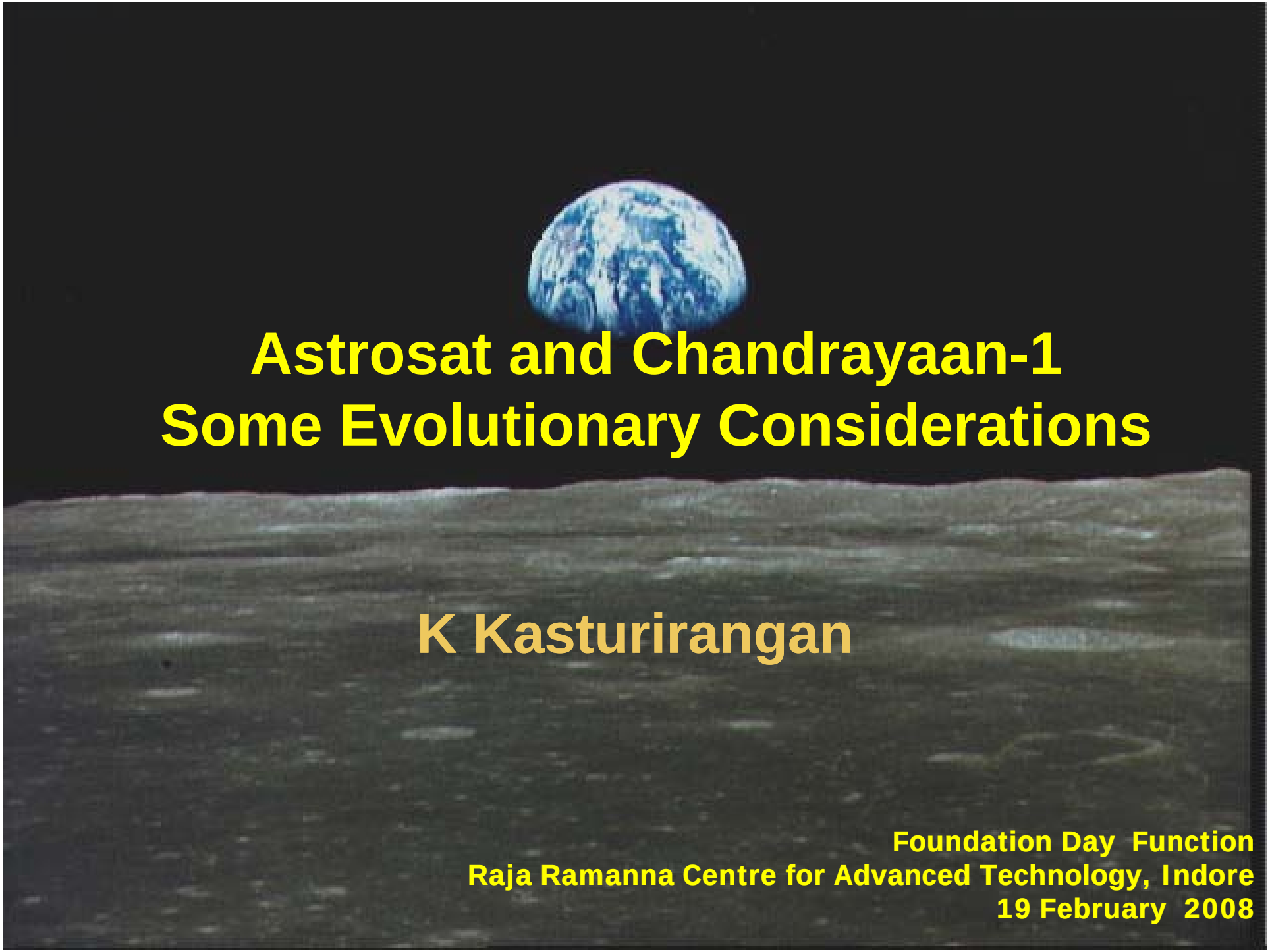
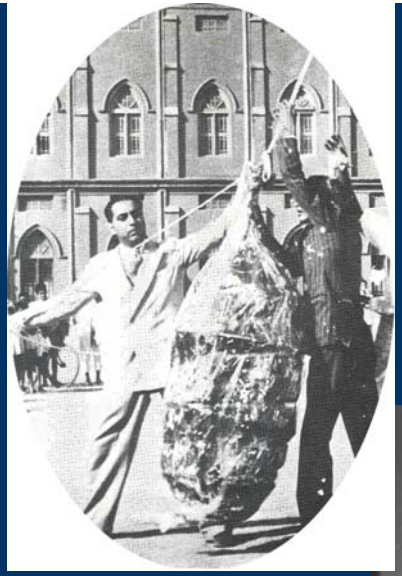


Astrosat and Chandrayaan-1
Some Evolutionary Considerations

K Kasturirangan

Foundation Day Function
Raja Ramanna Centre for Advanced Technology, Indore
19 February 2008

