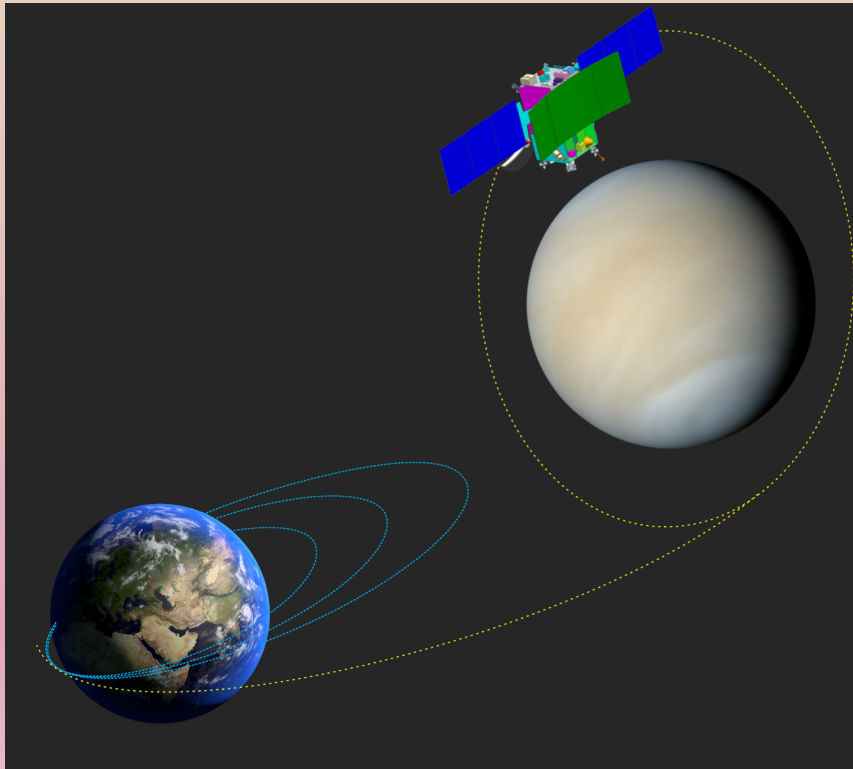




## ***Venus Orbiter Mission***

***....to study surface, atmosphere and plasma environment***



**Nigar Shaji**

Study Team Lead  
U R Rao Satellite Centre  
ISRO

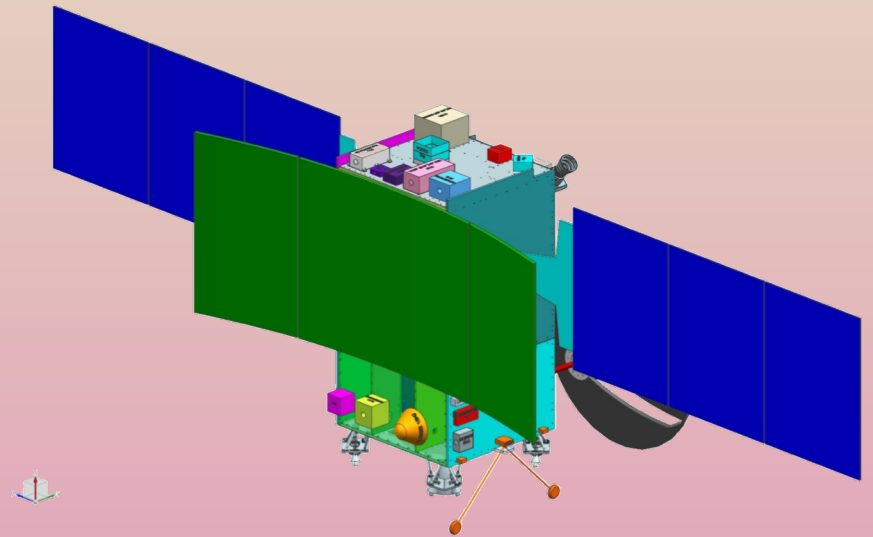
**17<sup>th</sup> Venus Exploration Analysis Group (VEXAG), LASP, Boulder, USA**

**11/06/2019**



## *Venus Orbiter Mission* (to be approved)

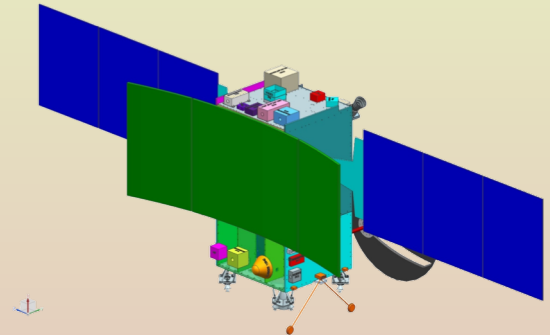
- **Baseline Mission**
  - ✓ Orbiter
  
- **Potential Augmentation**
  - ✓ Sub-Satellite
  - ✓ LLISSE-TD from NASA





## Science Objectives

- Mapping the Venusian surface at high spatial resolution of 30-40 m
- Determining the structure and stratigraphy of surface/sub surface features -- volcanic hot spots
- Determining the structure and composition of the atmosphere
- Understanding Cloud Dynamics
- Investigating Venusian Ionosphere



