

赤外線天文衛星Astro-Fによる 小惑星サーベイ観測計画

Photometric and Spectroscopic Observations
of Point Sources
in the Solar System
By ASTRO-F

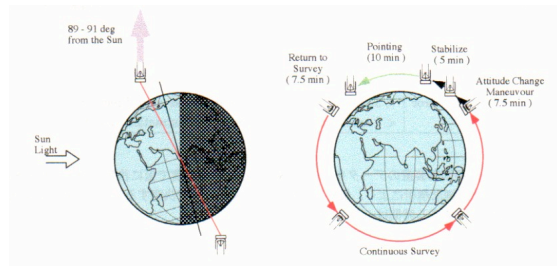
S. Hasegawa



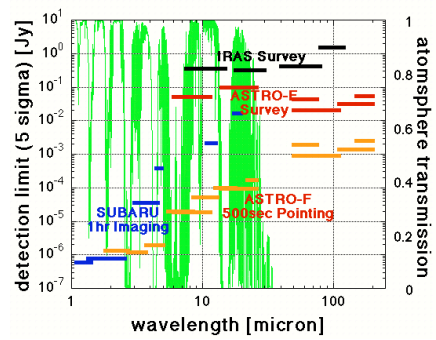
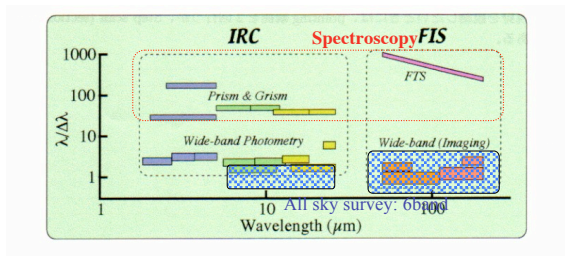
ASTRO-F Telescope Design

- Effective diameter: 0.67 [m]
- Optical Design: Ritchey-Chretien type
- Temperature: 5.8 - 5.1 [K]
- Wavelength coverage: 2-200 [micron]
- Orbit: Sun synchronous polar orbit
- Telescope type: Survey type
- Observation mode: Survey or Pointing

ASTRO-F Orbit



ASTRO-F instruments

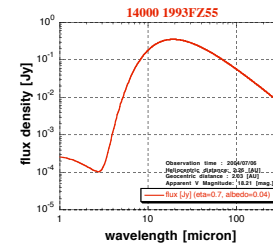


ASTRO-F Observation Plan

Launch (0 Day)	Launch
~60 days	Performance Verification Phase
~60 days	Phase 1 start High priority of all sky survey
~180 days	Phase 1 end
~180 days	Phase 2 start start of pointing observation
~550 days	Phase 2 end (until LqHe evaporate out)
~550 days	Phase 3 Start (only NIR/IRC)
~?? days	Phase 3 end (until mechanical coolers are broken)

SED of the main-belt asteroid

- < 3 μ m:
 - reflected light
- > 3 μ m:
 - thermal radiation



Asteroid survey using ASTRO-F

- The ASTRO-F solar system survey
 - Unbiased catalogue for asteroid's albedo and size
- Phase III near-infrared space-based spectroscopic survey of small solar system objects
 - 3- μ m spectroscopic survey of asteroids

TAFSSOS

The ASTRO-F Solar System Survey (TAFSSOS)

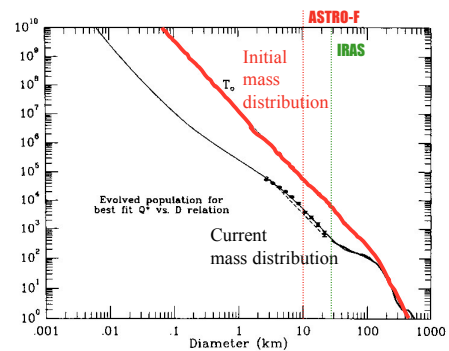
- PI: Thomas G. MUELLER
- Required Data/observation of ASTRO-F
 - All-sky Survey (IRC and FIS)
 - NEP and LMC Survey (IRC and FIS)

TAFSSOS

Purpose

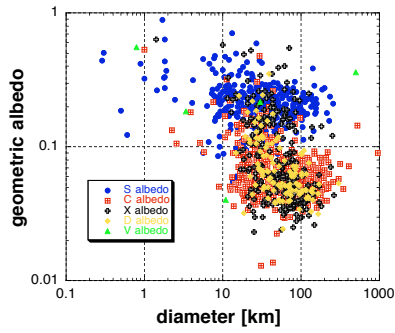
- To obtain the catalogue for albedo and diameter of asteroids
 - exact size
 - Size distribution, Orbital calculation
 - Size distribution
 - Initial MB mass, Collisional process, family creation
 - Albedo
 - Identifying of asteroidal spectroscopic type
 - Albedo distribution
 - Redox-address in MB

TAFSSOS

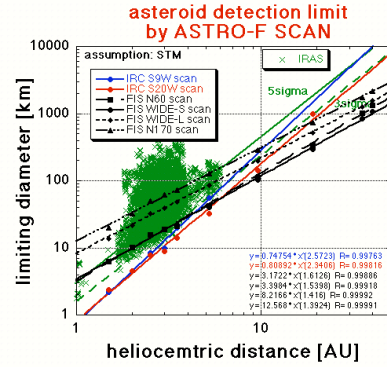


(Durda et al. 1998)