Rohini Satellite



Homi Bhabha Flying a Balloon

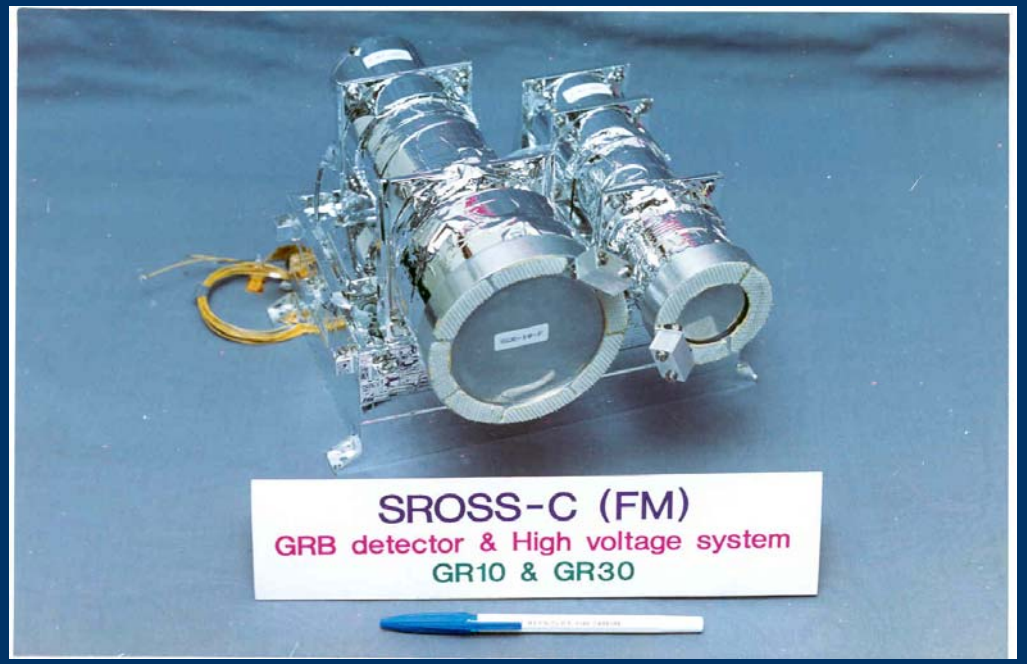
Vikram Sarabhai

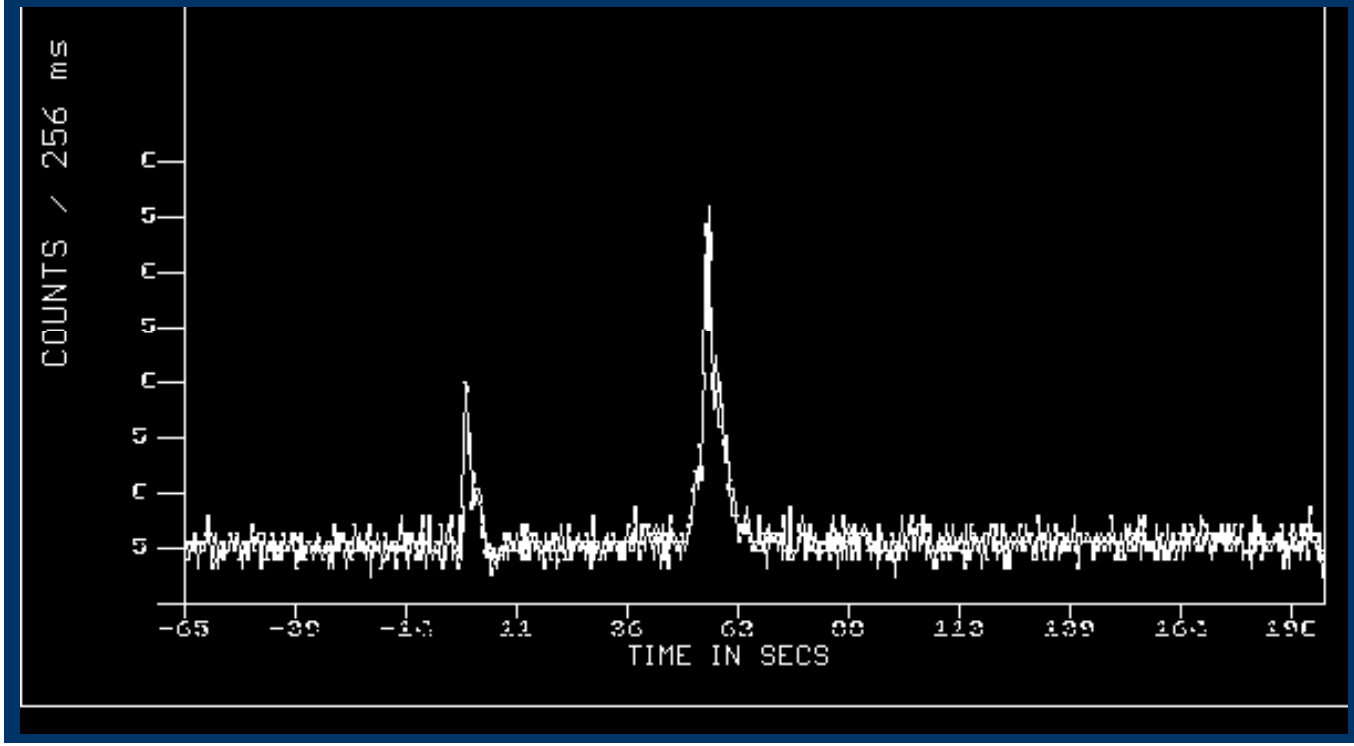
Hard X-ray Detector: Balloon Payload

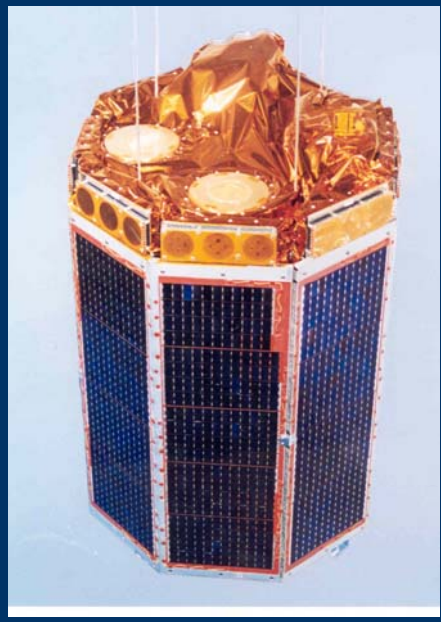
Rohini Sounding Rockets

Balloon Launch at Hyderabad

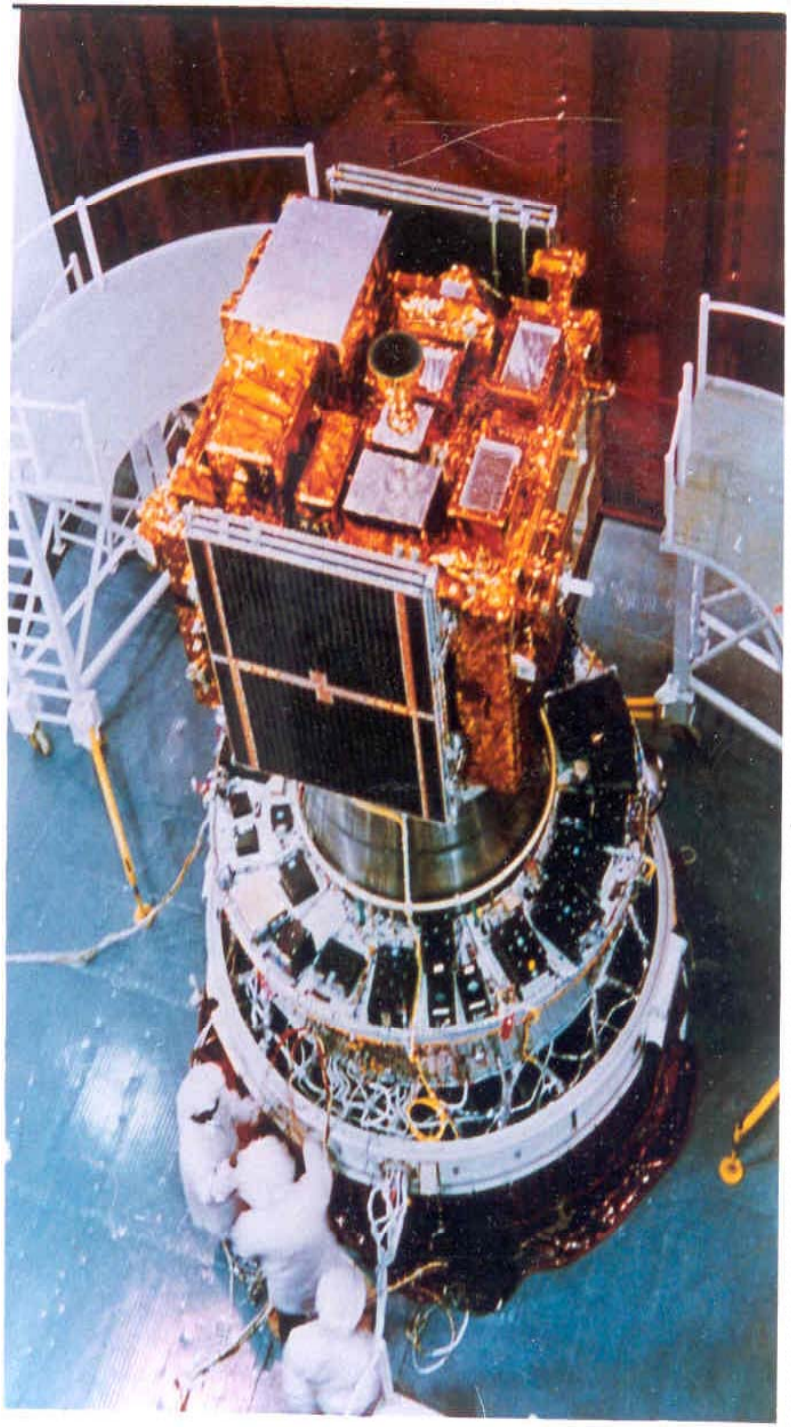
Gamma Ray Burst experiment on SROSS (1994)

