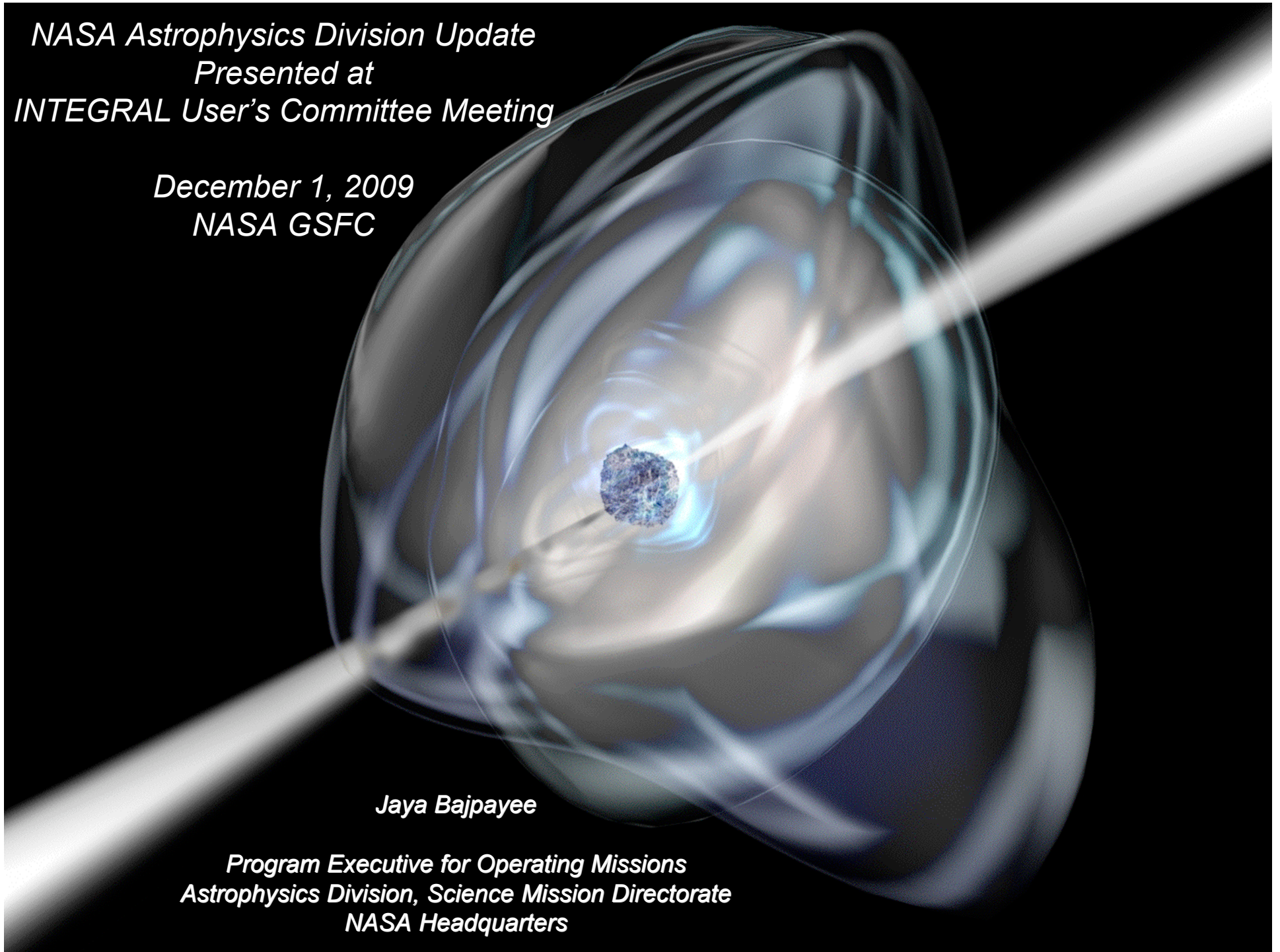


*NASA Astrophysics Division Update  
Presented at  
INTEGRAL User's Committee Meeting*

*December 1, 2009  
NASA GSFC*

*Jaya Bajpayee*

*Program Executive for Operating Missions  
Astrophysics Division, Science Mission Directorate  
NASA Headquarters*

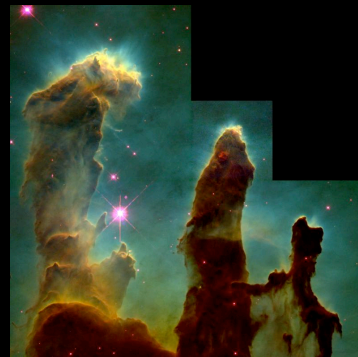
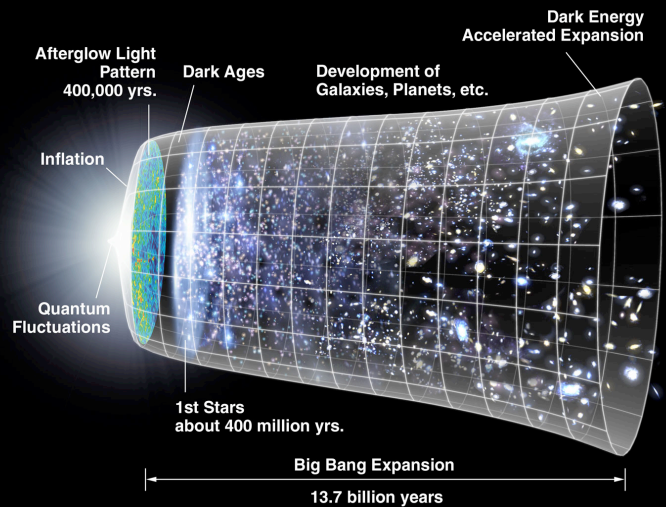
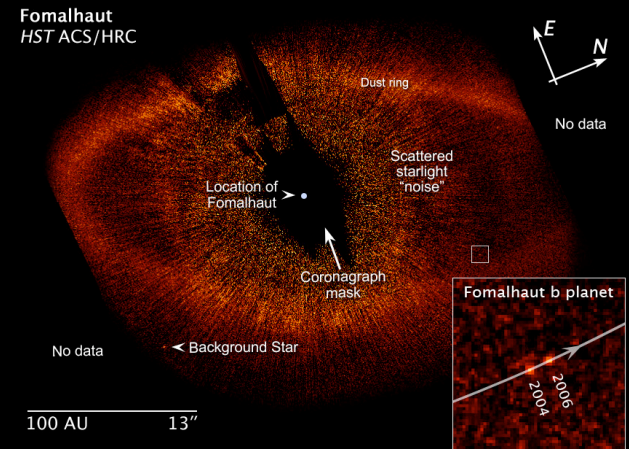
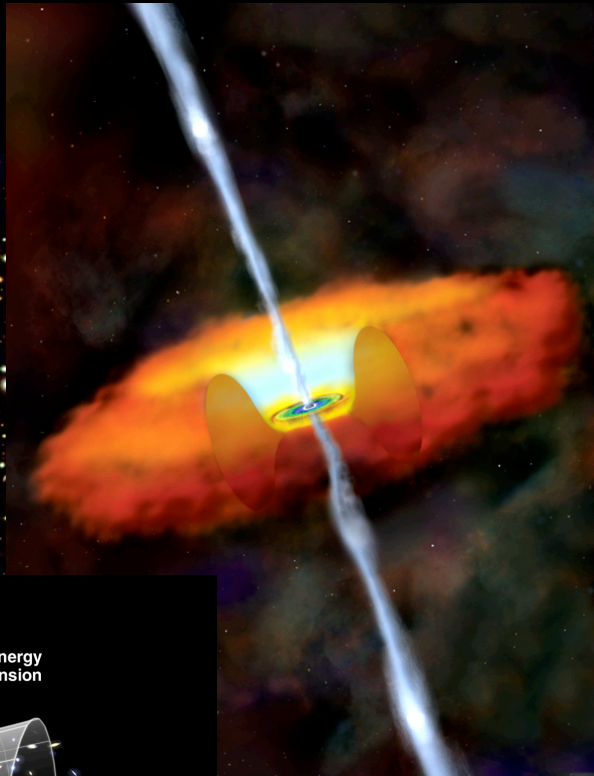
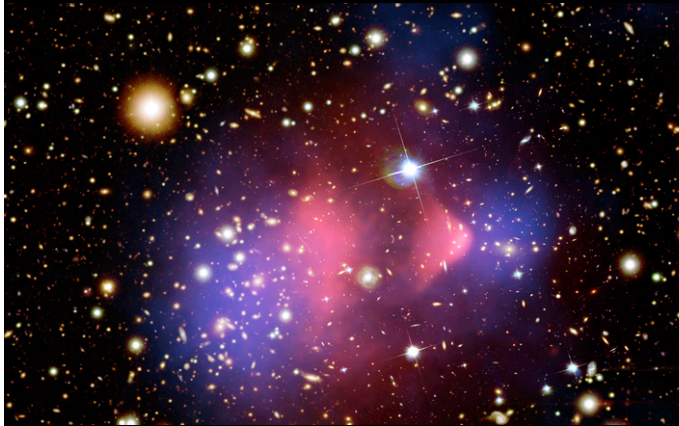


# NASA's Astrophysics Program

“How does the Universe work?”

