

Satellites as calibrators and Models

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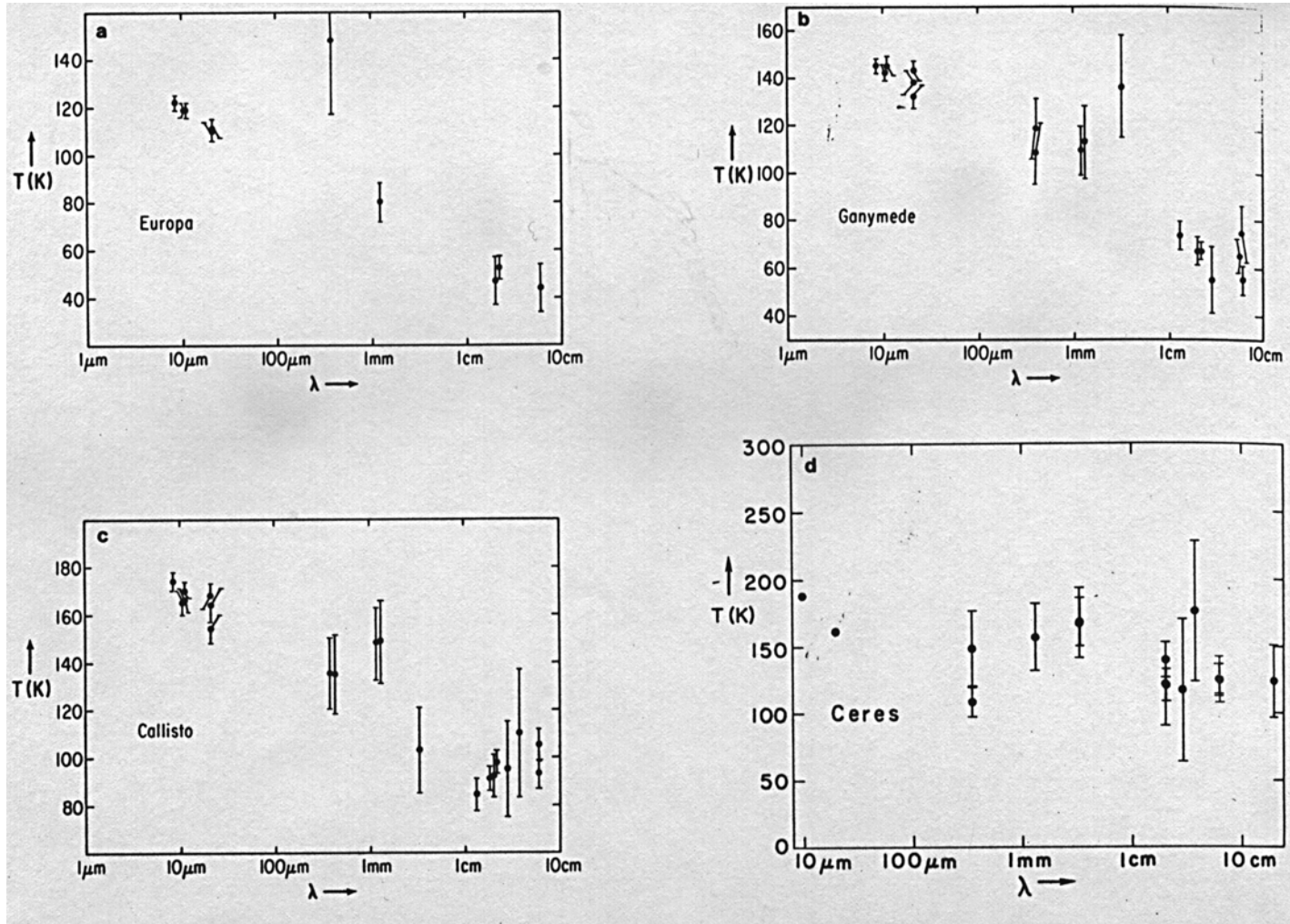
- Galilean Satellites
- Titan