### Indian Proposals – 54

✓ Recommended- 16

### International Proposals – 21

✓ Recommended-7

▪ (USA-3, Russia-1, Russia-France -1)

### Collaborative payloads

- India/Germany-1
- India/Sweden-1



Indian Payload (short-listed)

Theme	Surface/Subsurface	Atmospheric	Ionospheric	Sun-Venus Environment
<b>Payloads Selected</b>				
Venus L&S-Band SAR	X			
VARTISS (HF radar)	X		X	X
VSEAM (Surface Emissivity)	X	X		
VTC (Thermal Camera)		X		
VCMC (Cloud Monitoring)		X		
LIVE (Lightning Sensor)		X		
VASP (Spectro Polarimeter)		X		
SPAV(Solar occultation photometry)		X		
NAVA ( Airglow imager)		X	X	X
RAVI(RO Experiment) *		X	X	X
ETA (Electron Temperature Analyser)			X	
RPA(Retarding Potential Analyser)			X	
Mass Spectrometer		X	X	
VISWAS (Plasma Analyser) *			X	X
VREM (Radiation Environment)			X	X
SSXS (Solar Soft X-ray Spectrometer )				X
VIPER (Plasma Wave Detector)				X
VODEX (Dust experiment)			x	



International Payloads (short-listed)

Theme		Surface/Subsurface	Atmosphere	Ionospheric	Sun-Venus Environment
Payloads selected	Institution				
Onboard SAR Data Processing and Radar Stereo DEM Generation and Analysis	Jet Propulsion Laboratory Radar Science and Engineering Section	X			
Vesper	NASA/Goddard Space Flight		X		
Venus Lightning Mapper	University of California, Los Angeles, USA		X		
VIRAL (Venus InfraRed Atmospheric gases Linker)	Space research Institute, Moscow & LATMOS, France	X		X	X
IVOLGA: a laser heterodyne NIR spectrometer for studying of structure and dynamics of the Venusian mesosphere	Moscow Institute of Physics and Technology		X		



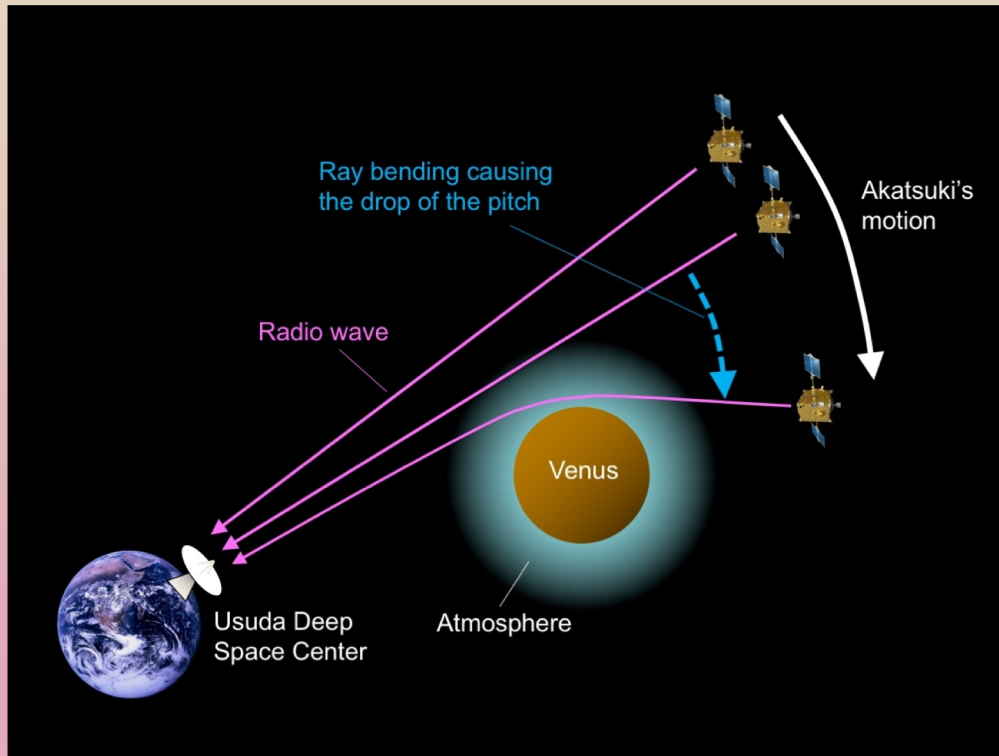
## *Contribution to the Perspective of VEXAG Goals and Objectives*