“How did we get here?”

“Are we alone?”

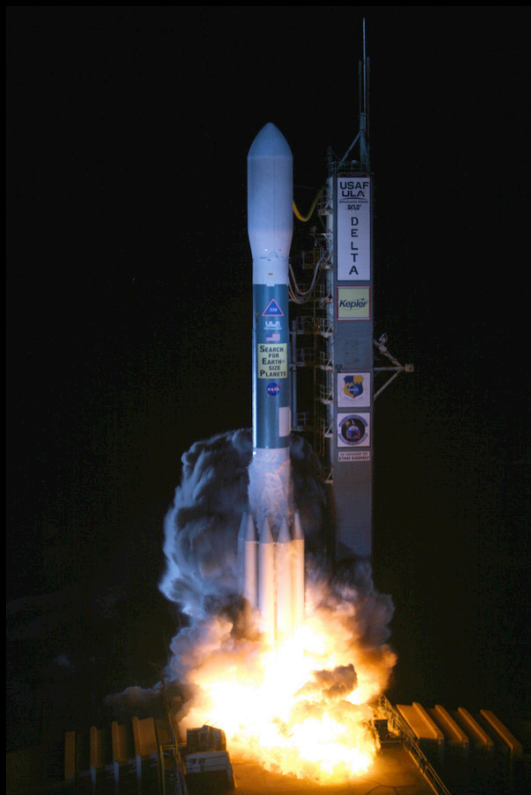


*Making new discoveries with largest portfolio of space-based Astrophysics missions in history...*

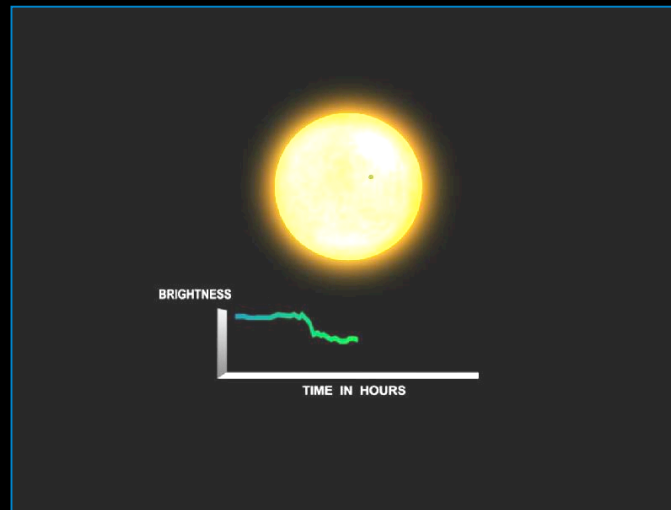


# Kepler

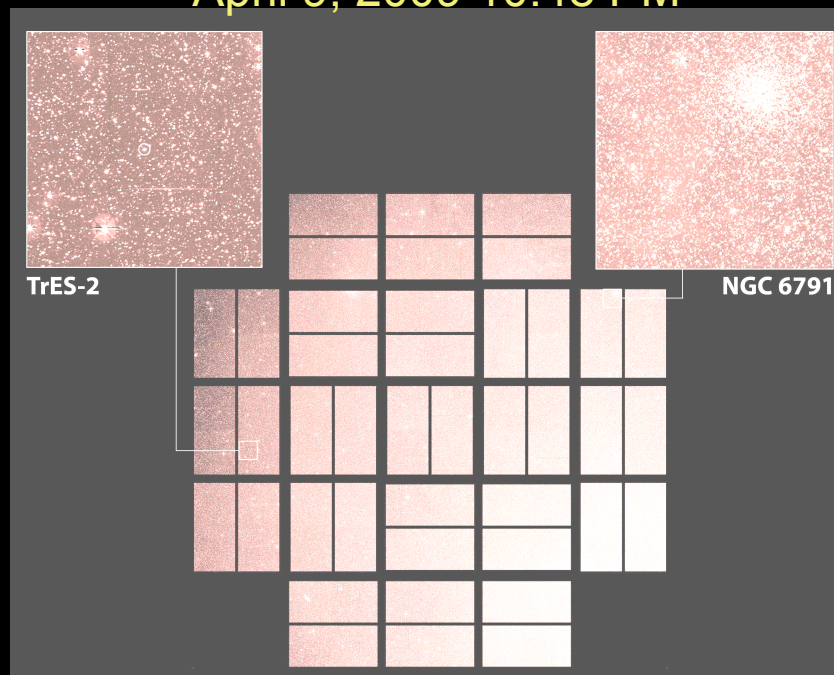
March 6, 2009 10:48 PM



“Liftoff of the Delta-2 Rocket with Kepler, on a search for planets in some way like our own.”



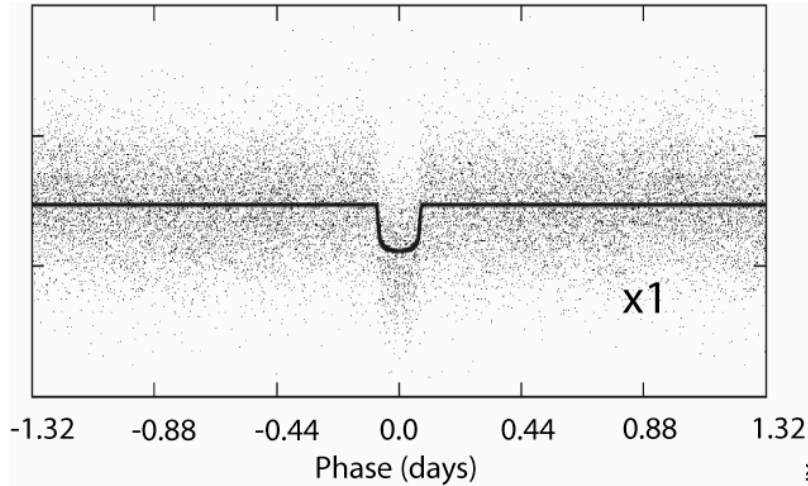
April 9, 2009 10:48 PM



First Light image showing detector layout and star field.