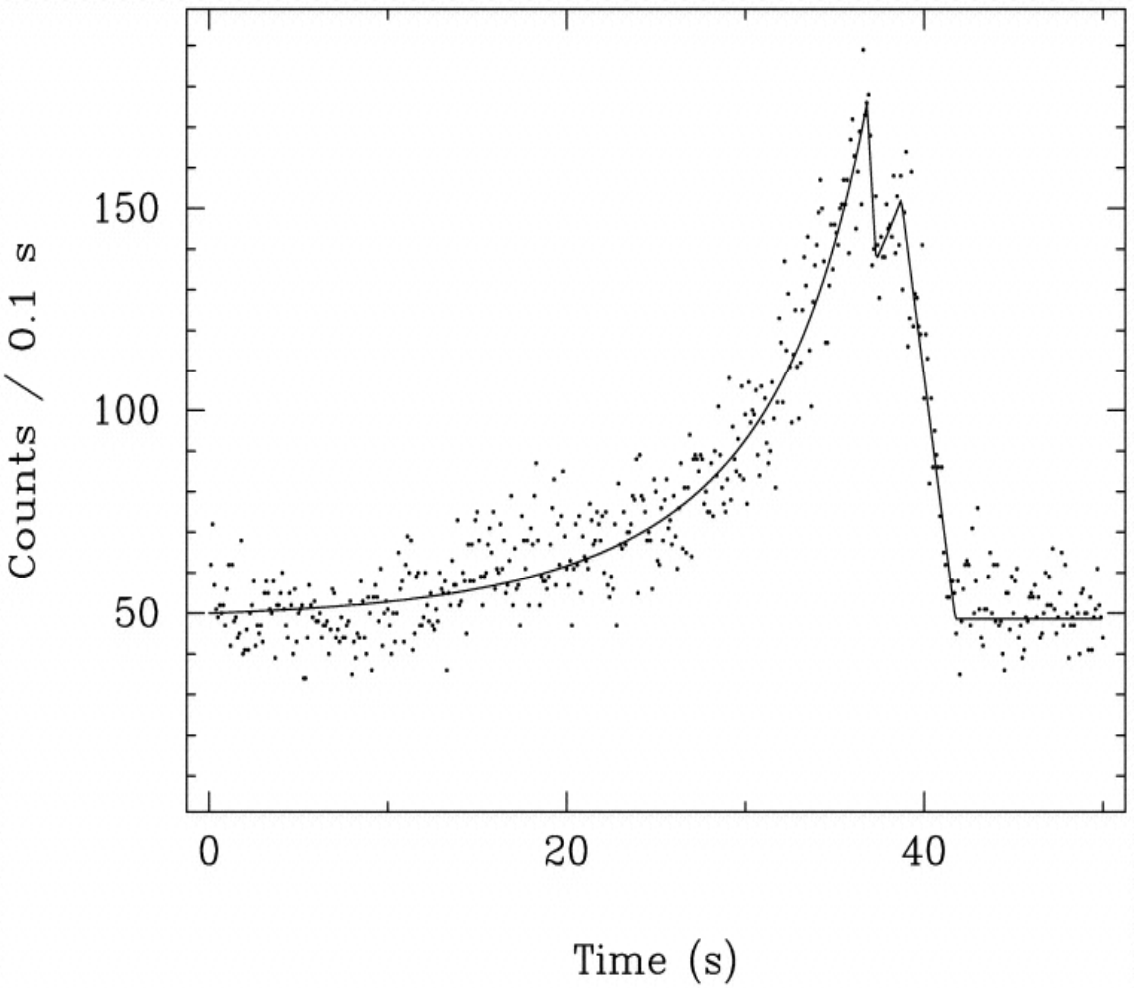






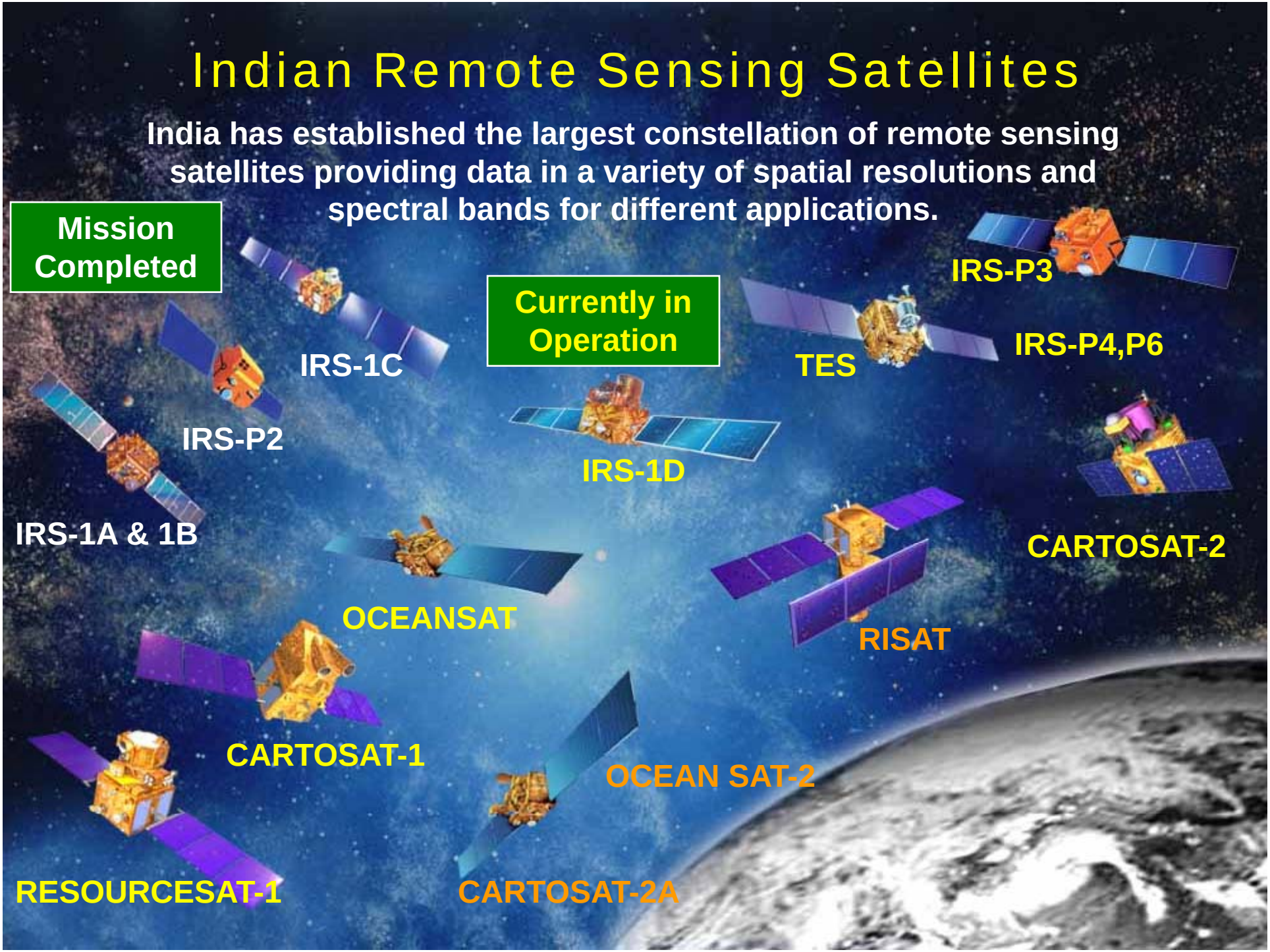
IXAE on IRS-P3 (1996)





