

SQUARE KILOMETER ARRAY US CONSORTIUM

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Thermal Studies of Solar System Objects with the SKA

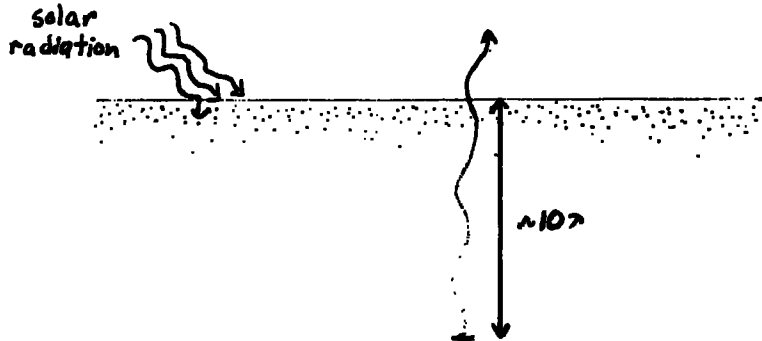
Speaker: Lynn Carter, Cornell

Thermal Studies of Solar System Objects with the SKA

**Lynn Carter
Cornell University**

Why Study Thermal Properties?

- Different wavelengths penetrate to different depths in the surface



- Modeling of data can give information on
 - surface temperature
 - surface layers
 - dielectric constant
 - thermal inertia
 - rock type and particle size
- Previous VLA studies of Mercury, Mars, Asteroids, Galilean Satellites, and the Moon.