Icy Galilean Satellites

- Io(1”), Europa(0.8”), Callisto(1.4”), Ganymede(1.3”)
- Limits from HPBW: Satellites-Planet Distance
Io, Europa, < 2-3’ ; Callisto, Ganymede < 6-12’
- Estimate Flux at 2000 GHz ($T_b \sim 120$ K): 350 Jy
- Herschel Sensitivity @ 2000 GHz
→ S/N > 100 in 1 minutes

T_b Versus Frequency



Brightness Temperature

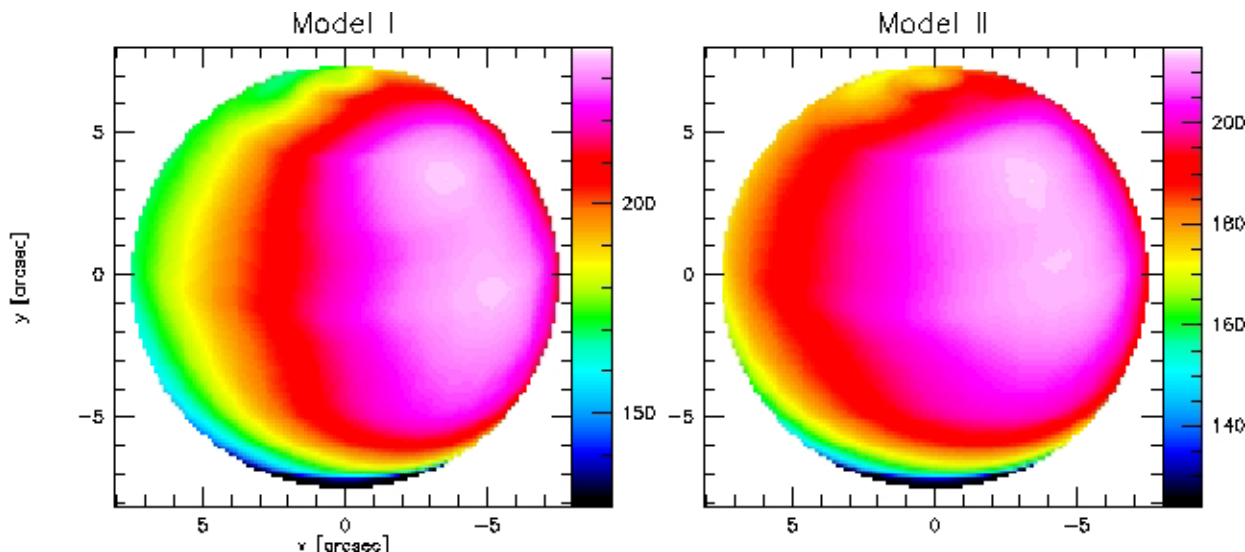
Presently poorly known in the submm/FIR

	1.3mm Muhleman 91	0.35mm De Pater 89
Ganymede	83 ± 5 K	114 ± 10 K
Callisto	105 ± 6 K	135 ± 11 K

→ Need accurate Measurement in the submm (SMA,CSO,JCMT,IRAM)

Modelling

- Thermal Models as for Mars
- Parameters : Surface temperature, Dielectric constant
Thermal inertia, Surface roughness
- Ganymede not consistent with thermal model
(Muhleman et al 1991)