TAFSSOS



TAFSSOS



TAFSSOS

Expected Results

- Past work
 - IRAS: 2228 unbiased survey data
 - ISO: ~ 40 data
 - IRAS+MSX+ISO+Ground-based obs: ~ 2500
- ASTRO-F:
 - ~ 13000 asteroids including NEOs, etc

TAFSSOS

Uniqueness

**“Unbiased” and “uniform”
catalogue
for albedo and size of
asteroids**

3NIRS70

Phase III Near-Infrared Space- Based spectroscopic survey of Small Solar System Objects (3NIRS70)

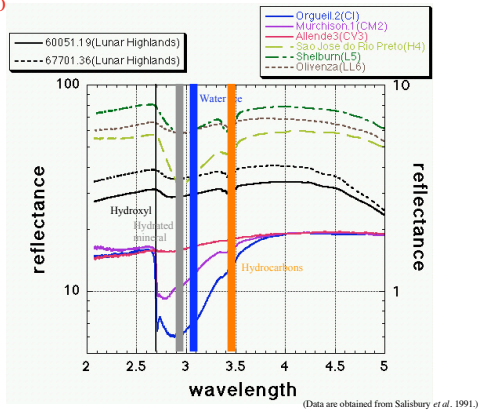
- PI: Sunao HASEGAWA
- Required Data/observation of ASTRO-F
 - IRC pointing (~1000/years in phase III)

3NIRS70

Purpose

- To find hydrated and hydroxylated minerals and hydrocarbons on the asteroids surface

3NIRS70



3NIRS70

Expected Results

- Hydrated mineral distribution in MB
- To help searching meteorite counterparts of D and P type asteroids
- Identifying 'true' metallic asteroids

3NIRS70

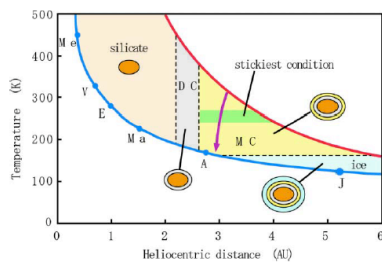
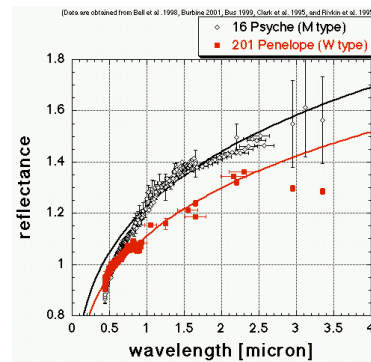


Fig. 3.—Occurrence of grain surface materials, silicate, molecular cloud (MC) and diffuse cloud (DC) organic matter and ice in the protosolar nebula. Structure of grains in the respective regions are also shown. Red line shows the temperature distribution of the accretion disk, identical to that in Fig. 1, and blue line with filled circles (planets) shows the passive disk (Hayashi et al. 1985). The stickiest condition of the millimeter-sized organic grains is shown by the green solid line. Arrow shows the cooling history of the grains/grain aggregates.

(Kouchi et al. 2002)

3NIRS70



3NIRS70

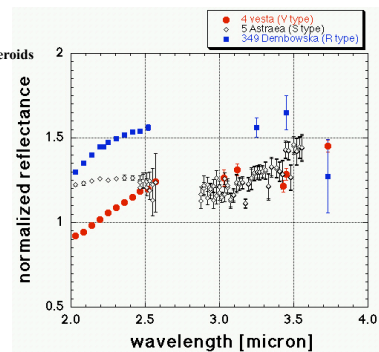
Uniqueness

- SIRTf will not be loaded with the spectrometer of NIR (2.0-5.0 micron).
- Largest telescopes are not fit to do statistical study which is necessary to observe a large number of samples.

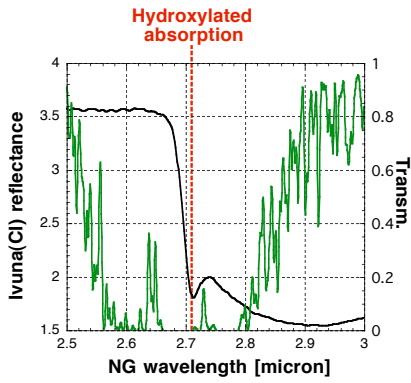
3NIRS70

L-band spectroscopy of asteroids

- Spectral resolution > 0.1micron ~100 asteroids
- Spectral resolution < 0.1micron ~20 asteroids



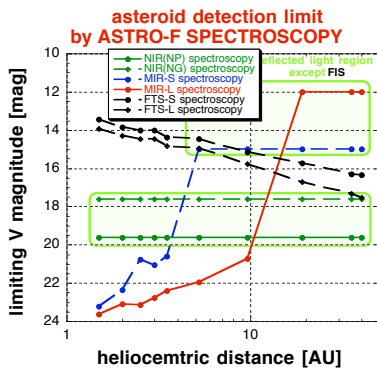
3NIRS70



Uniqueness

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3NIRS70



MUSES-C vs ASTRO-F

- **MUSES-C**
– Sample Return, In-Situ Observations
- **ASTRO-F**
– Statistical Studies