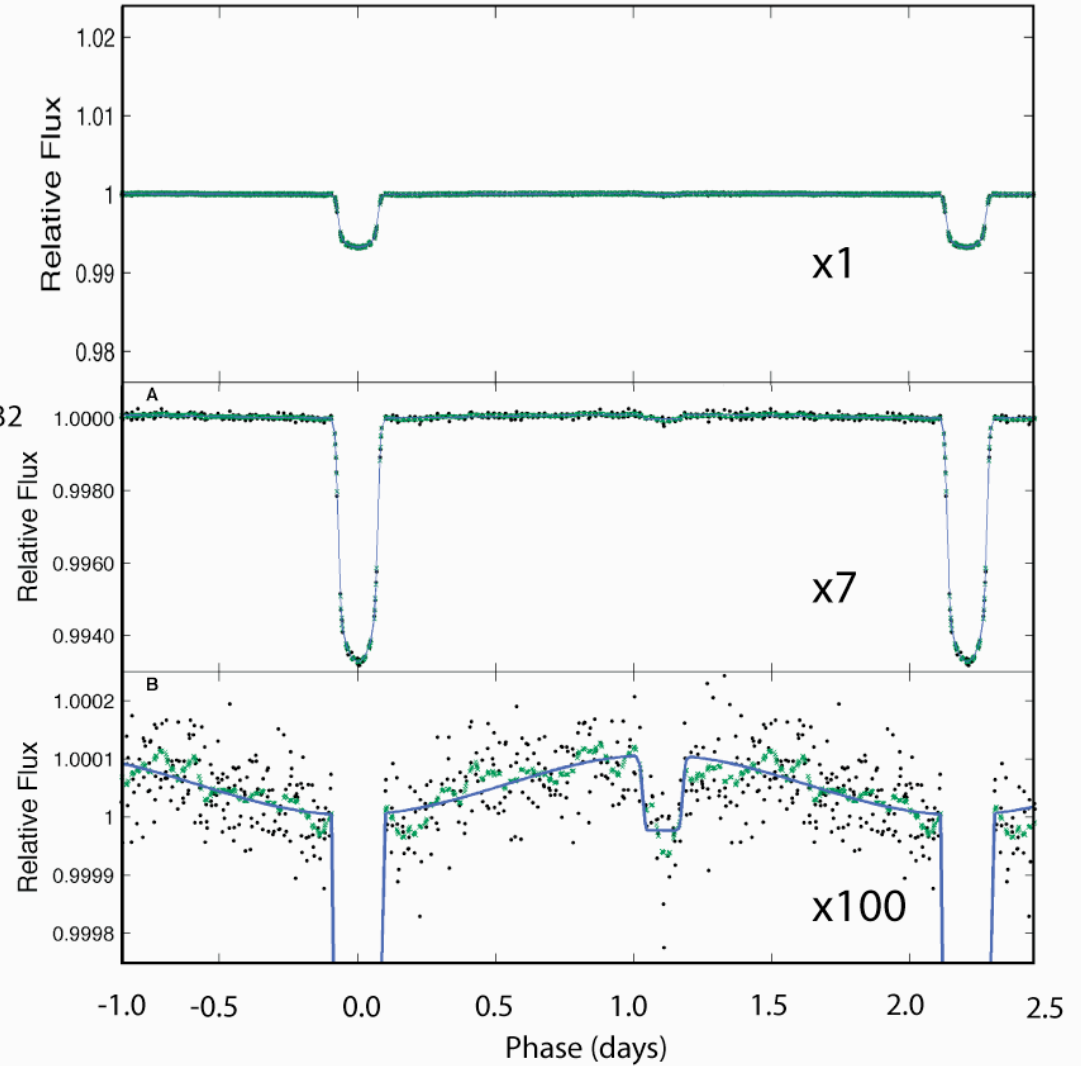
# Kepler Early Science Results

## Aug 6 Press Conference

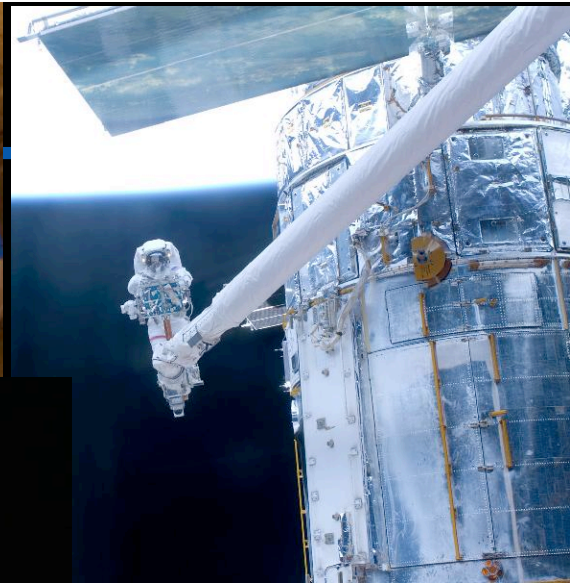
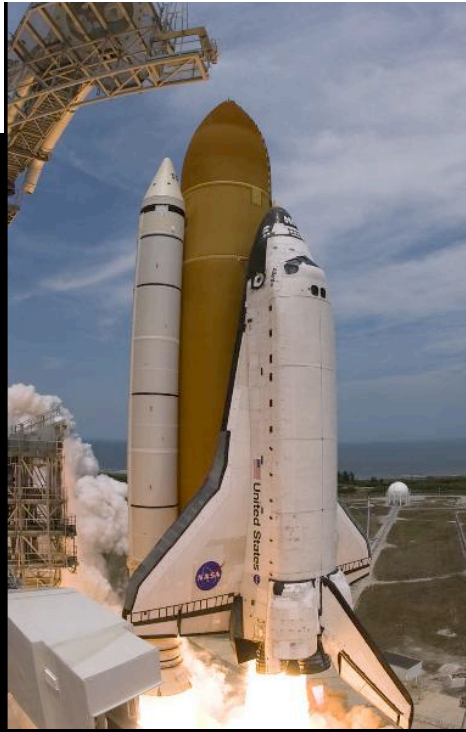


16,620 HATNet data points (57.7 days of data)

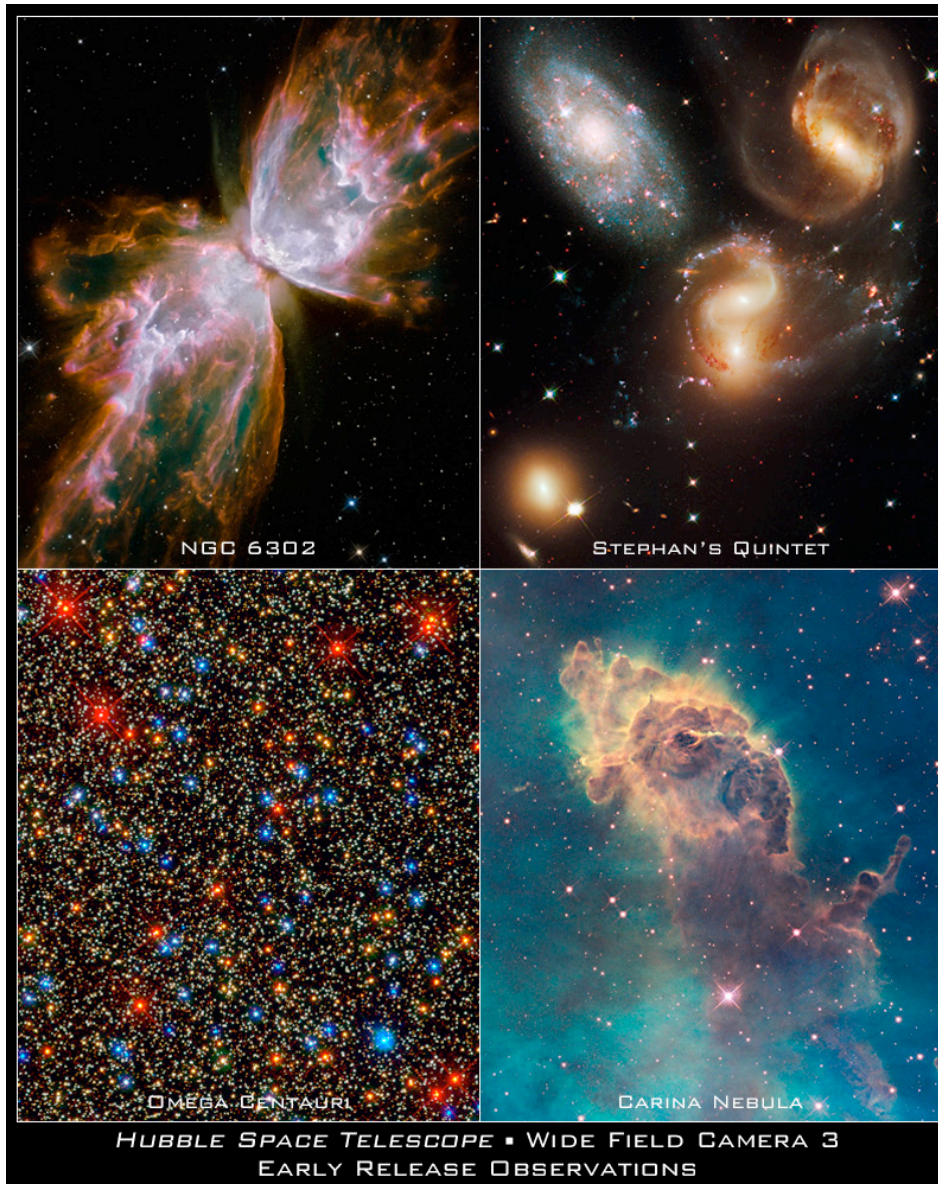
HAT-P-7b data from the ground  
A. Pal et al., 2008