Mars Thermal
Model
uncertainties 5%

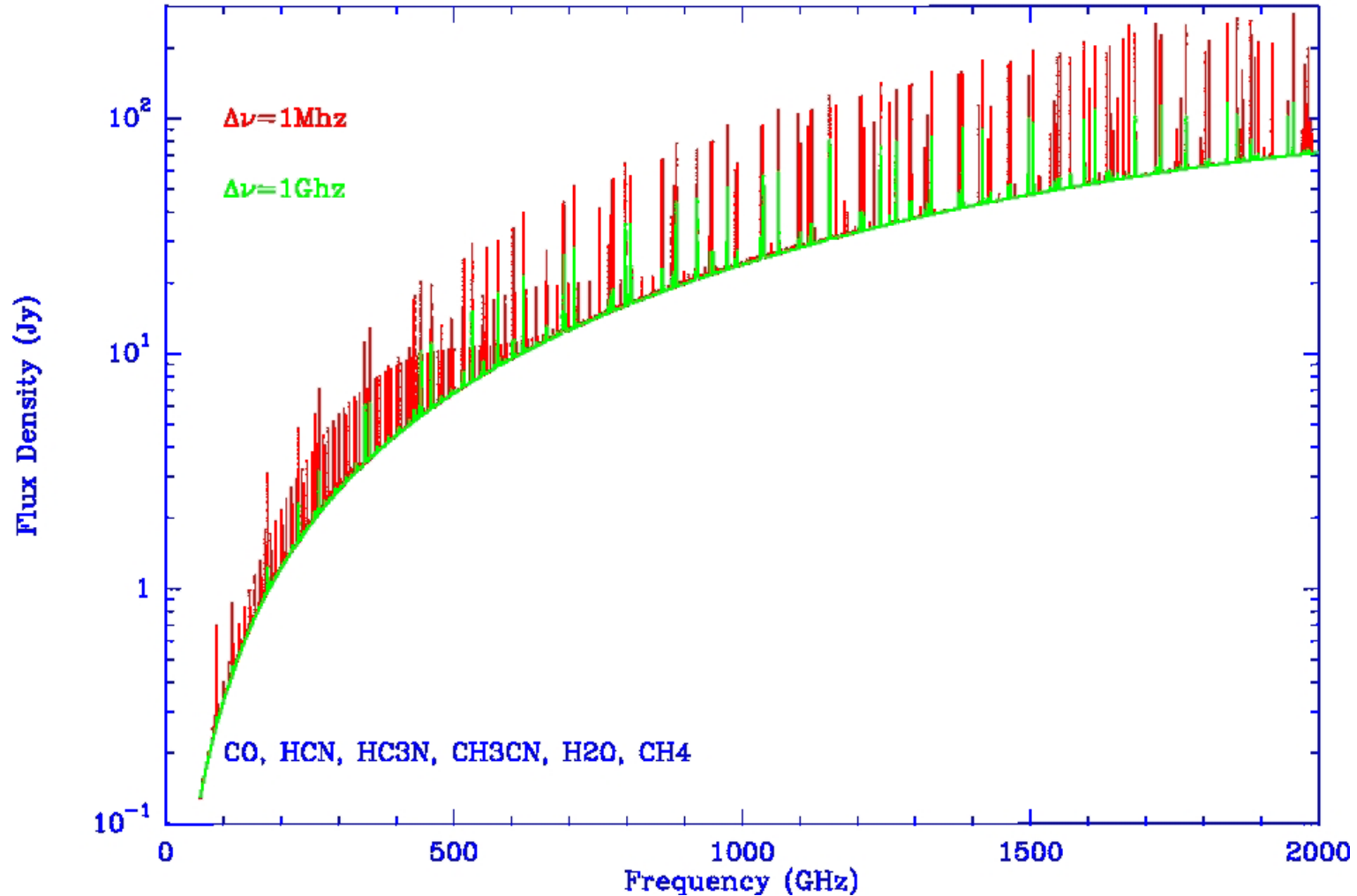
Titan

- Dense atmosphere with N_2 and CH_4
- Thermal Structure Known (Voyager, Cassini)
- Radiative Transfer Models as for Giant Planets :
- Collision induced opacity : N_2-N_2 and N_2-CH_4
- Opacity from Minor compounds at submm : CO, HCN, HC_3N , CH_3CN , CH_4
- Expected better constraints after Cassini +

Reference spectra from CIRS

Flux Versus Frequency

TITAN



→ Flux, Frequency and Image Gain Calibration

Conclusions

- Icy satellites can be used as calibrator ($\sim 5-10\%$)

Need more accurate measurements in the SUBMM/FIR

+ Thermal modelling

- Titan models are accurate (Continuum $< 5\%$, Line $< 5-10\%$)

more constraints from Cassini/CIRS

→ Flux, Frequency and Image Gain Calibration

- Herchel observations for cross-calibration