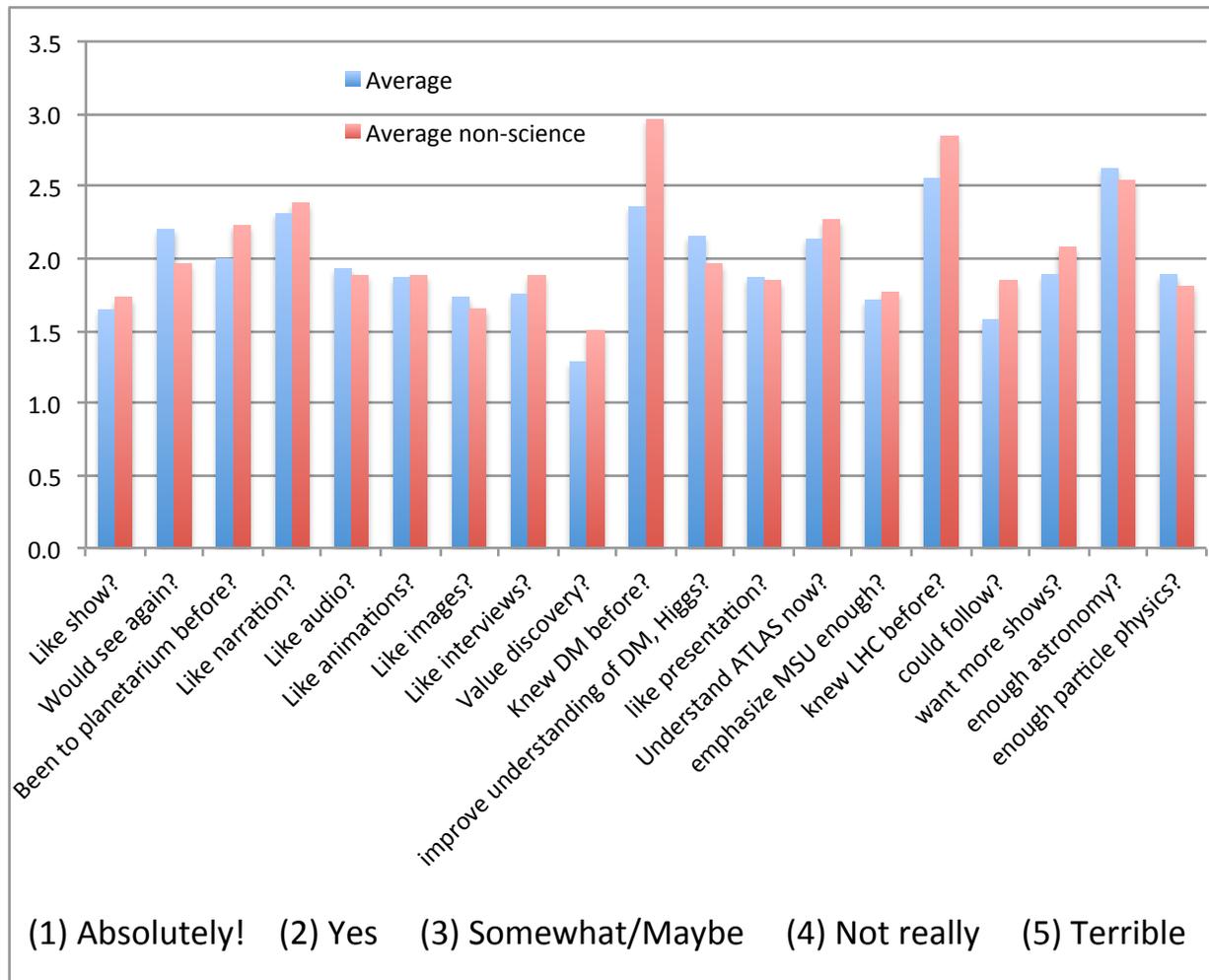
Please provide a little information about yourself so that we can better understand our audience.

Age: _____ Gender: _____ Education Level: _____ Major: _____

Using a five point scale, please circle the number that best describes your experience watching
Relics of the Big Bang

Focus group

- 2011 show on Higgs, DM, big bang, LHC, ATLAS
- MSU students and others
- Liked most: Presentation, Higgs, music
- Liked least: narrator too slow, title misleading, flashes