Kepler Commissioning data (10 days)  
W. Borucki et al., 2009



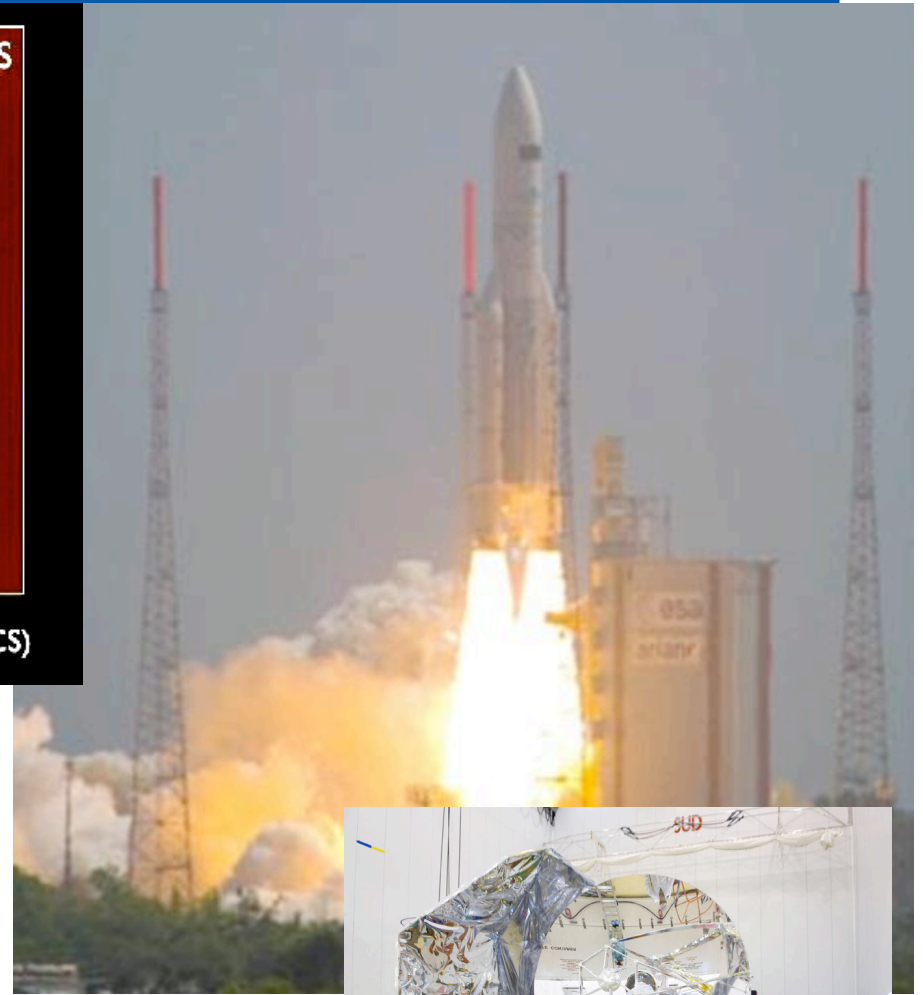
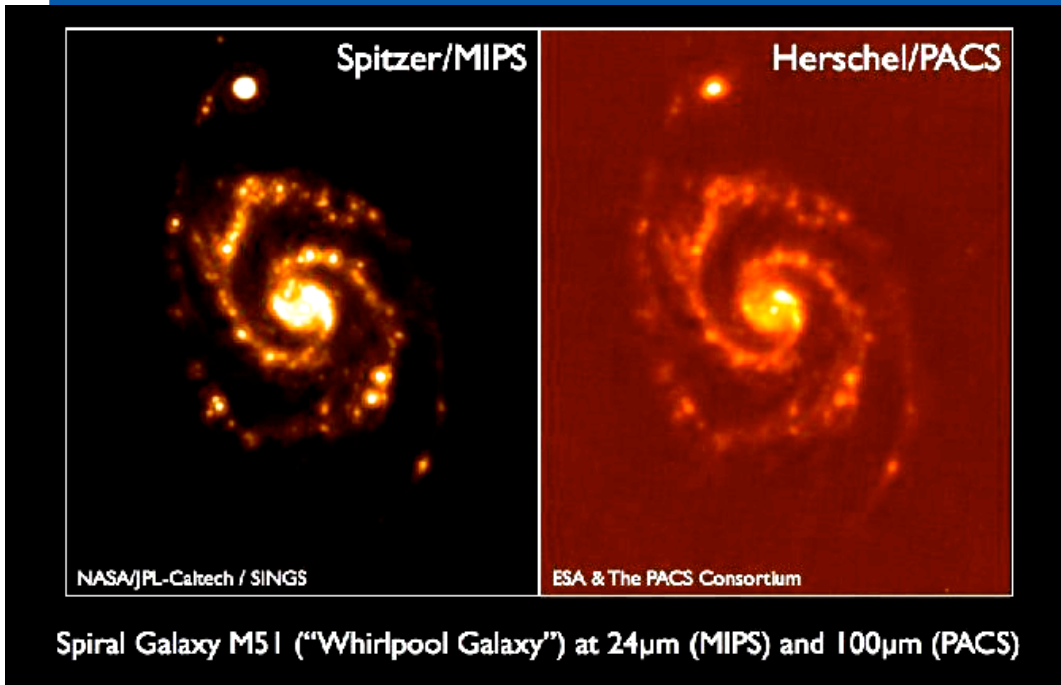
# HST SM4 – Early Release Observations



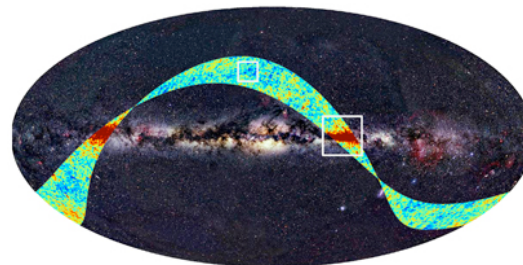
## Hubble Development (SM-4)

- ✓ Launched – May 11 at 2:02 PM.
  - ✓ Rate Sensor Units – replaced
    - ✓ WFC3 – installed
    - ✓ SI C&DH – installed
    - ✓ COS – installed
  - ✓ New batteries – installed
  - ✓ ACS – wide field channel repaired
    - ✓ STIS – repaired
  - ✓ Fine Guidance Sensor – replaced
  - ✓ New Outer Blankets 5, 7 & 8 – replaced
  - ✓ Soft Capture Mechanism – installed
- Reboost – not required

# Herschel/Planck Launch and First Light

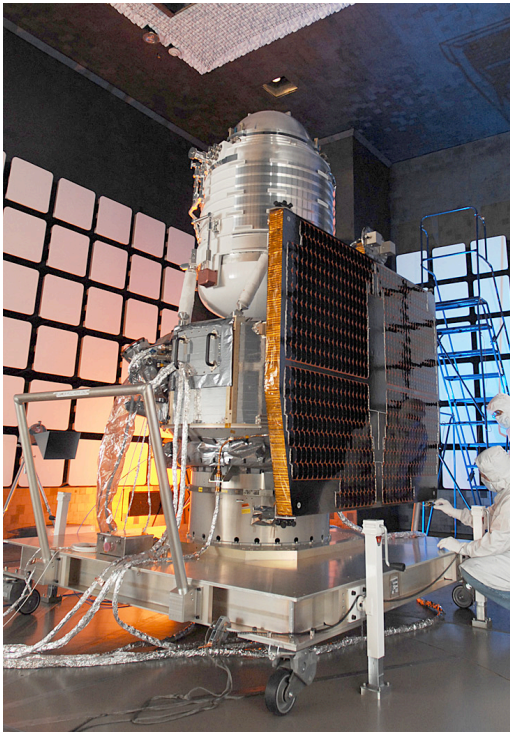


The Herschel and Planck spacecraft launched on May 14, 2009, from the Guiana Space Centre in French Guiana. Image credit: ESA-CNES-Arianespace/Optique Vidéo du CSG



# WISE Ready for Launch

- Passed Pre-ship Review on Aug 4
- Flight System arrived at VAFB on Aug 14.
- Launch scheduled for Dec 9



WISE before shipping to VAFB



WISE at VAFB



WISE launch  
stay tuned . . .