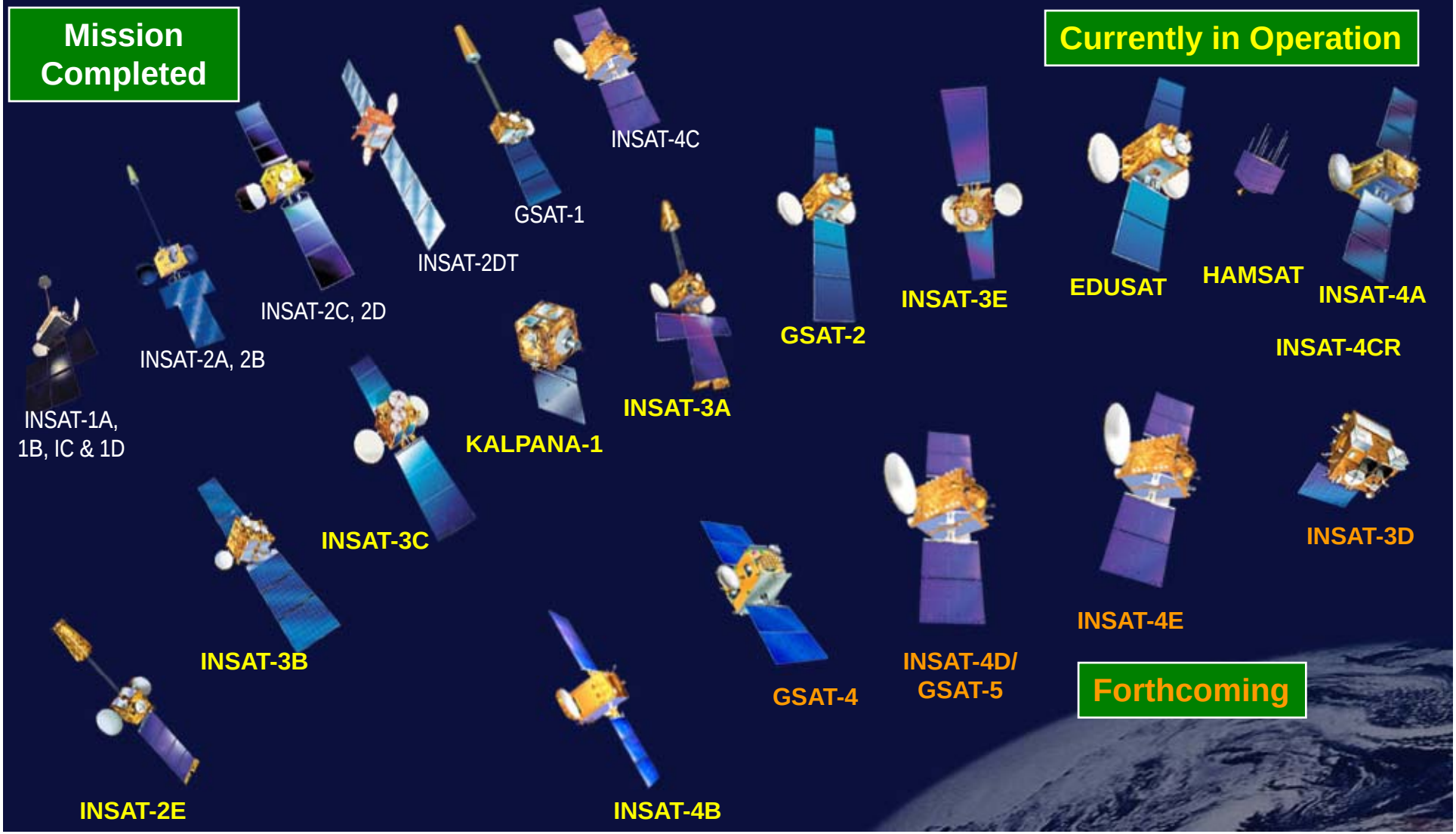
Indian Remote Sensing Satellites

India has established the largest constellation of remote sensing satellites providing data in a variety of spatial resolutions and spectral bands for different applications.



INSAT Satellites

Indian National Satellite (INSAT) System established in 1983, is a multipurpose system for telecommunications, television broadcasting and radio networking, meteorology and disaster warning.



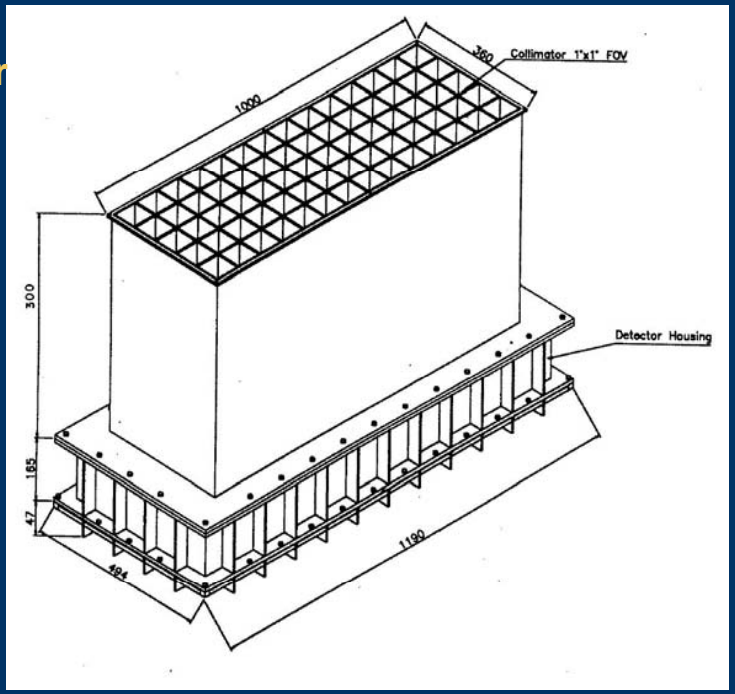
ISRO LAUNCHERS

	PSLV	GSLV	GSLV MkIII
Weight (T)	294	400	629
Payload (Kgs)	1500 SSO	2250 GTO	4000 to 4500 GTO
Flights	11 (1993-07)	5 (2001-07)	--

Scientific objectives of ASTROSAT

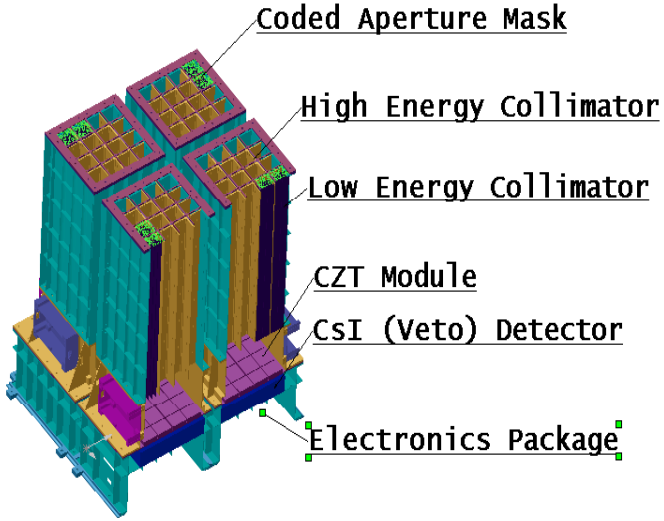
- To understand the broad-band x-ray emission spectrum in cosmic sources.
- To study correlated intensity variations over time in the visible, UV, soft and hard X-ray bands to address the origin of radiation in the different wave bands.
- Search for black hole sources by limited surveys in the galactic plane.
- Measure magnetic fields of neutron stars by detection and studies of cyclotron lines in the X-ray spectra of X-ray pulsars.
- Detect and locate new transient X-ray sources.
- Multi-band survey covering Ultra-violet band from 130-300 nm and X-ray band from 0.3 - 100 keV .
- Deep surveys of selected regions of the sky to detect faint quasars to study their clustering and large scale structures, and obtain UV fluxes from very distant galaxies.

