

National Aeronautics and Space Administration



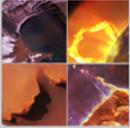
Physics of the Cosmos: Overview and Update

Astrophysics

Rita Sambruna
PCOS Program Scientist

January 8, 2012

www.nasa.gov



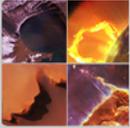
Program Structure at NASA HQ

Program Director: Michael Moore, Acting Deputy Division Director

Program Scientist: Rita Sambruna

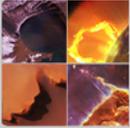
Program Executive: Jaya Bajpayee

Discipline Scientists: W. Sanders, I. Harrus, L. Kaluziinsky, W. Danchi



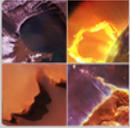
New Leadership at APD

- Dr. Paul Hertz is Acting Director of the Astrophysics Division
- Mr. Michael Moore is Acting Deputy Director

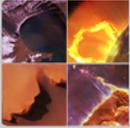


Talk Content

- PCOS Program Overview
- Community Links
- Programmatic Updates



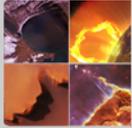
Introduction: the Physics of the Cosmos program



Physics of the Cosmos (PCOS)

pcos.gsfc.nasa.gov

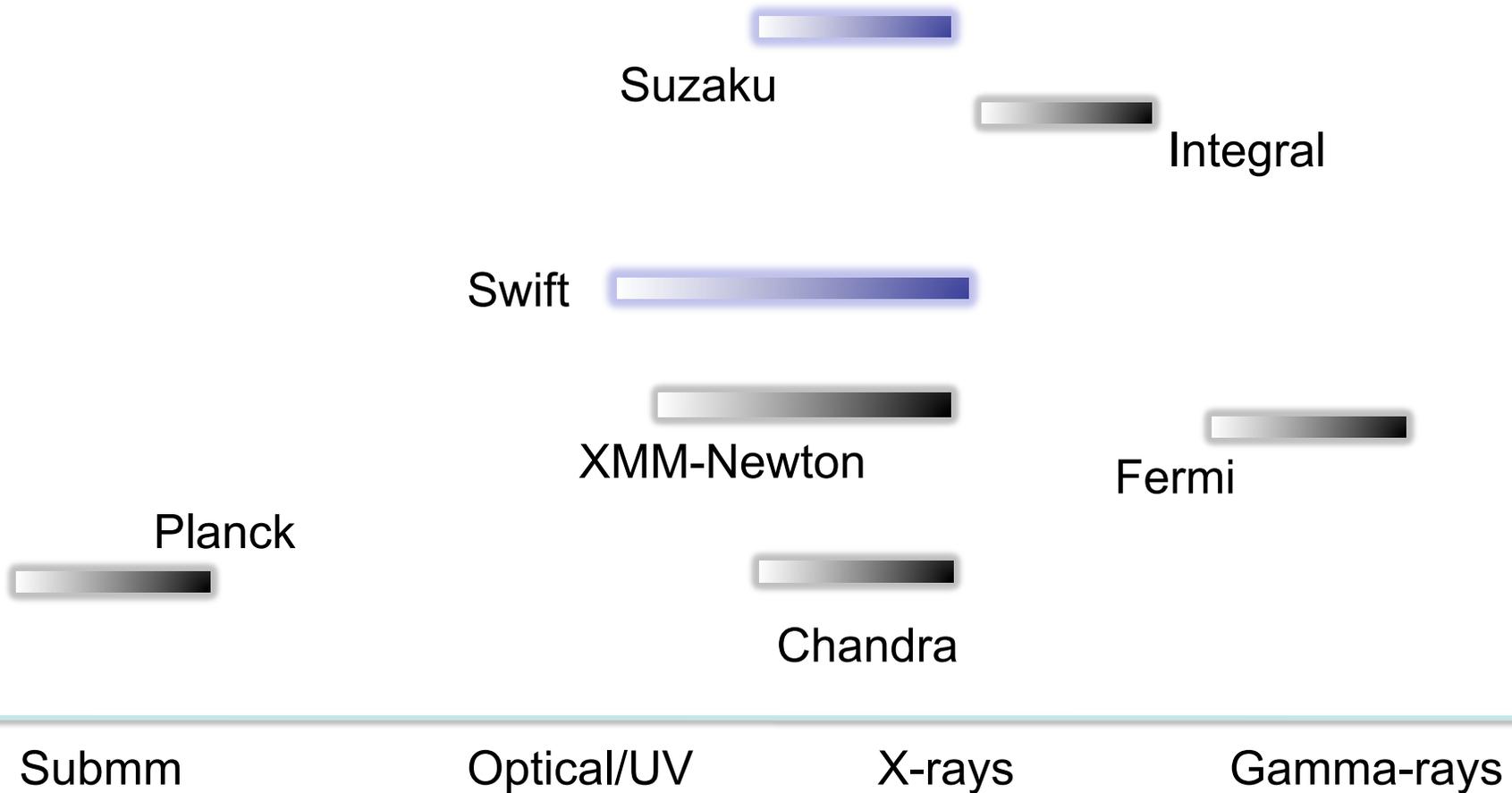
- One of the three science and technology programs in the Astrophysics Division (APD), with Cosmic Origin (COR) and ExoPlanets (EXEP)
- PCOS incorporates **cosmology, high-energy astrophysics, and fundamental physics** projects aimed at addressing directly central questions about the nature of complex astrophysical phenomena such as **black holes, neutron stars, dark energy and matter, and gravitational waves**. Ultimate quest is to understand *How the Universe works, from the very small to the very large scales.*
- PCOS utilizes a fleet of space-based missions operating across the whole electromagnetic spectrum

