

SOLAR SYSTEM STUDIES

PLANETARY RADAR WITH THE SKA

MAJOR AREAS OF CURRENT INTEREST:

Terrestrial Planets

Mercury - Surface Mapping, Polar “Ice”

Venus - Terrain Properties, Surface Change Monitoring

Outer Planet Satellites

Surface & Sub-Surface Properties of the Galilean Satellites

Surface Properties of Titan

Asteroids and Comets

**Survey of Near Earth Asteroids via High Resolution Imaging
(surface ages, compositions, sizes, shapes, rotation vectors)**

Survey of Bulk Properties (some imaging) of Main Belt Objects

Survey of Cometary Nuclei via High Resolution Imaging

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PLANETARY RADAR WITH THE SKA

WHAT MATTERS FOR RADAR OBSERVATIONS?

SENSITIVITY AND RESOLUTION

SENSITIVITY:

Assuming an Arecibo Equivalent Transmitting Capability

At 3 GHz SKA Sensitivity ~ 25 x Arecibo (now)

10 GHz SKA Sensitivity ~ 150 x Arecibo

S/N dependence on distance - 4th power

At 3 GHz Equivalent S/N ~ 2.2 x Arecibo current limit (AU)

10 GHz Equivalent S/N ~ 3.5 x Arecibo

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MAJOR AREAS OF INTEREST IN 2010:

Asteroids and Comets

Near Earth Asteroids - Very Small Number Imaged by Spacecraft

NGST ~ 300 m at 0.05 AU

Main Belt Asteroids - Similar Situation

Periodic Comets - CONTOUR and Rosetta Will Image 3 to 4 by 2011

“New” Comets - CONTOUR Might Image One (with luck)

NEW SKA BASED RADAR STUDIES POTENTIALLY VERY IMPORTANT

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PLANETARY RADAR WITH THE SKA

Mercury - MESSENGER Discovery Mission Orbiter Approved.

Importance of Future Radar Studies Dependent on Results.

Venus - No New Missions Approved, Radar Studies Useful

Galilean Satellites - Long Wavelength Radar Studies Important

Titan and Smaller Satellites of Jupiter and Saturn -

Cassini Mission Will Make Radar Studies of Titan

SKA RADAR STUDIES OF SATELLITES WILL BE IMPORTANT

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SENSITIVITY - RESOLUTION AND DETECTION

Asteroids and Comets

Current Imaging Resolution - 20 m at 0.05 AU

SKA Radar - 20 m at 0.11 AU - 3 GHz

20 m at 0.175 AU - 10 GHz

NB Probability of Occurrence Goes as Volume - Distance Cubed

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PLANETARY RADAR WITH THE SKA

COULD A SKA RADAR STUDY TRITON (29 AU) OR PLUTO (30 AU)?

**Current Arecibo S/N for Titan ~ 100 (Assumes optimum system)
(One day's observations)**

SKA Radar S/N (10 GHz) for Titan ~ 15,000

Triton ~ 25

Pluto ~ 16

**MAPPING OF TITAN AT ~ 40 km RESOLUTION AND STUDY OF
BULK PROPERTIES OF TRITON AND PLUTO POSSIBLE**

NO OTHER KUIPER BELT OBJECTS DETECTABLE

SOLAR SYSTEM STUDIES

PLANETARY RADAR WITH THE SKA

TECHNICAL DRIVERS:

Construction of an Additional 200 m x 200 m Station for Transmitting

**Transmitting Capability for Round Trip Light Travel Times
of 10 sec to 8 hrs**

Capability to Record Signals From Each SKA “Station”.

SOLAR SYSTEM STUDIES

PLANETARY RADAR WITH THE SKA

WHY ASTEROIDS AND COMETS?

Least Processed “Large” Bodies in the Solar System

Impact History from Crater Density

→ Collisional History Leading to Flux of Asteroids in the Inner Solar System

Practical Issues of Resource and Hazard Potential