# Other Major Events

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- Chandra X-ray observatory 10 year anniversary conference (September 21-24, 2009)
- Fermi Gamma-ray Space Telescope 1<sup>st</sup> year science results (October 2009)
- Swift Conference Celebrating 5 years (November 17-20, 2009)
- SOFIA open door flight tests (beginning in October/November 2009)
- Women in Astronomy and Space Science conference: *Meeting the Challenges of an Increasingly Diverse Workforce* (October 2009)
- James Webb Space Telescope mission CDR (spring 2010)
- Hubble Space Telescope 20 year anniversary (April 2010)
  
- New discoveries with largest portfolio of space-based Astrophysics missions in history...



XMM-Newton  
(ESA)

Swift

Suzaku (JAXA)

FERMI

INTEGRAL (ESA)

GALEX

RXTE

Herschel (ESA)

Planck (ESA)

WMAP

Hubble

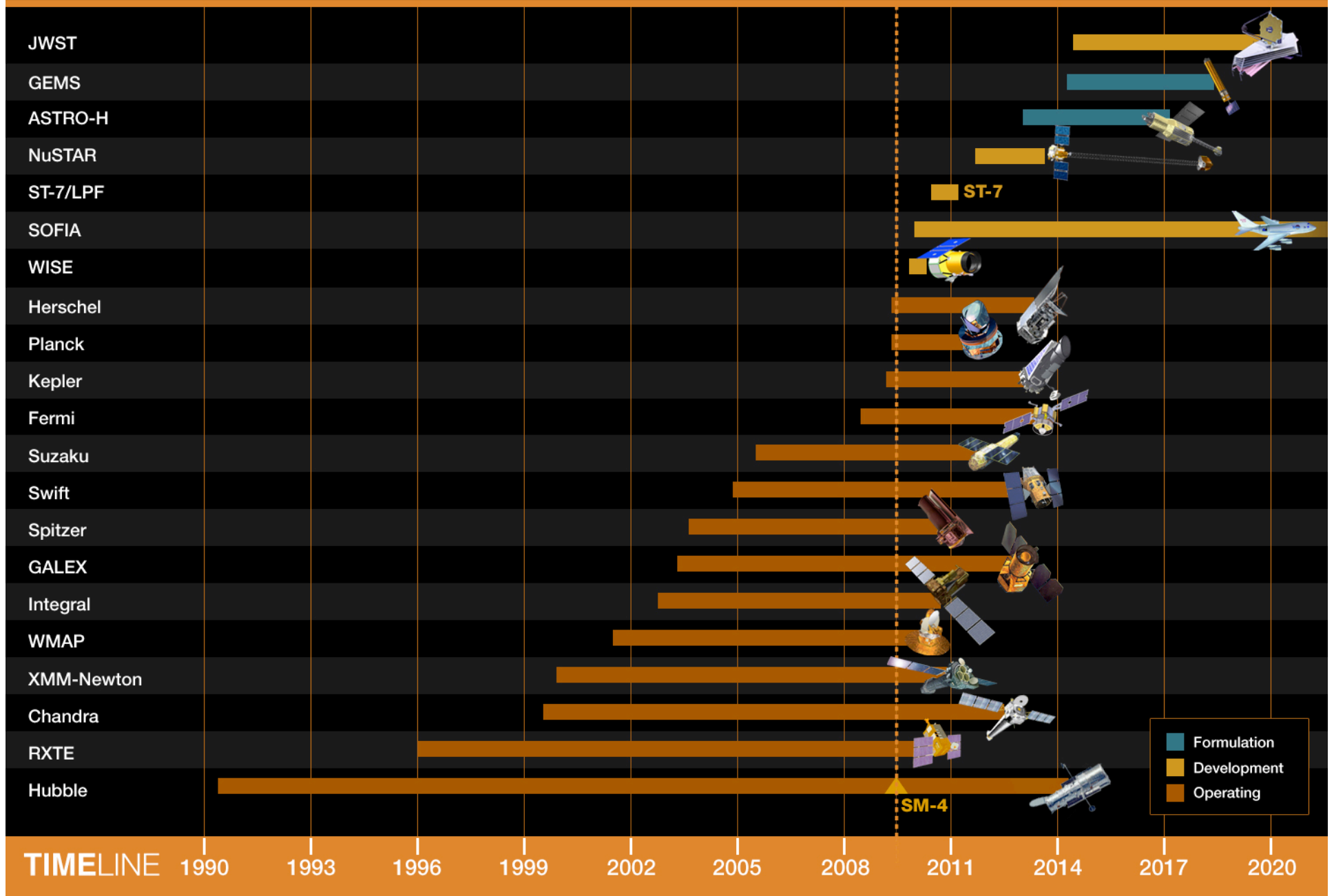
Kepler

Chandra

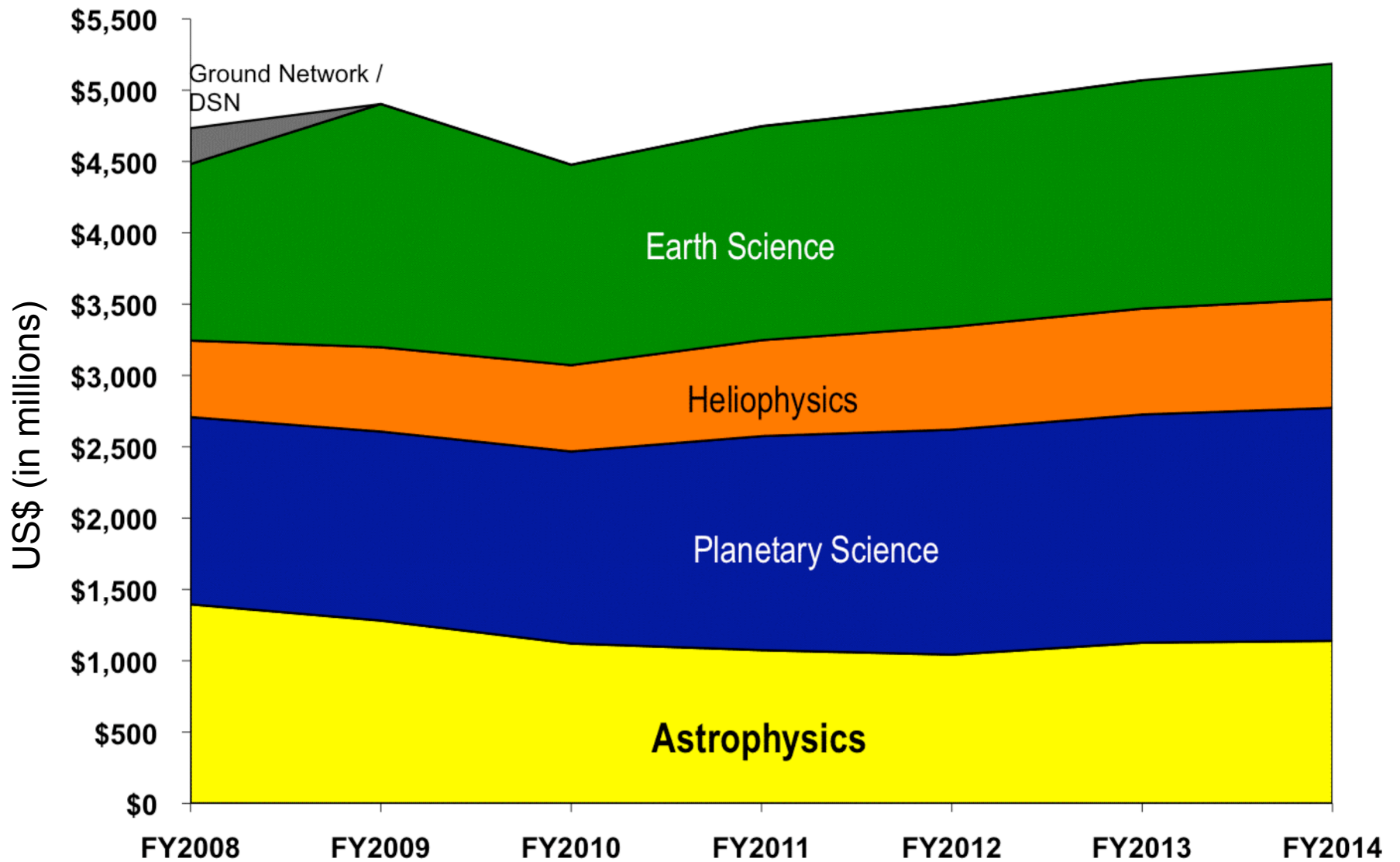
Spitzer

*14 Operating Missions providing  
numerous discoveries each month*

# Astrophysics Missions timeline

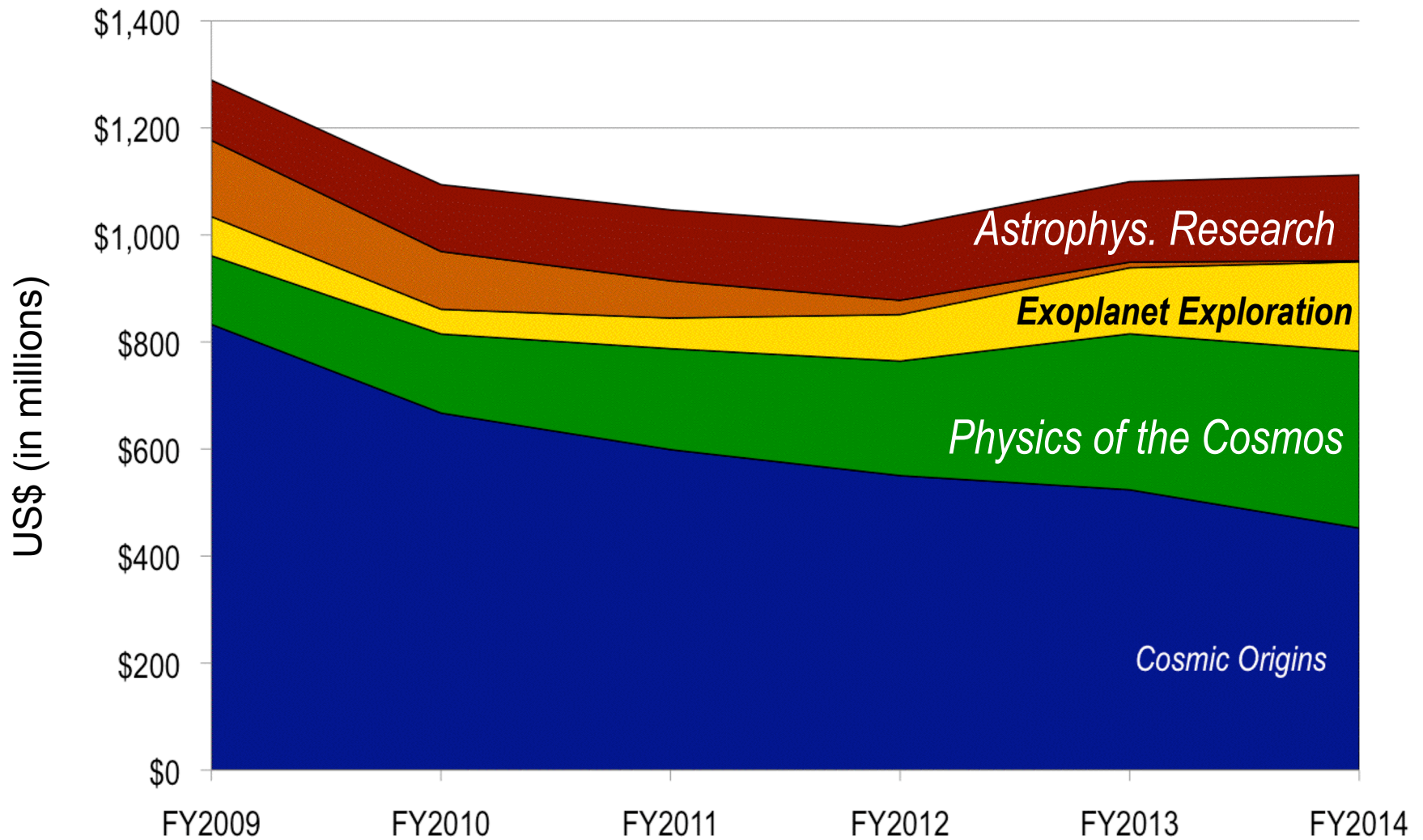


# SMD Budget Profile 2008 - 2014



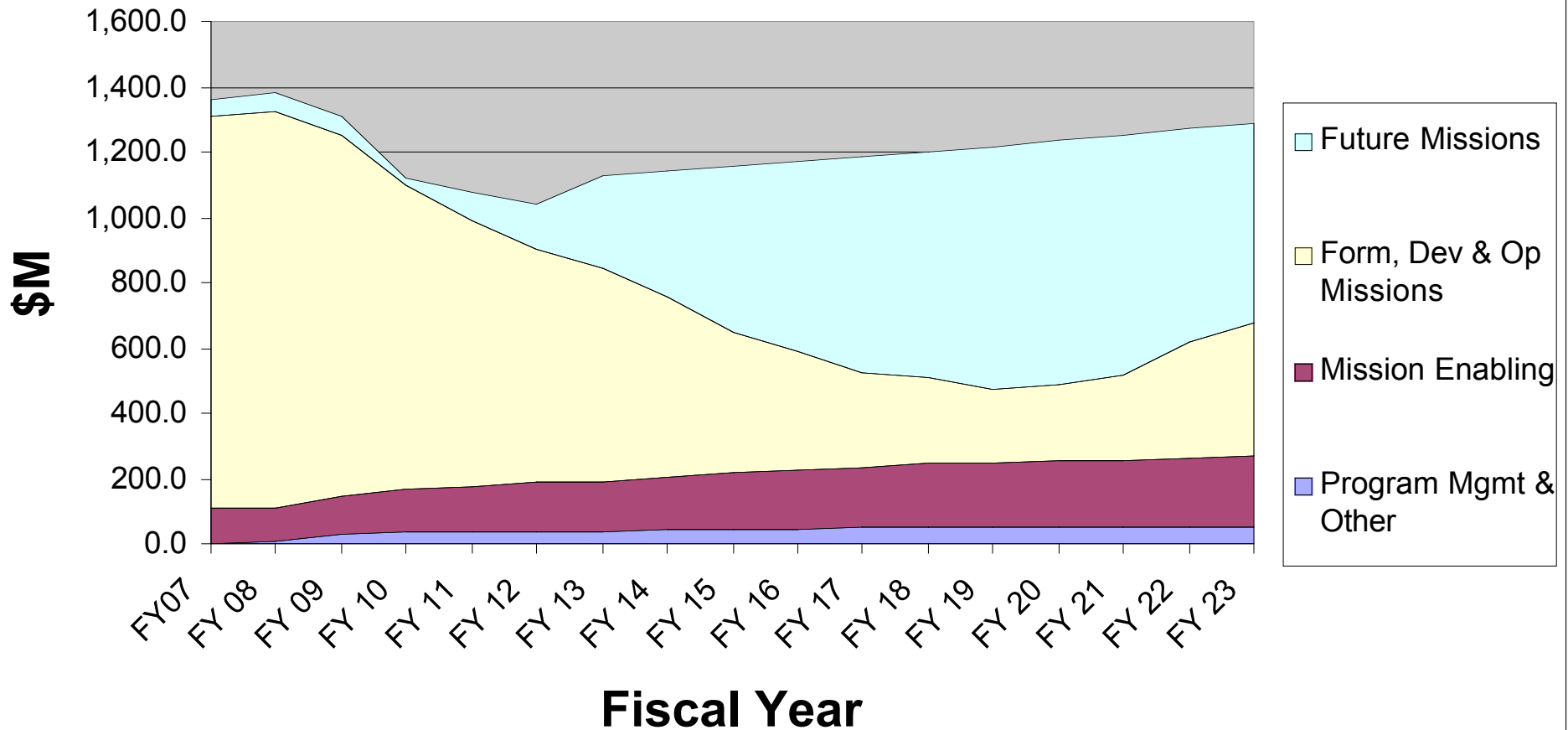


# Astrophysics Division Budget Profile 2009 - 2014



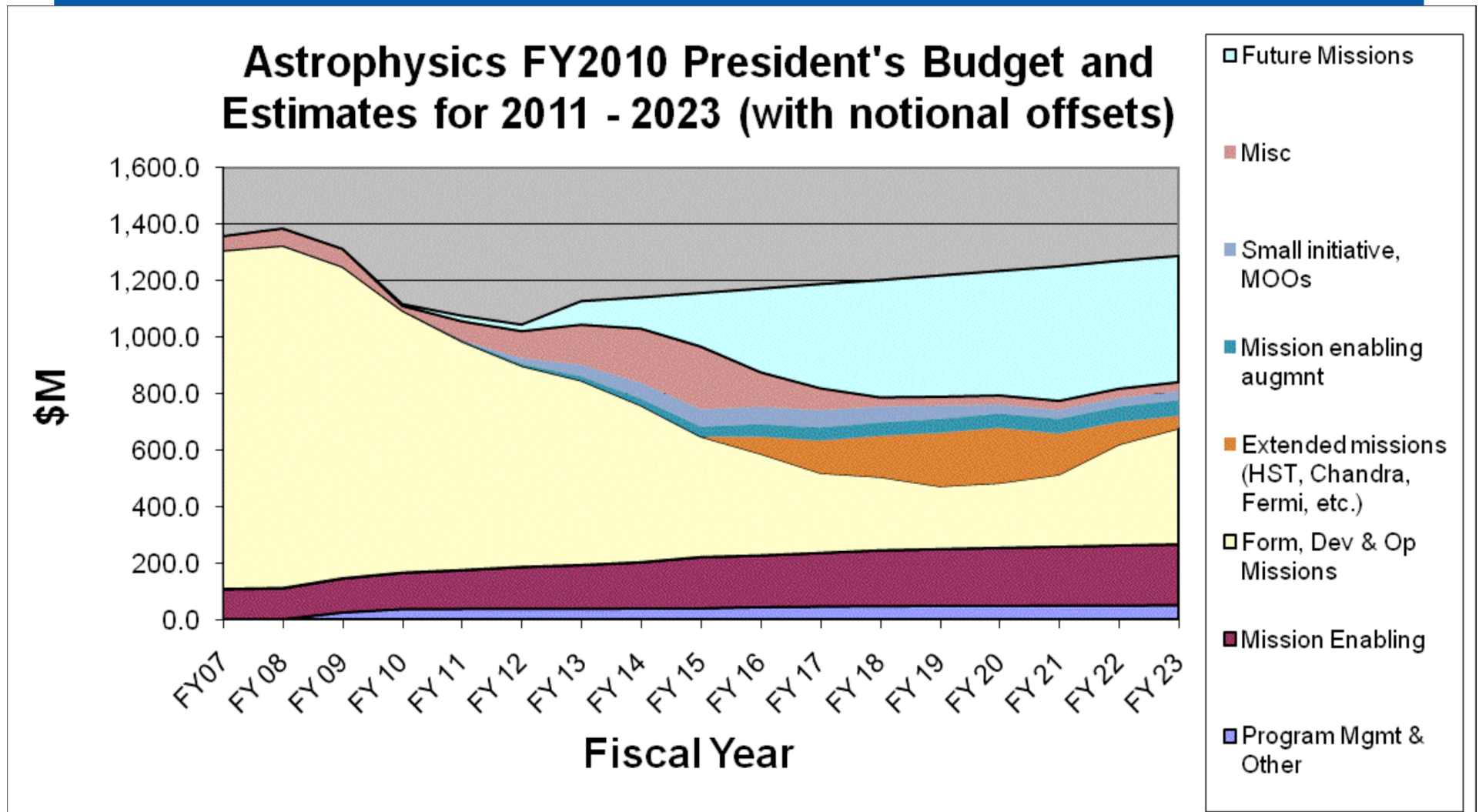
# Budget Guidance for Decadal Survey

## Astrophysics FY2010 President's Budget and Estimates for 2011 - 2023



- Assumed operating missions beyond 2016 include JWST, SOFIA