**II. Understand atmospheric dynamics and composition on Venus.**

**III. Understand the geologic history preserved on the surface of Venus and the present-day couplings between the surface and atmosphere.**



## Radio Science experiments using Akatsuki



*Courtesy: Immamura et al, EPS, 2017*

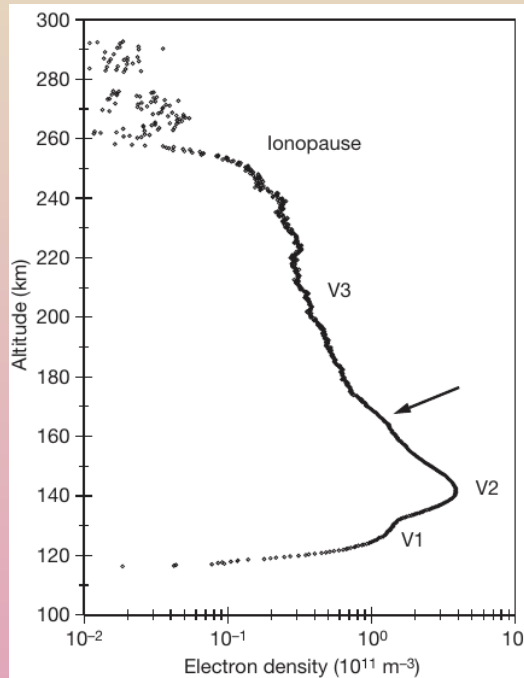
Under MOU between ISRO and JAXA,  
Akatsuki RS signals are being  
tracked at ISRO Deep Space Network  
(IDSN)

~21 Occultation events were  
captured during 2017 - 2019

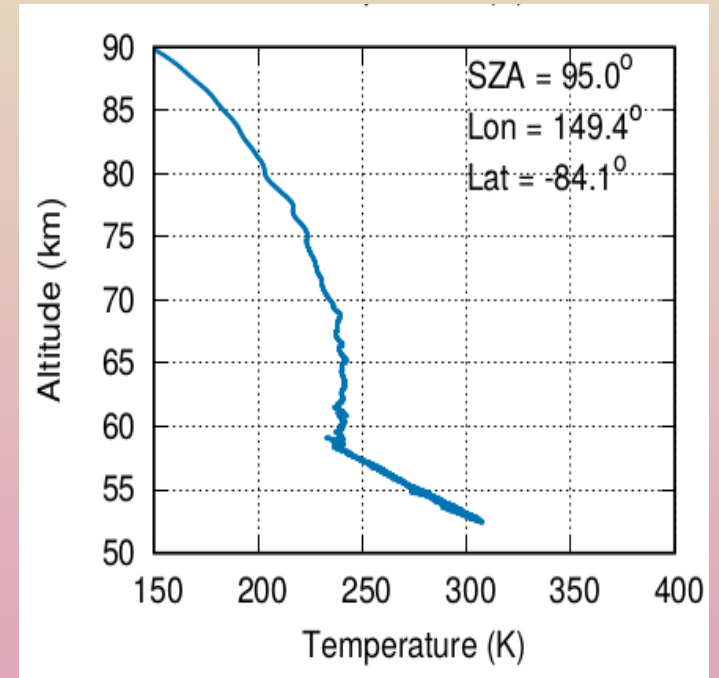
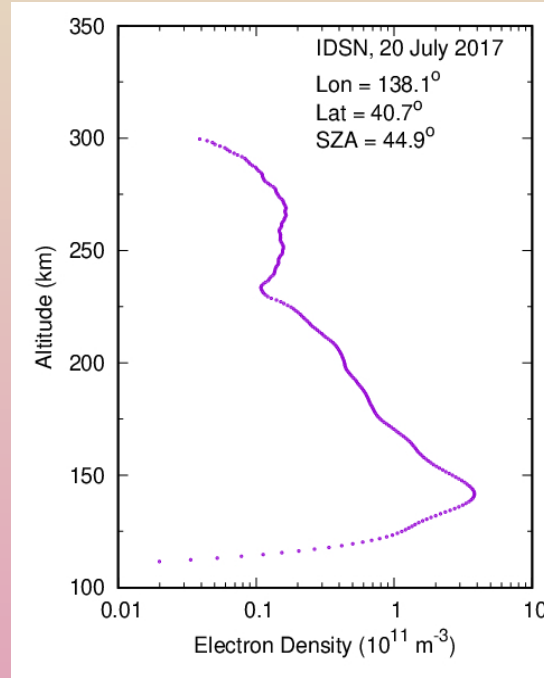
Experiments were conducted in open loop mode  
and data was recorded in CCSDS-RDEF Format