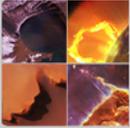


PCOS portfolio across the EM spectrum

-  Operating PCOS missions
-  Operating Explorers (PCOS Science)

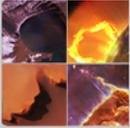
+ Suborbital (not shown)





PCOS Science remains vibrant

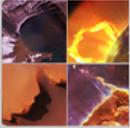
- Astronomy magazine compiled a list of the top 10 discoveries in 2011; 5/10 (50%) are APD-related
- **3/5 (60%) are PCOS-science related**
 - #1 - The last flight of the space shuttle
 - #2 - These standard candles aren't so standard (Fermi, RXTE)**
 - #3 - Most earth-like planet found.. yes, no, yes?
 - #4 - Scientists watch as a black hole eats a star (Swift)**
 - #5 - Water may still flow on Mars
 - #6 - A great understanding of the complexities of our star
 - #7 - Found: an asteroid sharing Earth's orbit
 - #8 - The Milky Way blows bubbles (Fermi)**
 - #9 - New class of stellar explosions
 - #10- Mercury reveals itself



Selected Recent Awards

PCOS science and technology research commands high visibility:

- The 2011 Nobel Prize in Physics was awarded to S. Perlmutter, B. Schmidt, A. Riess for their study of SN leading to the discovery of **acceleration of the Universe and dark energy**
- The Presidential Early Career Award for Scientists and Engineers (PECASE) was given to B. Mazin for his work on **low-temperature, ultra-sensitive detectors operating from IR to X-rays**

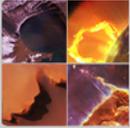


Avenues for PCOS Research Support

- **Observations, data analysis, theory:**
Astrophysics Data Analysis Program (ADAP)
Astrophysics Theory Program (ATP)
Mission Guest Observer/Investigator Programs
- **Technology Development:**
Astrophysics Research and Analysis (APRA), TRL <4
Strategic Astrophysics Technology (SAT), TRL=4-6

Next APRA & SAT deadline: 23 March 2012

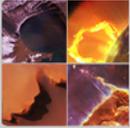
- **The Einstein Fellowship:**
~10-12 Fellows selected competitively each year for 3 years support
Average size of award ~\$100K (salary and benefits)



SAT/TPCOS for ROSES10

- 21 Proposals Submitted
- Selections:

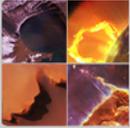
Schattenburg, M.	MIT	Development of Fabrication Process for Critical-Angle X-ray Transmission Gratings
Bautz, M.	MIT	Directly-Deposited Blocking Filters for Imaging X-ray Detectors
Bock, J.	JPL	Antenna-coupled Superconducting Detectors for Cosmic Microwave Background Polarimetry
McEntaffer, R.	Univ of Iowa	Off-plane Gratings Arrays for Future Missions
Reid, P.	SAO	Development of Moderate Angular Resolution Full Shell Electroplated Metal Grazing Incidence X-ray Optics