- HST De-orbit mission development ramps up ~2020
- “Future Missions” wedge would be used for new mission initiatives, R&A/technology augmentations, extended missions, etc.
- The amount of “Future Missions” funding available between 2013 – 2020 is ~\$4B

# Budget Guidance for Decadal Survey



- Assumed operating missions beyond 2016 include JWST, SOFIA; plus HST, Chandra, Fermi, etc. (e.g., Astro-H)
- HST De-orbit mission development ramps up ~2020
- “Future Missions” wedge is for strategic missions recommended by the Astro2010 decadal survey
- The amount of “Future Missions” funding available between 2013 – 2020 is ~\$2.3B

# Astro 2010 Senior Review

2010 Senior Review Schedule	
Draft Call for Proposals issued	September 16, 2009
Call for Proposals issued	October 19, 2009
Proposals due	February 8, 2010
Senior Review panel meets	April 6 - 9, 2010
Publication of new budget guidelines, and instructions to the projects	April 29, 2010

Invited Missions	
Chandra	Spitzer
GALEX	Suzaku
INTEGRAL	Swift
Planck	WISE
RXTE	WMAP
	XMM

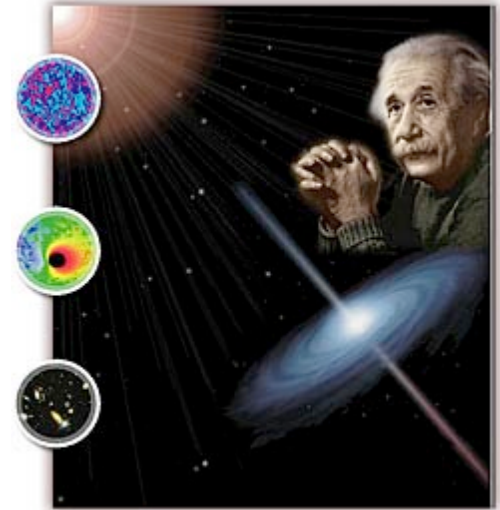
SR Report of 2006 and 2008 available on Astrophysics website



# Meeting National Needs

Astrophysics supports... “increasing our understanding of the universe and our place in it.” (OSTP-OMB FY2011 Budget Priorities Memo)

- **Basic R&D on the fundamental laws of nature** that ultimately drive innovation and long-term economic growth.