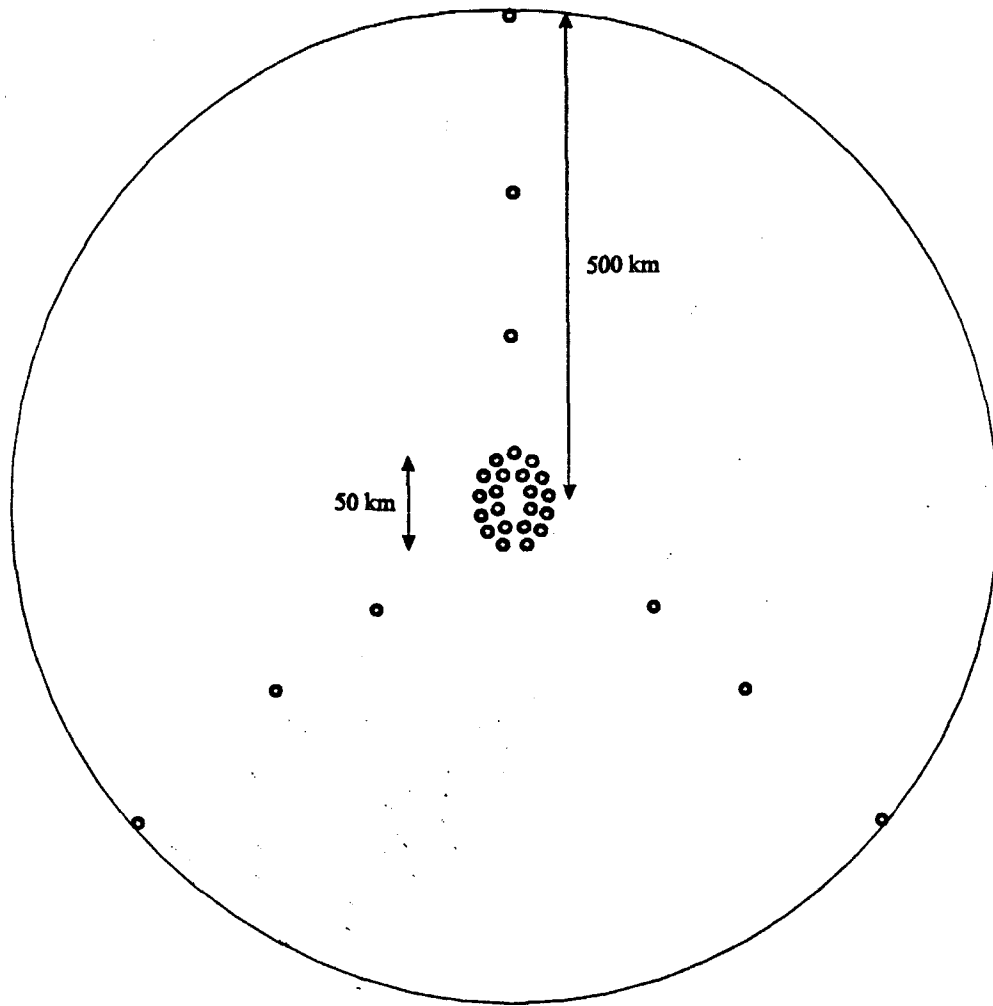


Table 1: SKA Parameters

SKA Parameter	Design Goal
A_{eff}/T_{sys}	$2 \times 10^4 \text{ m}^2/\text{K}$
Frequency Range	0.03–20 GHz
Imaging Field of View	1° square at 1.4 GHz
Angular Resolution	0.1" at 1.4 GHz
Surface Brightness Sensitivity	1 K at 0.1" resolution (continuum)
Number of Spectral Channels	10^4
Number of Simultaneous Frequency Bands	2
Clean Beam Dynamic Range	10^6 at 1.4 GHz

Sample Linear Resolutions in the Solar System

	SKA 20 GHz (1.5 cm)	SKA 2 GHz (15 cm)
Mars	2.5 km	25 km
Asteroid Belt (2.5 AU)	12 km	120 km
Galilean Satellites	21 km	210 km

Asteroids

- **Best resolution (at 20 GHz and 2 AU) is 10 km.**
- **Large asteroids can be resolved**
 - can get 100 pixels across Ceres
 - determine geology, structure
 - compare with radar and optical data
- **With the proposed SKA sensitivity, in 8 hours it will be possible to detect a 3 km asteroid at 2.5 AU.**
- **It should be possible to survey many objects in the asteroid belt (2-3 AU).**
 - over 200 asteroids with radius greater than 100 km

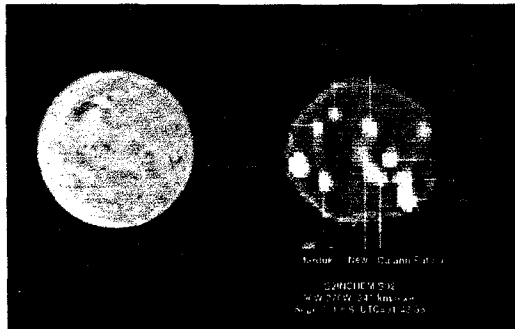
Kuiper Belt Objects (KBOs)

- **At 20 GHz, the resolution at 40 AU is 200 km.**
 - **Using a temperature of 40 K**
- **At a distance of 40 AU, the SKA will be able to detect KBOs bigger than 100 km.**
- **The SKA will be able to detect large numbers of KBOs and image the larger ones.**

Outer Planet Satellites

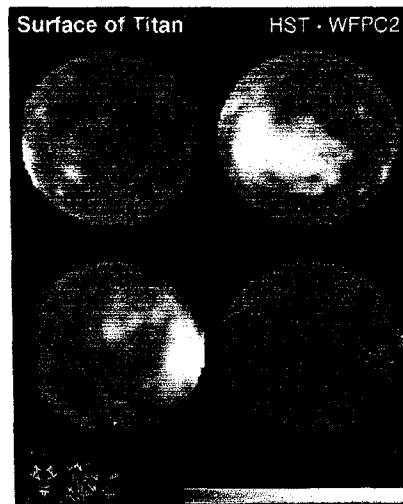
Io

- Resolution (20 GHz): 20 km
- cool lava flows much larger than 20 km
- constrain thermal models of hotspot emission



Titan

- Resolution (20 GHz): 42 km
- long wavelengths needed to penetrate haze
- radio and infrared comparison



Summary

- SKA will allow much higher resolution radio imaging of asteroids, terrestrial planets, and satellites.
- Detection and surveys of small asteroids and Kuiper Belt Objects will also be possible.
- It is very important for planetary studies that the SKA function at short wavelengths.