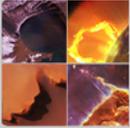
Einstein Fellowship 2011

Deadline was Nov 3, 2011

- 189 applications for ~11 fellowships
- Selection to be announced in Spring 2012
- Areas of proposed research: cosmology, accretion physics, galaxy formation, clusters, compact objects, AGN, X-ray binaries, SN and SNR, GRBs, General Relativity, hardware, technology
- Einstein Fellows Symposium in Fall 2012 in Boston, MA

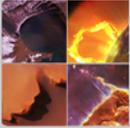


Community links



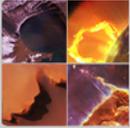
Program Analysis Groups (PAGs)

- The Program Analysis Groups (PAGs) include all members of the community interested in providing input to NASA on issues of strategic importance via analysis studies
- PAGs hold regular public meetings to provide their members the opportunity to hear about their work and voice their input
- PAGs report to NASA via the NAC's Astrophysics subcommittee
- The **PhysPAG** is the PAG of the PCOS program



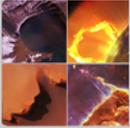
The Executive Council (EC)

- The PAGs are coordinated by an Executive Council (EC) composed of members of the community solicited and selected by NASA
- Term is 3 years
- The Chair of the EC is a member of the NAC's Astrophysics Subcommittee
- PhysPAG EC members: S. Ritz (Chair), R. Brissenden, S. Hanany, G. Mueller, E. Hays, J. Rhodes
- The EC is NOT the PhysPAG



Study Analysis Groups (SAGs)

- The PhysPAG identifies specific, well-defined topics for further detailed studies, and sets up taskforces of volunteers to perform the analysis – Study Analysis Groups (SAGs)
- The NAC's Astrophysics subcommittee reviews the SAGs and charges them with the specific study request, identifying final deliverables for input to NASA



PCOS' SAGs

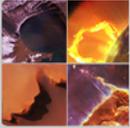
- PCOS has 3 SAGs:

TechSAG: X-ray and GW technology priorities
(see Brissenden and Mueller talks)
Chair. R. Brissenden

IPSAG: development of Inflation Probe mission concept(s)
(see J. Bock talk)
Chair S. Hanany

Communication SAG: outreach, interaction with community
(see Ritz talk)
Chairs S. Ritz & J. Rhodes

- **Gamma-ray SAG** in progress, approved by APS in October 2011
(see L. Hays and J. McEnery talk)

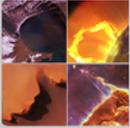


PCOS Program Office (PO)

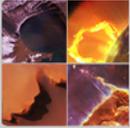
The PCOS Program Office is located at NASA's Goddard Space Flight Center (see M. Ahmed/J. Townsend talks)

Primary Functions:

- Liaison with PCOS community
- Collect SAGs input to conduct detailed technical and cost studies and formulate roadmaps for technology and science investments
- Organize community events (e.g., X-ray and GW workshops in December 2011)
- Leads the Education and Public Outreach (EPO) for the Program

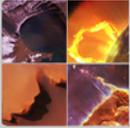


Programmatic News



X-ray and GW mission concept studies

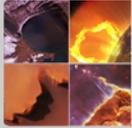
- Requests for Information (RFIs) for X-ray and GW mission concepts issued in Fall 2011 on how to best realize the IXO and LISA science objectives, as recommended by New World New Horizon
- Rationale is to present 2-3 mission concepts to Committee on Astrophysics and Astronomy (CAA) in Spring 2012 for the CAA consideration
- Received 14 X-rays and 16 GW responses
- Responses posted at pcos.gsfc.nasa.gov/studies



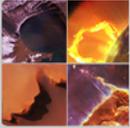
X-ray and GW RFI Workshops

- X-ray and GW community workshops held in December 2011 to discuss responses and reach consensus on mission concept(s)
- Led by Community Science Teams (CST) selected through a Dear Colleague search
- CST Members listed at pcos.gsfc.nasa.gov/studies
- CSTs will deliver a report with consolidated input to CAA by Spring 2012

