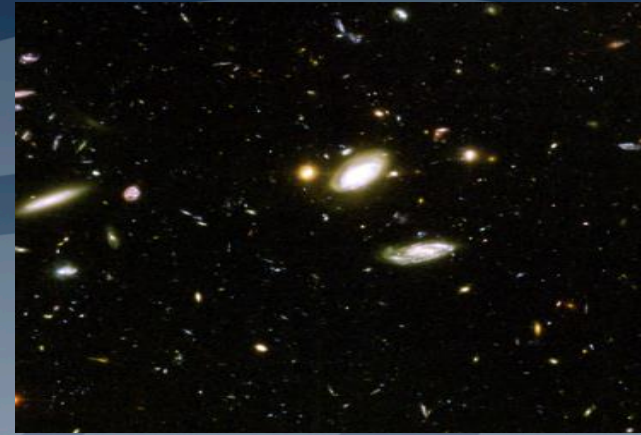


# NASA Astrophysics SmallSats



**2021 NASA Small Spacecraft Forum**

March 25, 2021

Michael R. Garcia, Program Scientist,  
NASA Astrophysics SmallSat Lead

# NASA Astrophysics SmallSats



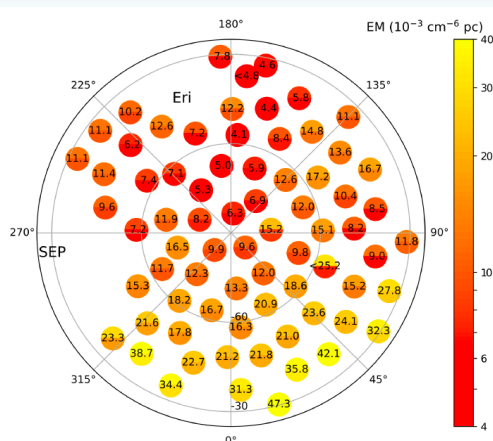
- **CubeSats:**
  - Solicited via ROSES/APRA first in 2012, Research and Analysis programs
  - CubeSat Initiative began with APRA/2017, \$5M budget line allows ~1 new CubeSat/year
  - First Launch in July 2018, next scheduled for Sept 2021, mostly 6U, one 12U
- **Pioneers:**
  - A new class of small missions offered for first time in ROSES-2020, \$20M maximum PI cost cap.
  - Includes SmallSats, CubeSats >6U, major balloon payloads, and modest ISS attached payloads with a \$20M cost cap, not including launch.
  - Solicited through ROSES; relieves burden of writing full Explorers MO proposal (ROSES 2020 Amendment D.15).
- **Astrophysics Science SmallSat Studies (AS<sup>3</sup>):**
  - 2018 (9) and 2019 (8) paper studies (~\$100K each) of <\$35M SmallSats as possible Explorer MO

# Astrophysics CubeSats

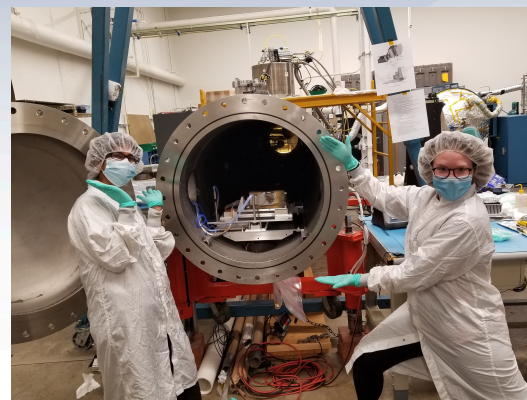
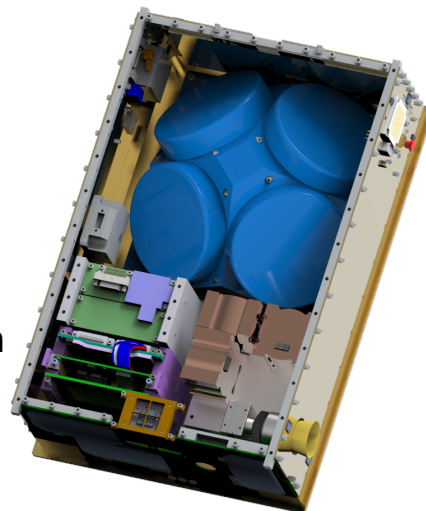


– Solicited annually in ROSES/APRA, ~1 new start per year, ~<\$5M each total cost