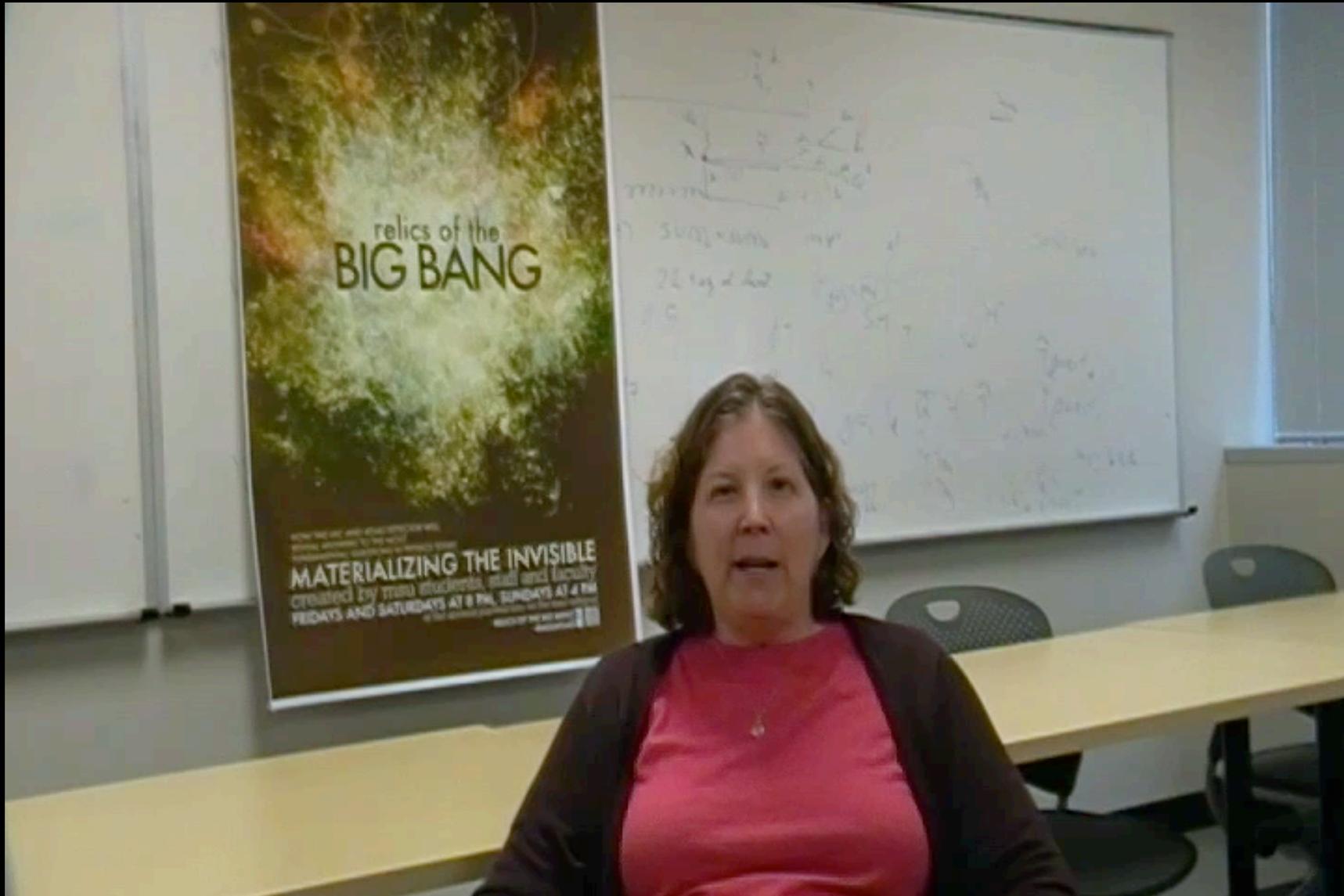


Feedback comments

- Focus group
- Comments after the show
- Comments after Higgs update presentation
- Positive and negative and confused and questions
 - “You make particle physics look awesome”
 - “Big Bang in the title is misleading”
 - “Did the MSU cyclotron find the Higgs?”
 - “How is this relevant for the real world?”
 - “Can you see the Higgs?”
 - “Did dark matter or the Higgs boson cause the big bang?”
 - “Are you closer to a theory of everything?”

Higgs update

- Summer 2012, flat video, presented following scheduled show



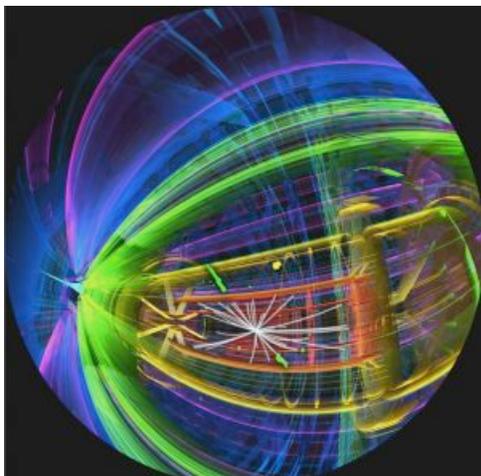
Full-dome video

- High-resolution projection onto the planetarium dome
- Multi-projector setup
 - 2 to 6 projectors
 - Driven by a rack of computers
 - Up to 4k by 4k pixels
- For smaller planetariums, single projector
 - half-dome convex mirror or fisheye lens
 - Up to 2k by 2k pixels
- Technology improves rapidly