(see J. Townsend, R. Petre, R. Stebbins talks)

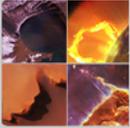


Backup



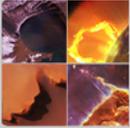
PCOS Science Questions

- *What are the origin, evolution, and fate of the Universe?*
- *What are the conditions of space, matter, and time in extreme gravitational fields?*
- *Why is the Universe accelerating, and how does this acceleration depend on cosmic time?*
- *What makes “dark matter” and why is it dark?*
- *Can we validate General Relativity by testing its predictions?*



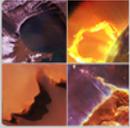
PCOS Program Office (PO) (see M. Ahmed and J. Townsend talks)

- Liaison with PCOS community
- Collect PhysPAG input
- Conduct Technology Management Board (TMB) reviews to evaluate and prioritize technology needs
- Deliver Program Annual Technology Report (PATR)
- Education and Public Outreach (EPO) for the Program



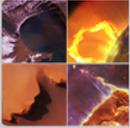
HQ Personnel Changes

- J. Grunsfeld is the new Associate Administrator for the Science Mission Directorate
- T. Lanz left APD for a position in Nice, France. The ATP and Fundamental Physics programs will be managed by L. Sparke and H. Hasan, while G. Wahlgren will oversee the Laboratory Astrophysics program



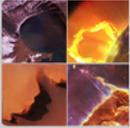
PO Personnel Changes

- Ann Hornschemeier Cardiff is the new PCOS Chief Scientist as of Dec 3, 2011. Ann is the recipient of the 2007 Annie Jump Cannon award for her research on galaxies at X-rays, and former Deputy Project Scientist for IXO.
- Mark Clampin is the Chief Technologist for PCOS and COR as of December 2011. He is currently the Webb telescope Observatory Project Scientist and works in the Exoplanets and Stellar Astrophysics Laboratory at NASA's Goddard Space Flight Center, Greenbelt, Md.



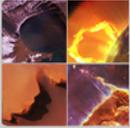
Program Management Quarterly

- The Division has begun a quarterly dialog among the Physics of the Cosmos, Cosmic Origins, Exoplanet Exploration, and Explorers Program Management
- Objective: improve communication among programs, develop overarching astrophysics programmatic strategies, and learn from each others' successes/failures
- The Team had its kick-off meeting on Nov 8, 2011 at JPL. A follow-up meeting is planned for early 2012



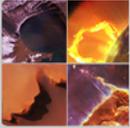
Senior Review of operating missions

- Senior Reviews of operating missions in Astrophysics Division are held every two years to review and rate the missions performance
- Reviewers are selected by NASA
- The next SR will be held in 2012. Mission presentations to SR will occur Feb 28-March 2 and the review on....
- PCOS Missions under review:
Chandra, XMM-Newton, Planck, Fermi (first time), Suzaku, Swift

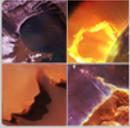


DO WE WANT THIS? International Partnerships

- ESA has selected Euclid, a dark energy mission, as one of the two M-class missions
- ESA open to NASA “participation”
- Memorandum of Intent with ESA 12/2011
- Memorandum of Understanding 04/2012
(see NASA Townhall)



Science Highlights



Top 10 Science Highlights of the Year

- **Kepler** Mission Discovers Its First Rocky Planet (January 10, 2011)
- **Fermi** Catches Thunderstorms Hurling Antimatter into Space (January 10, 2011)
- **Swift/Hubble/Chandra** Observe Black Hole Devouring a Star (April 7, 2011)
- **Hubble/Spitzer** Telescopes Discover Surprisingly Young Galaxy (April 12, 2011)
- **Gravity Probe B** Confirms Two Einstein Space-Time Theories (May 4, 2011)
- **GALEX** Helps Confirm Nature of Dark Energy (May 19, 2011)
- **Herschel** Helps Solve Mystery of Cosmic Dust Origins (July 7, 2011)
- **WISE** Discovers Coolest Class of Stars (August 23, 2011)
- **RXTE** Smallest Known Black Hole (December 15, 2011)
- **Kepler** Discovers First Earth-sized Planets Orbiting a Sun-like Star Outside Our Solar System. (December 20, 2011)