Large Area Xenon Proportional Counter (LAXPC)



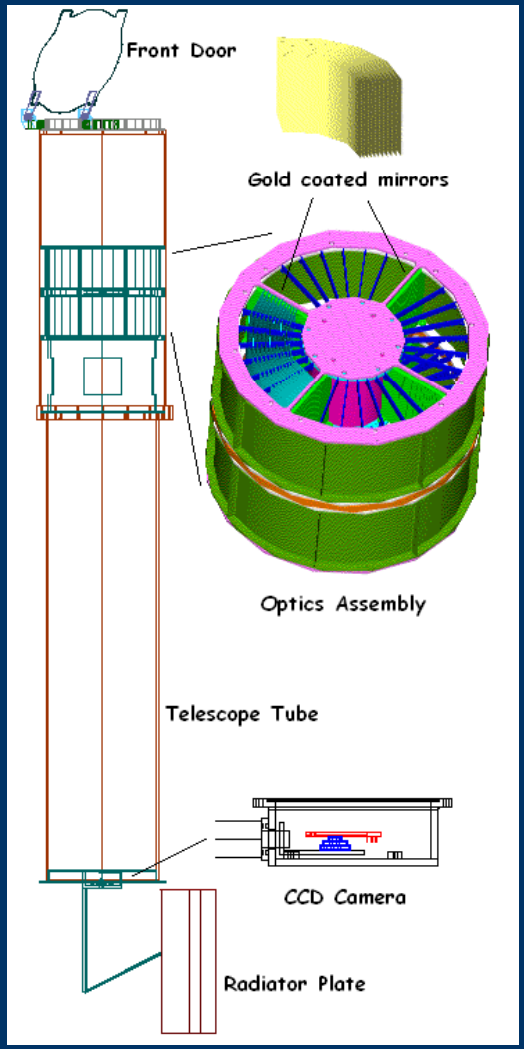
Energy Range 2 – 80 keV
Effective area ~ 6000 cm^2

CZT imager

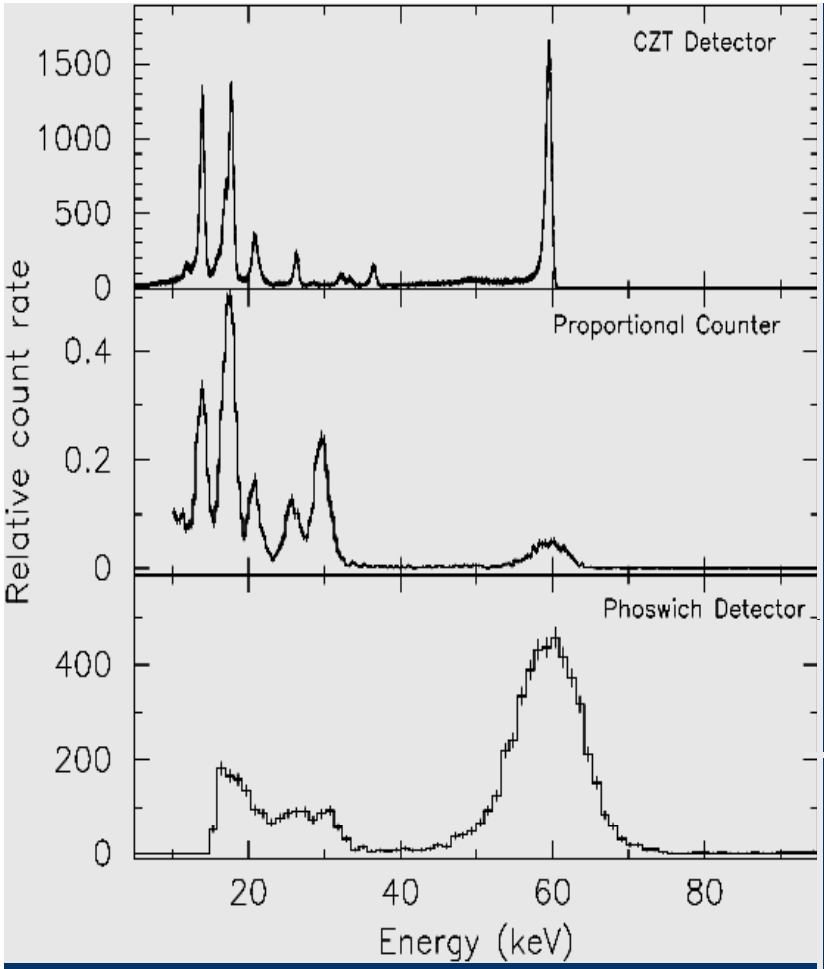


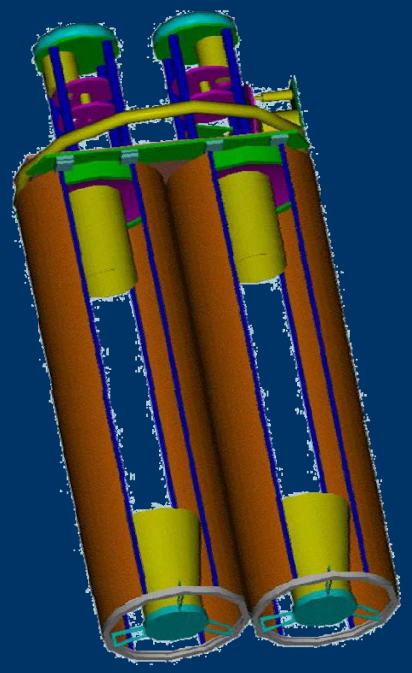
Energy Range 10 – 100 keV
Resolution = 5% @ 60 keV
Effective area ~ 1000 cm^2

Energy Range 0.5 – 8 keV
Focal length = 2 m
Effective area ~ 200 cm^2



Soft X-ray telescope (SXT)

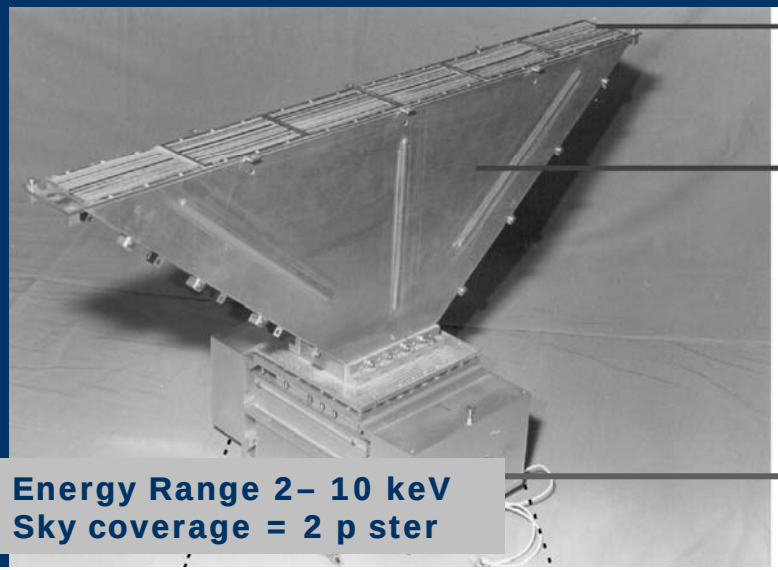




UV Imaging Telescope (UVIT)