  - *The cosmos is a frontier for defining the new physics of the 21<sup>st</sup> century.*
- **Numerous discoveries with the largest portfolio of space-based assets**
- **International science and technology cooperation** across a broad suite of science disciplines.
- **Highly synergistic cutting-edge technology** with applications in national security, commercial space imaging, medical imaging and data processing, cancer treatment, materials research, etc.
- **Nobel Prize-winning research** that enriches society and fills the next generation with excitement, wonder and hope.
  - *Astronomy and the search for life in the universe permeate modern society, setting the context for life as we know it and appealing to basic questions of our origins and uniqueness.*



# Backup

# SMEX Selection

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- Two **Small Explorer (SMEX)** missions down selected from six in study phase -- one in Astrophysics, one in Heliophysics
- Astrophysics SMEX: “The Gravity and Extreme Magnetism SMEX” (GEMS)
  - X-ray polarimetry of SMBH inner accretion disks (GR), magnetars, and supernova shock acceleration using a time projection chamber.
  - PI: Jean Swank, Goddard Space Flight Center.
  - Launch date 2014.
- Astrophysics **Mission of Opportunity** investigation selected:
  - High Resolution Soft X-ray Spectrometer (SXS) for JAXA’s Astro-H
  - PI: Richard Kelly, Goddard Space Flight Center