# Radio Science experiments using Akatsuki

Profiling the Venus atmosphere and ionosphere



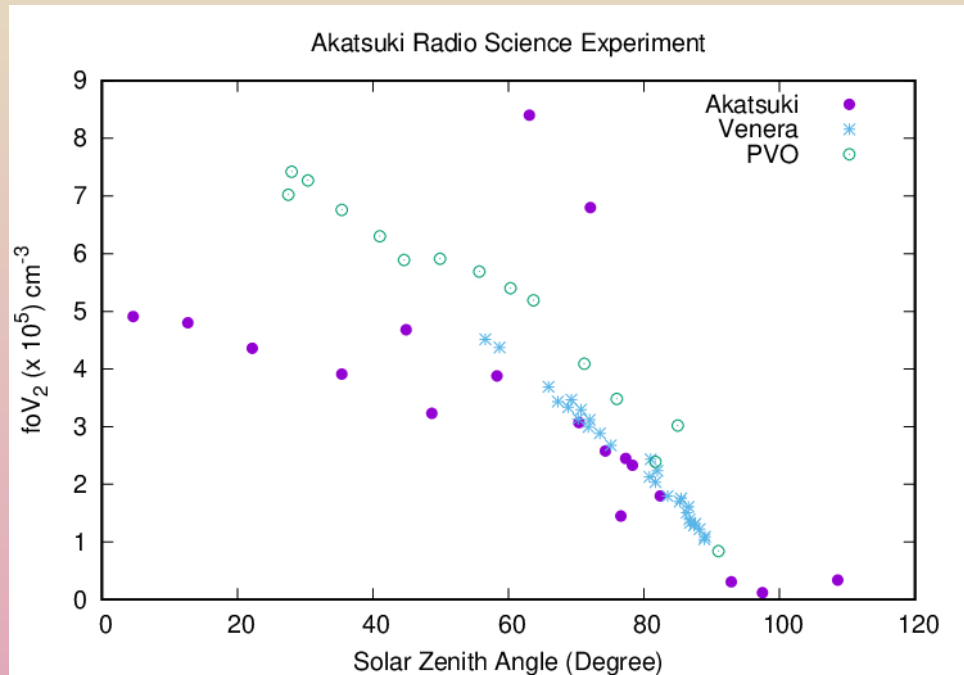
Patzold et al 2007



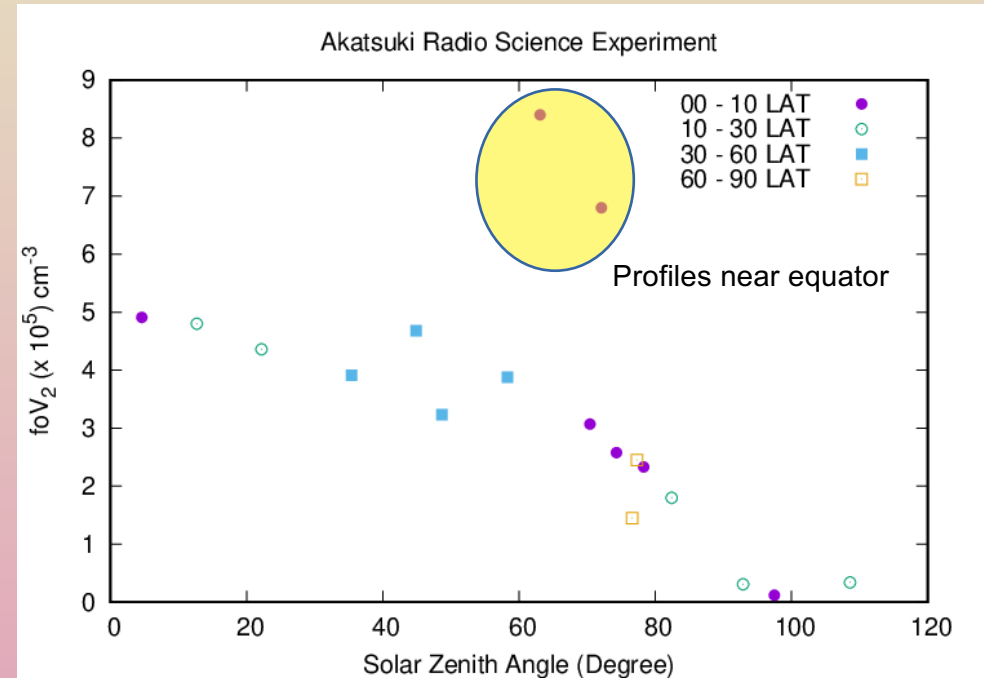


**THANK YOU**

# Venus Ionosphere



Comparison of peak V2 density as observed by different missions during different time periods



Detailed analysis of the profiles observed at the Venus equatorial region is in progress