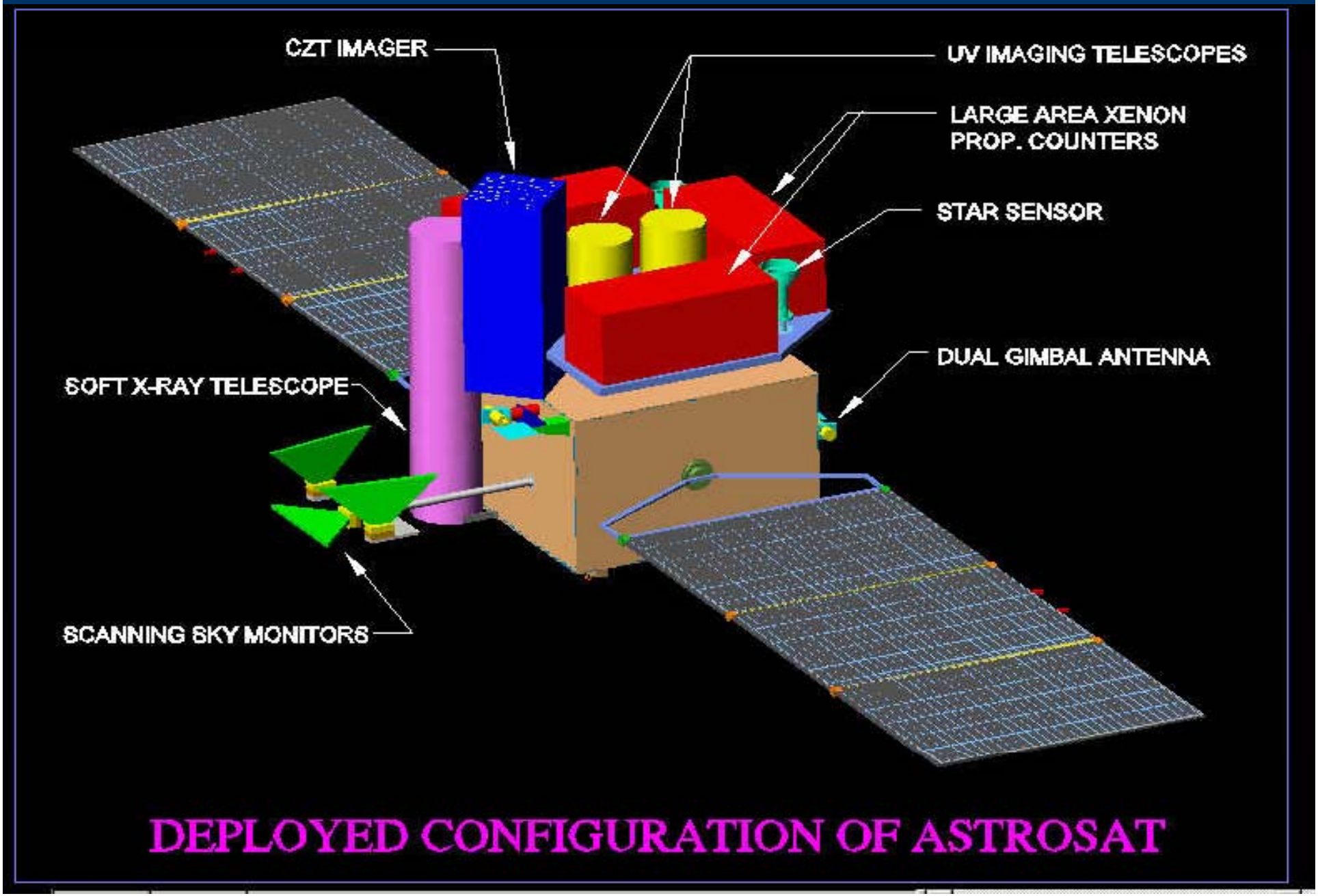
Visible (3500-6000 A°)
Near UV (1800-3000 A°)
Far UV (1300-1800 A°)
Ang. res = 1.8 arc sec

Scanning Sky Monitor (SSM)