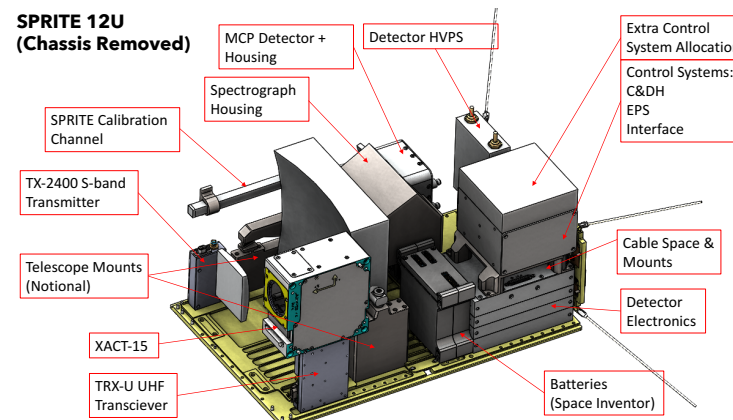
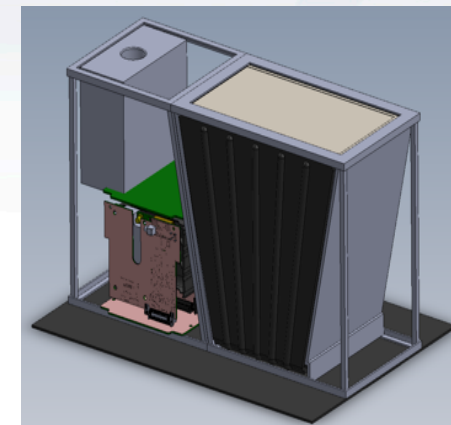
**HaloSat:** PI Phil Karret U of Iowa,  
Launch 5/2018, reentry 2/2021,  
OIV line in Galaxy Halo, determine  
mass and structure of Halo



**BurstCube:** PI Jeremy  
Perkins GSFC,  
Launch NET 12/21,  
GRB monitor w/ TDRSS  
real-time event notification



**CUTE:** PI Kevin France  
U CO,  
Launch 9/2021,  
UV Imaging of Hot  
Jupiter ablation, Arika  
Egan & Ambily Suresh  
in lab



**SPRITE,** PI Brian Fleming U CO,  
Launch NET 1/2023,  
First APD 12U, UV spectra of  
ionizing radiation from star forming  
galaxies

**BlackCat:** PI Abe  
Falcone Penn St.,  
Launch NET 3/2024,  
2-20 KeV wide FOV  
localization of X-ray  
Transients, real-time  
'cell phone' downlink

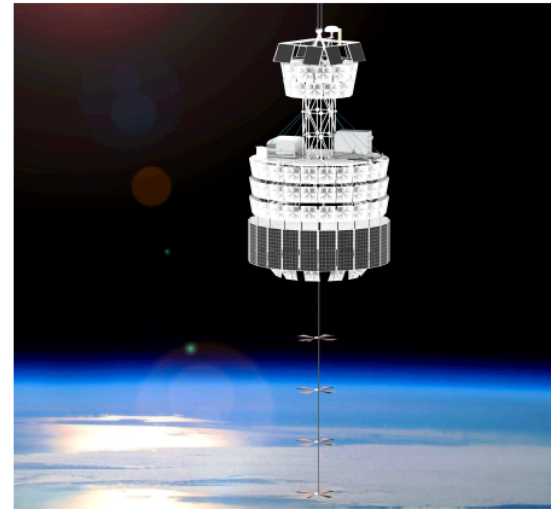


# Astrophysics Pioneers



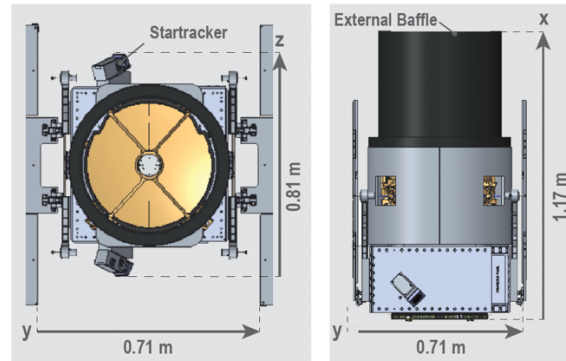
New ROSES-2020 Program, \$20M PI cost cap, NASA provided launch, 39 NOI, 24 Proposals, 22 selectable. WOW. Community excited and engaged! The future is bright. Four selected this year:

**PUEO:** A Long-duration Balloon-borne Instrument for Particle Astrophysics at the Highest Energies, PI Abigail Vieregg, U Ch

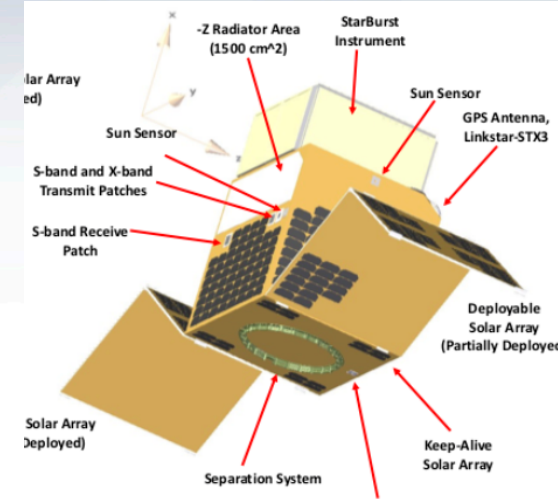


*Figure 10: A rendering of the PUEO payload, including a design for the low-frequency drop-down instrument.*

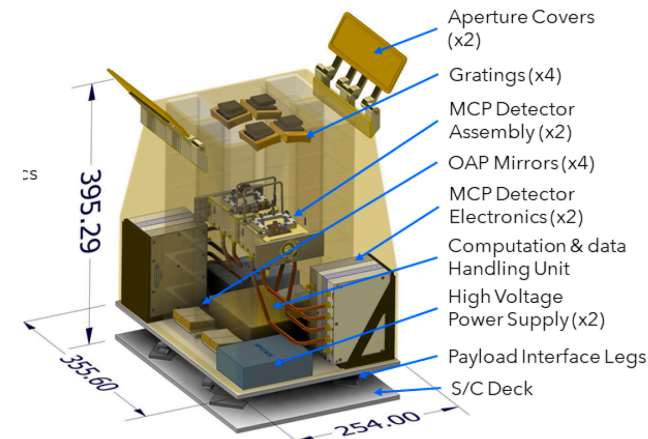
**Pandora:** Multiwavelength Characterization of Exoplanets and their Host Stars, PI Elisa Quintana, GSFC



**Figure 13:** BCT X-SAT-9 is accommodated by an EELV Secondary Payload Adapter (ESPA) Grande 5-m fairing. The stowed volume is 1,173.7 mm in X-axis, 809.2 mm in Z-axis, and 709.9 mm in Y-axis. Shown here with arrays deployed (left panel) and stowed (right).



**StarBurst:** Gamma-ray ASM, Simultaneous detection of NS/NS mergers with LIGO, PI Daniel Kocevski, MSFC



**Aspera:** IGM Inflow/outflow from galaxies via OVI 10<sup>5</sup>K emission line imaging. PI Carlos Vargas, U of A

Annual Solicitation Planned. 2021 Date TBD



# Astrophysics Science

## SmallSat Studies AS<sup>3</sup> v2, 2019

- AS<sup>3</sup> 2019 funding 8, ~\$100K 1 year studies of <\$35M SmallSats
- 2019 Topics include **ExoPlanets**, **GRB**, **Massive Stars**, **SMBH**, **EBL**, **Adaptive Optics**

**GOSoX** (Globe Orbiting Soft X-ray Polarimeter ), Herman Marshall/MIT

**NExtUP** (The Normal-incidence Extreme Ultraviolet Photometer) Jeremy Drake/Smithsonian Astrophysical Observatory

**MAGIC** (The Massive star Asteroseismology Instrument Cubesat) Derek Buzasi/Florida Gulf Coast University

**ORCAS** (Orbiting Configurable Artificial Star) Eliad Peretz/NASA

**MoonBEAM** (A Beyond Earth-orbit Gamma-ray Burst Detector for Multi-Messenger Astronomy) Chiumun Hui/NASA/MSFC

**BHAGERA** (Black Hole Accretion and Growth Experiment with Reverberation Analysis) Varoujan Gorjian/JPL

**MISE** (Mid-Infrared Sky Explorer) Asantha Cooray/University of California Irvine

**A Constellation of Small Satellites to Search for a Transiting Earth-Size Planet in an Earth-like Orbit about a Bright Sun-Like Star** Sara Seager/Massachusetts Institute of Technology