Dark Relics of the Big Bang

- 25-minute full-dome show on Dark Matter, cosmology, direct detection, LHC and ATLAS experiment
 - Executive producers: Michael Barnett, Kaushik De, RS
 - PIs: Michael Barnett, Kaushik De, Carmen Garcia, RS
 - Writer/Producer: Carey Ann Strelecki
 - Production coordinator, creative lead: Joao Pequeno
- In cooperation with major planetariums: Adler, Chabot
- Hollywood composer, narrator; professional animators
- Anticipated distribution: Spring 2014
- In conjunction with education resources, 2d version, web site, etc

ATLAS

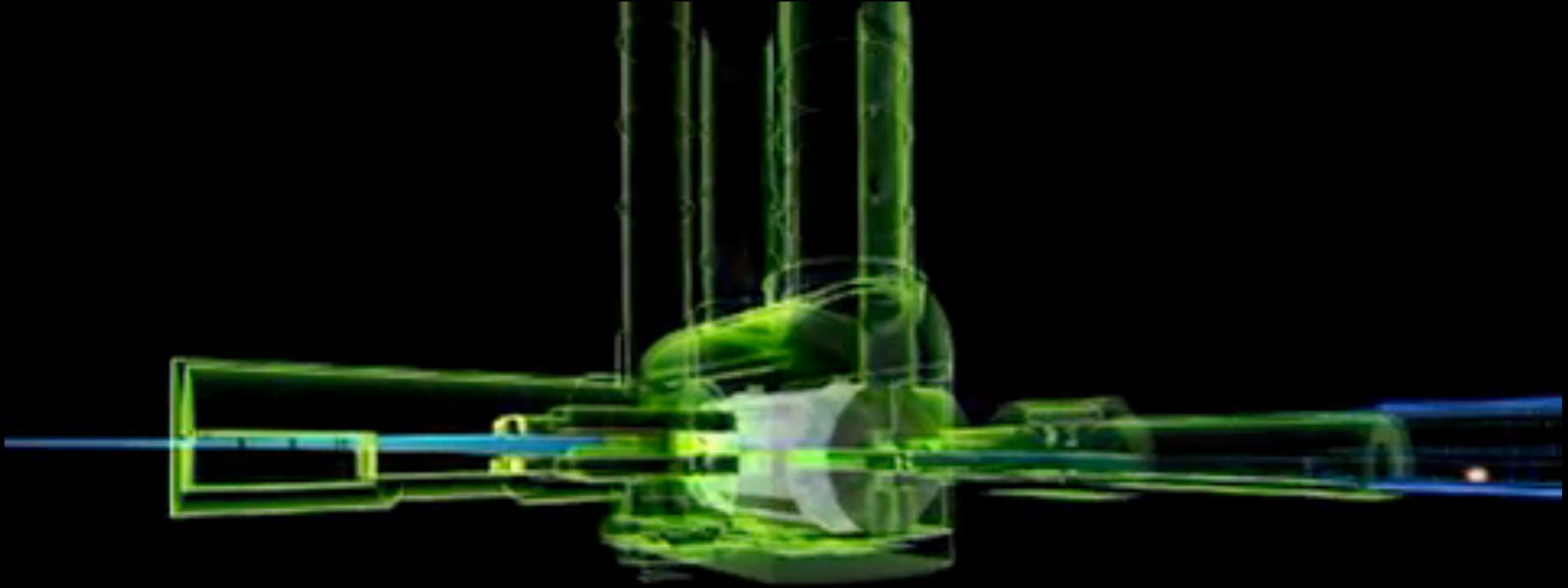


LUX

Taking dark matter out of a galaxy



LHC and ATLAS



Summary

- Bringing energy frontier and LHC to a planetarium
 - Short clips and full shows on particle physics, LHC, ATLAS
- Traditional show
 - Available for distribution: Relics of the Big Bang
 - On Higgs boson and dark matter and LHC and ATLAS
- Full-dome video show on dark matter in preparation
- Content development as group effort
 - MSU: creative team of undergrads
 - Several MSU departments
- Content available for other areas
 - Interactive touch screen

Outlook

- LHC content development has started
- Audiences are eager for more LHC and particle physics
- First show in preparation now
- Future shows planned