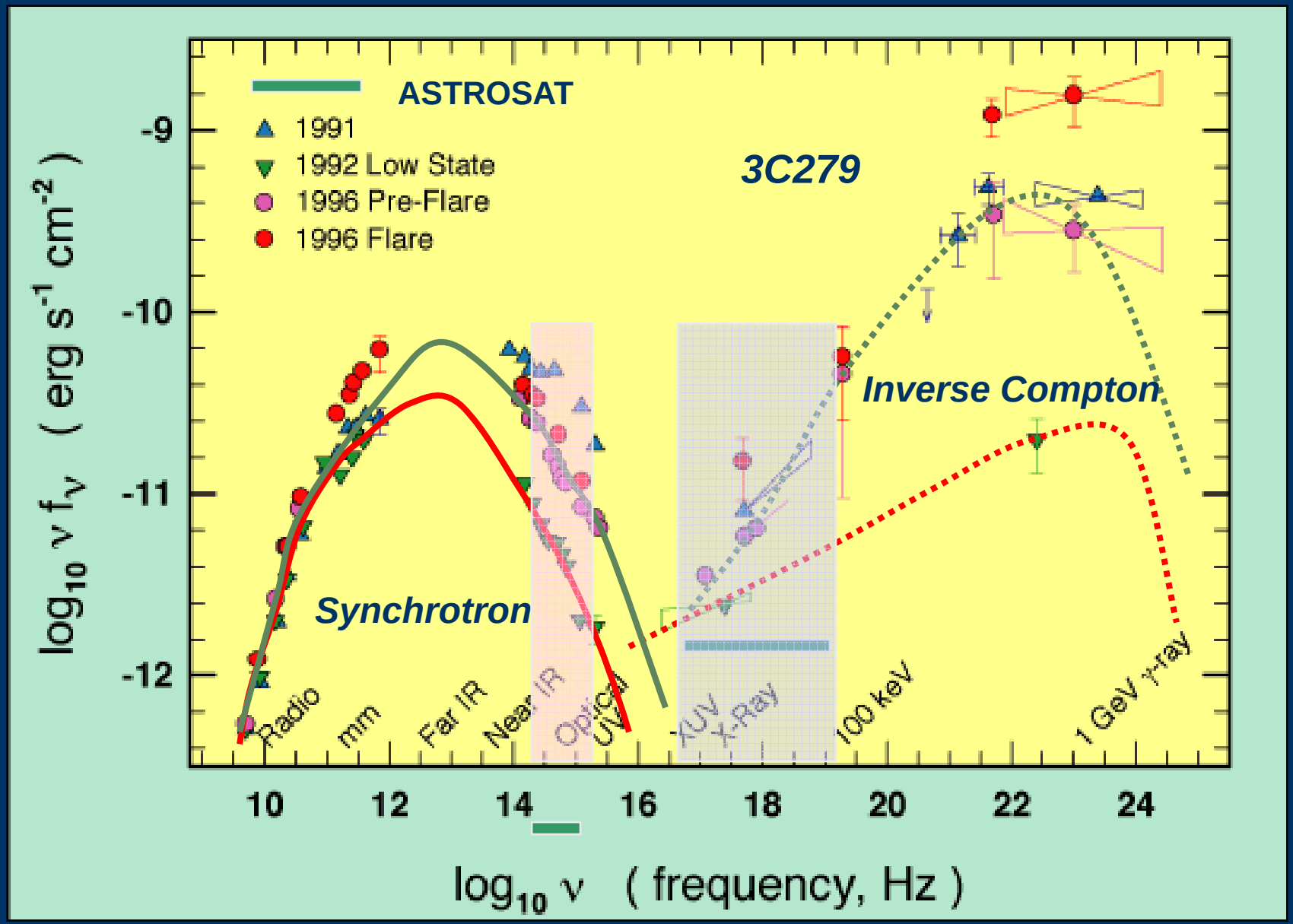


Energy Range 2– 10 keV
Sky coverage = 2 p ster

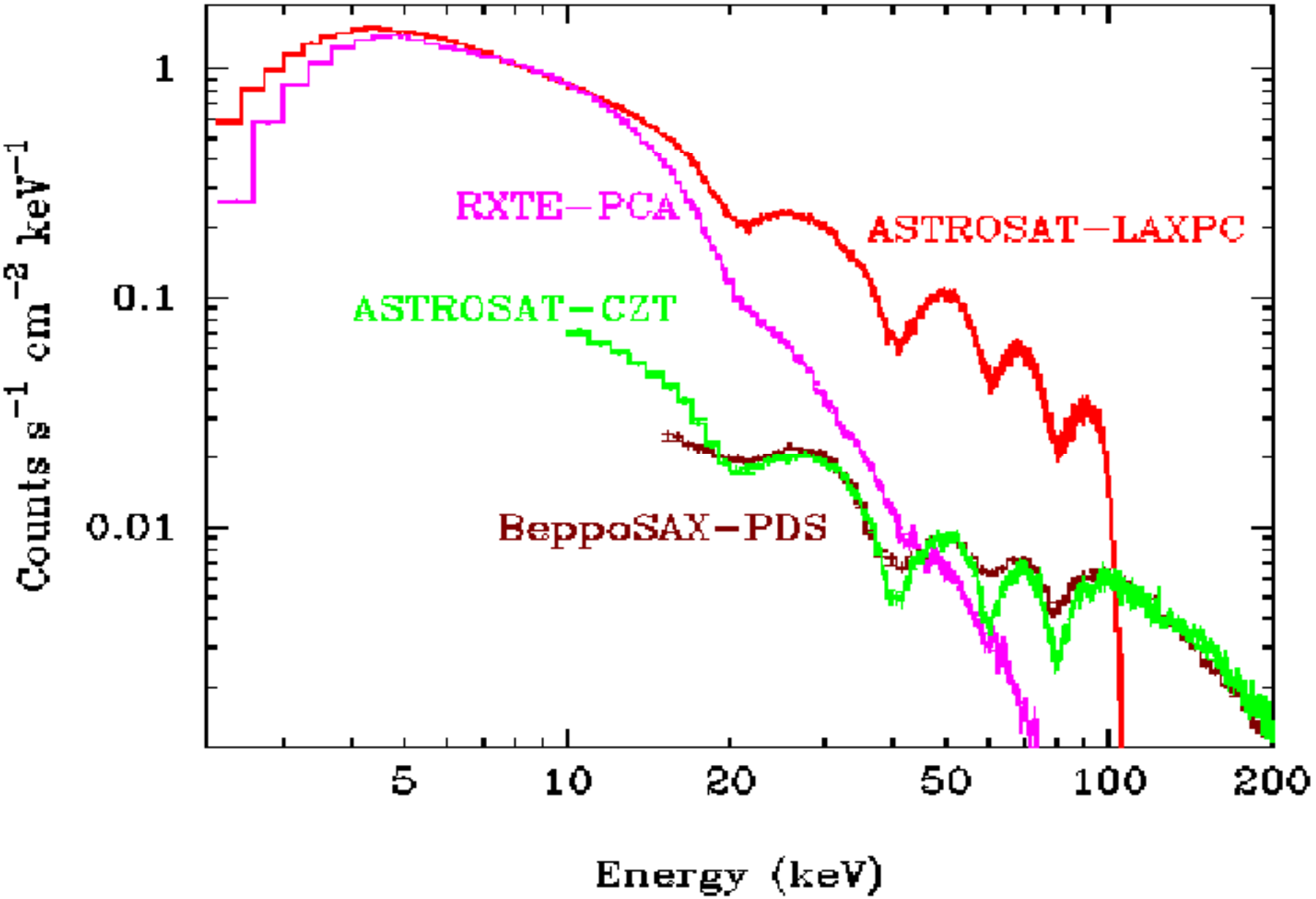
ASTROSAT


CZT IMAGER
UV IMAGING TELESCOPES
LARGE AREA XENON PROP. COUNTERS
STAR SENSOR
DUAL GIMBAL ANTENNA
SOFT X-RAY TELESCOPE
SCANNING SKY MONITORS
DEPLOYED CONFIGURATION OF ASTROSAT

Simultaneous Multiwavelength Coverage: Spectral



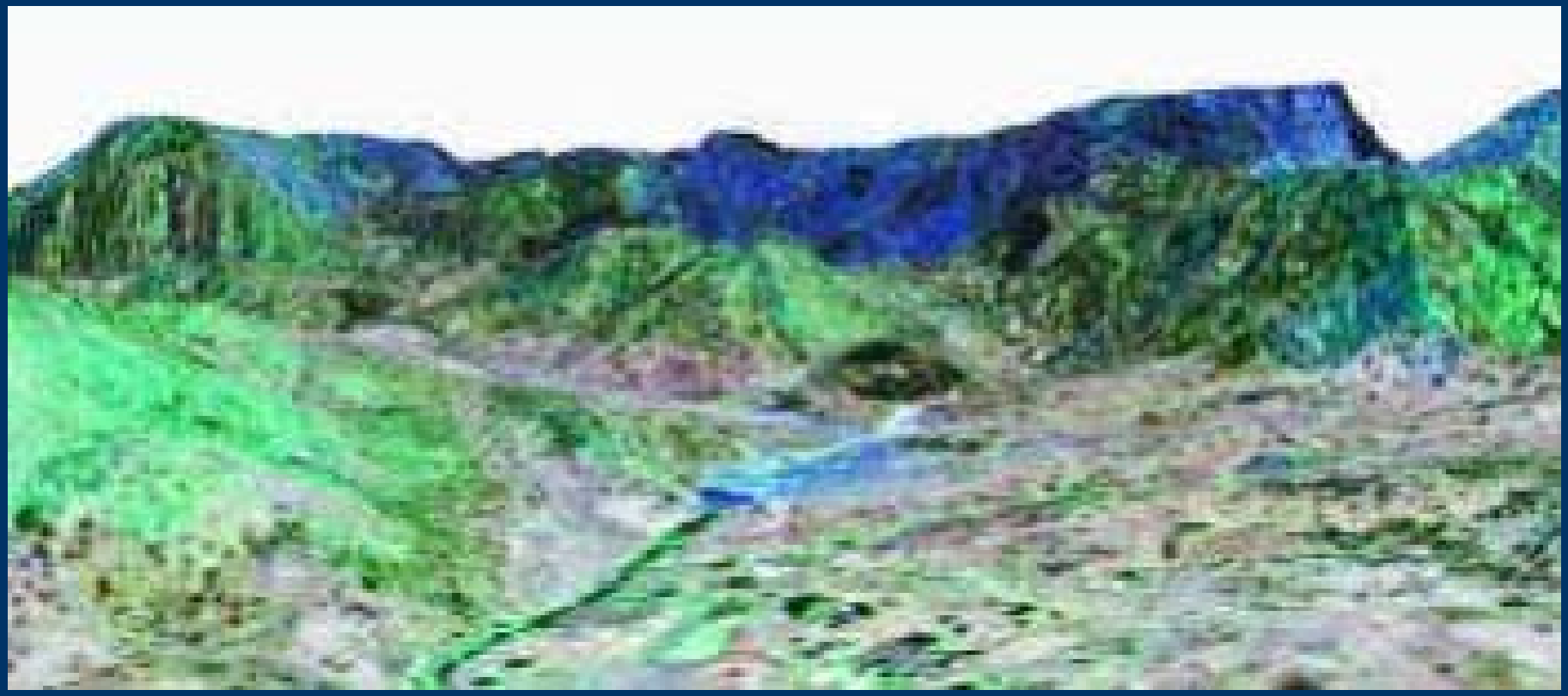
Detection of Cyclotron Lines



Early work on Lunar Science

Remote sensing

- Resourcesat
- Cartosat (2.5 m steroescopic resolution)