# Astrophysics Mission Events

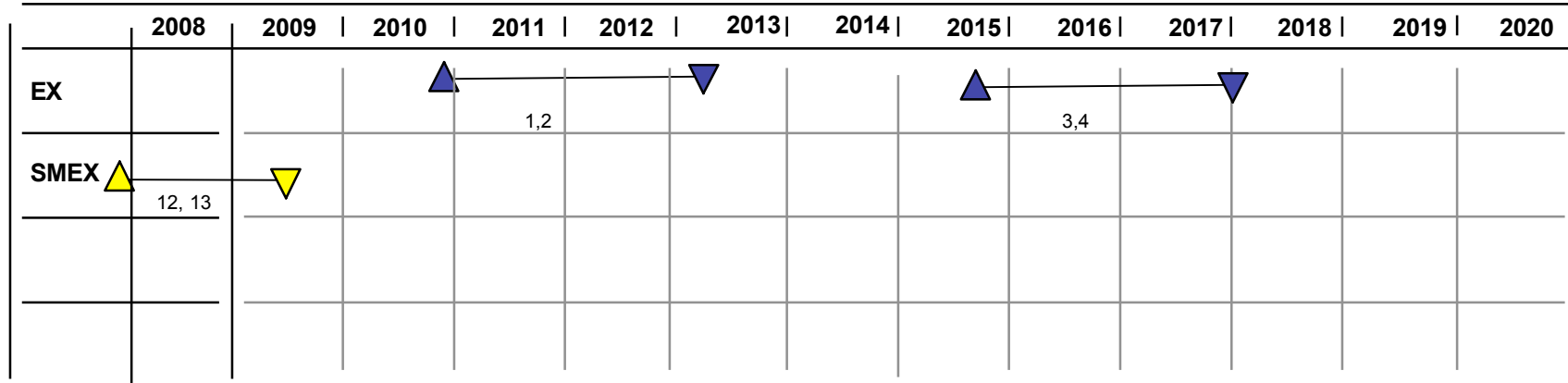
	CY2009				2010				2011				2012				2013						
<b>Mission Launches etc.</b>	▼ Mar 6 Kepler	▼ May 11 HST SM4	▼ May 14 Herschel Planck	▼ Dec 7 WISE					▼ Oct 26 SOFIA Early Sci					▼ Aug NuSTAR									
<b>Suborbital Rocket Program.</b>	▼ Feb CIBER #1	▼ Jun DICE #1	▼ Oct EXOS #1	▼ Dec FUSP #1	▼ Jan XQC #4	▼ Feb CI-BER #2	▼ Mar PICT-URE #1	▼ Jul FOR-TIS #1	▼ Oct FIRE FUSP #2	▼ Nov EX-OS #2	▼ Dec Mi-croX	▼ Jan IMA-GER #1	▼ Jan FOR-TIS #2	▼ Feb ACC-ESS #1	▼ Mar EX-OS #3	▼ Sep ACC-ESS #2	▼ Sep XA-CT #1	▼ Jan EX-OS #4	▼ Mar ACC-ESS #3	▼ Mar XQC #5	▼ Apr XA-CT #2	▼ Sep ACC-ESS #4	▼ Sep ACC-ESS #4
<b>Balloon Campaigns</b>	Antarctica (CREAM, ANITA, superpressure dev) D/J				(CREAM V, SPB Test) D/J				D/J				D/J				D/J						
Sweden	(AESOP, LEE, superpressure dev) M/J												M/J										
Ft. Sumner (spr)	(EBEX, NCT, FIREBall, CREST) A/M/J												A/M				A/M						
Palestine									J/J				J/J				J/J						
Ft. Sumner (fall)	(PROTOEXIST, STO, HASP) S/O								A/S				A/S				A/S						
Australia									M/A (TIGRE, FIREBall, NCT, HERO, INFOCUS, SPB Test)								M/A						
<b>Opportunities</b>					TBD Explorer AO				TBD JDEM AO				TBD Exoplanet AO										

Last Updated: September 18, 2009

**Legend**  
 Purple - Mission with International lead  
 \* Student Opportunity balloon flight

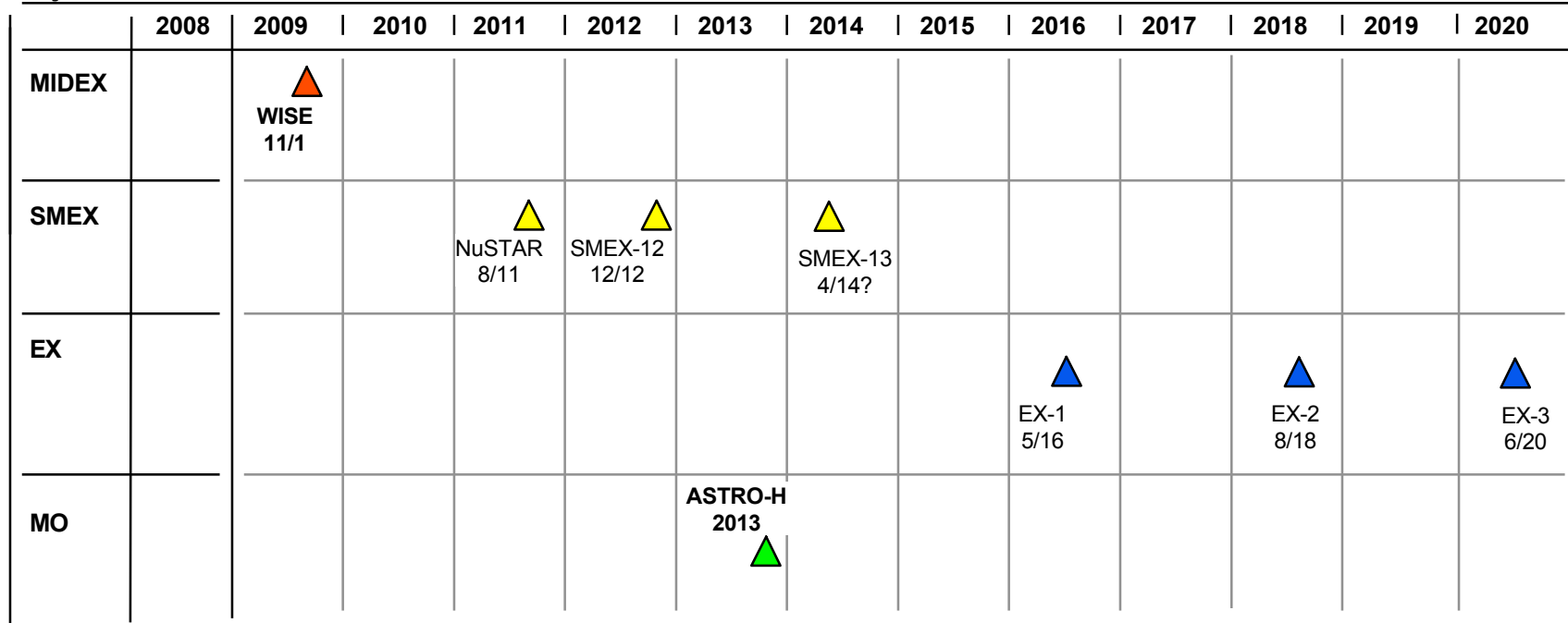
# Explorers Tentative Schedule

## Projected Announcements of Opportunity



▲ = Issued    ▼ = Selected

## Projected Launch Schedule



•NOTE: Chart represent approximate dates for EX missions depending on budget, access to space, SMEX selection, which are subject to change

# Astrophysics Fellowships

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Fellowships aligned with Astrophysics Division Science Themes.

- Solicit proposals with Physics of the Cosmos, Exoplanet Exploration, or Cosmic Origins science as focus rather than mission specific.
- Management by existing fellowship organizations.
  - *Sagan* fellows: Exoplanet Exploration program office, JPL
  - *Einstein* fellows: Chandra X-ray Center
  - *Hubble* fellows: STScI
- Stipend (all new fellows): \$60,500.
- Identical Deadline for Applications: (most recent round).
  - Einstein Fellows: 156 applicants, 10 selections.
  - Sagan Fellows: 51 applicants, 5 selections.
  - Hubble Fellows: 237 applicants, 17 selections.
- For more information see:
  - Sagan: <http://nexsci.caltech.edu/sagan/fellowship.shtml>
  - Einstein: <http://cxc.harvard.edu/fellows/>
  - Hubble: <http://www.stsci.edu/institute/org/spd/hubble-fellowship/hubble-fellow-overview>

# Astronomy & Astrophysics Decadal Survey

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- NRC Astro2010 Decadal Survey now well underway, Roger Blandford (Stanford U.) is Chair. Nearly 160 scientists involved.
  - Five Science Frontiers Panels
  - Four Program Prioritization Panels
  - Six Infrastructure Study Groups
- 18 Town Halls have taken place around the country.
- Nearly 600 community responses to Astro2010 solicitations
- New science priorities for the next decade and beyond
- Division is working diligently with the Survey to provide information and support mission inputs
  - Science Frontier and Program Prioritization Panels are meeting this summer
- Independent cost estimation should result in better estimates for medium and large strategic initiatives.
- Final Report Released Summer 2010
- [http://www7.nationalacademies.org/bpa/BPA\\_049810](http://www7.nationalacademies.org/bpa/BPA_049810)