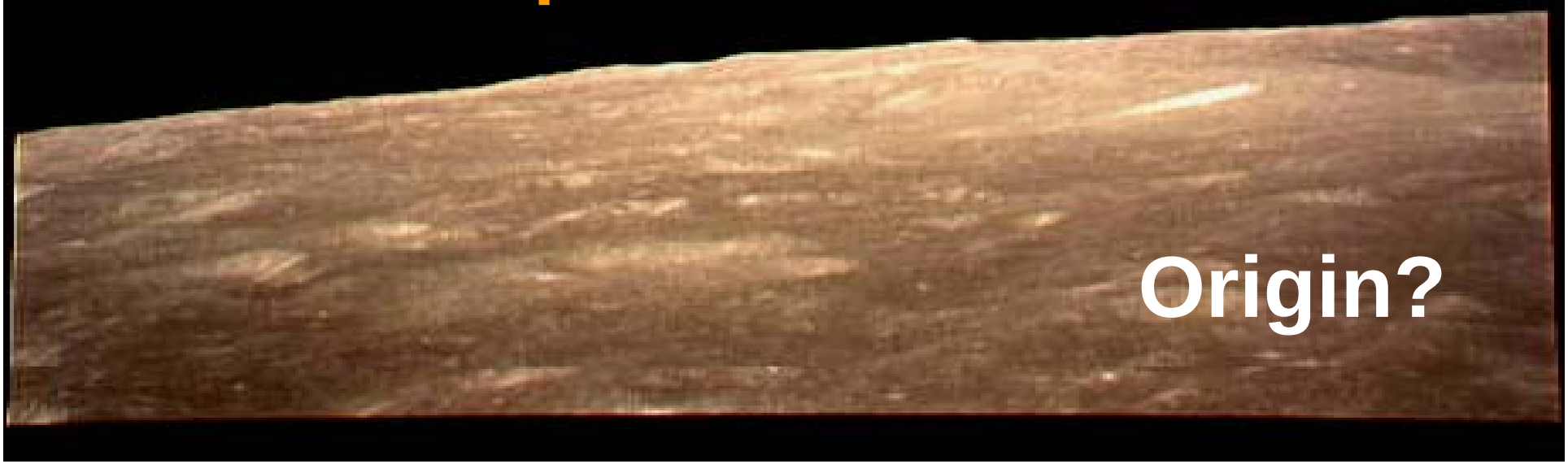


CHANDRAYAAN-1: India's Mission to the Moon

- Will address some of the outstanding questions concerning the origin and evolution of the Moon.
- Will give impetus to planetary research through a committed long-term program.
- Will provide unique opportunities to upgrade several areas of technology, and
- Will help to create a cadre of young scientists who can also participate in future international planetary missions.

Theories

- Fission
- Capture
- Accretion
- Giant impact



Origin?

Understanding the origin and Evolution of the Moon

Physical Properties of the Moon

Topography

Gravity

Magnetic Field

Radiation Environment

The bulk chemistry of Moon

Nature of the Lunar Crust

The Lunar Far-side:
Rock types, Chemistry

Special Regions of Interest:

Polar Regions ,

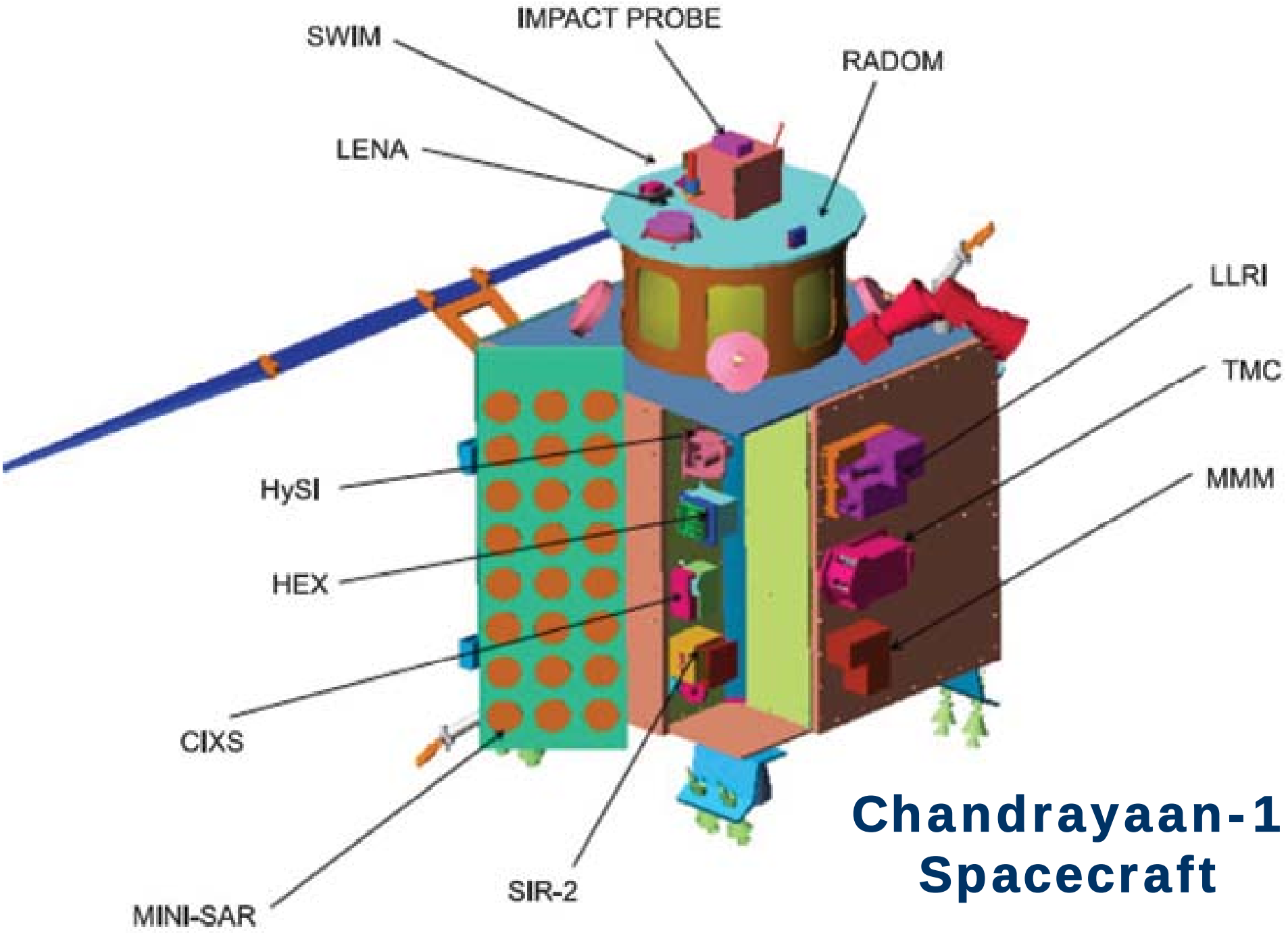
South Pole Aitken Region,

Selected Basins and Craters with central uplift

Nature of Volatile Transport on Moon (Water on Moon?)

Chandrayaan-1 payloads

Payload	Sensor Configuration	Wavelength/ energy Range	Spatial Resolution	Objective
Hyperspectral imager (HySI)	Wedge filter pixelated imager	0.4–0.92 μm with 15 nm resolution using 64 channels	80 m	Areal mapping of minerals
Infra red spectrometer (SIR-2)	Grating spectrometer	0.93–2.4 μm	100 m	Linear mapping Of minerals
Moon Mineral Mapper (M^3)	Grating spectrometer and HgCdTe detector	0.7 to 3.0 μm with 10 nm resolution	30 m	Areal mineral and resource (water, organics) mapping
Terrain mapping Camera (TMC)	Three stereo cameras with pixelated detectors	Panchromatic	10 m areal 5 m elevation	Topographic mapping
Laser Ranging (LLRI)	Pulsed Nd-Yag laser with optical system	1064nm	Elevation 10 m	Topography, Chandrayaan altimetry
X-ray Fluorescence spectrometer (C1XS)	Swept charged CCD	1–10 kev	20 km	Chemical mapping (Mg, Al, Si, Ca, Ti, Fe)
Solar X-ray Monitor (XSM)	Si pin diode	2–10 kev	–	Solar X-ray spectrum
High energy X-ray spectrometer (HEX)	CdZnTe detector	20–250 kev	40 km	Th, ^{210}Pb mapping
Synthetic Aperture Radar (mini SAR)	Radar, Scatterometer and altimeter	2.4 GHz	100 m	Soil properties Topography, altimetery
Neutral atom analyzer (SARA)	Mass spectrometer and solar wind monitor	10ev-kev	100 m	atmospheric neutrals (H-Fe) composition, Magnetic anomalies,
Radiation Dose Monitor (RADOM)	Si semiconductor	>8kev	–	Radiation dose



Chandrayaan-1 Spacecraft

Chandrayaan-1 Mission Phase

SUN

ETO: 240 X 1,00,000 km

GTO: 240 X 36,000

PERIGEE MANEUVERS

MCC

LTT: 240 X 3,86,000 Km

MCC

LOI

OPL. ORBIT

CAPTURE ORBIT

PROGRESS OF MOON IN ITS ORBIT

"No Country which wishes to play a leading part in the world can afford to neglect pure or long term research"

Homi J Bhabha

Thankyou