Comets
II. WSO-UV prospects

Evgeny Kanev on behalf of FCU team

27.10.2017, Madrid, Spain

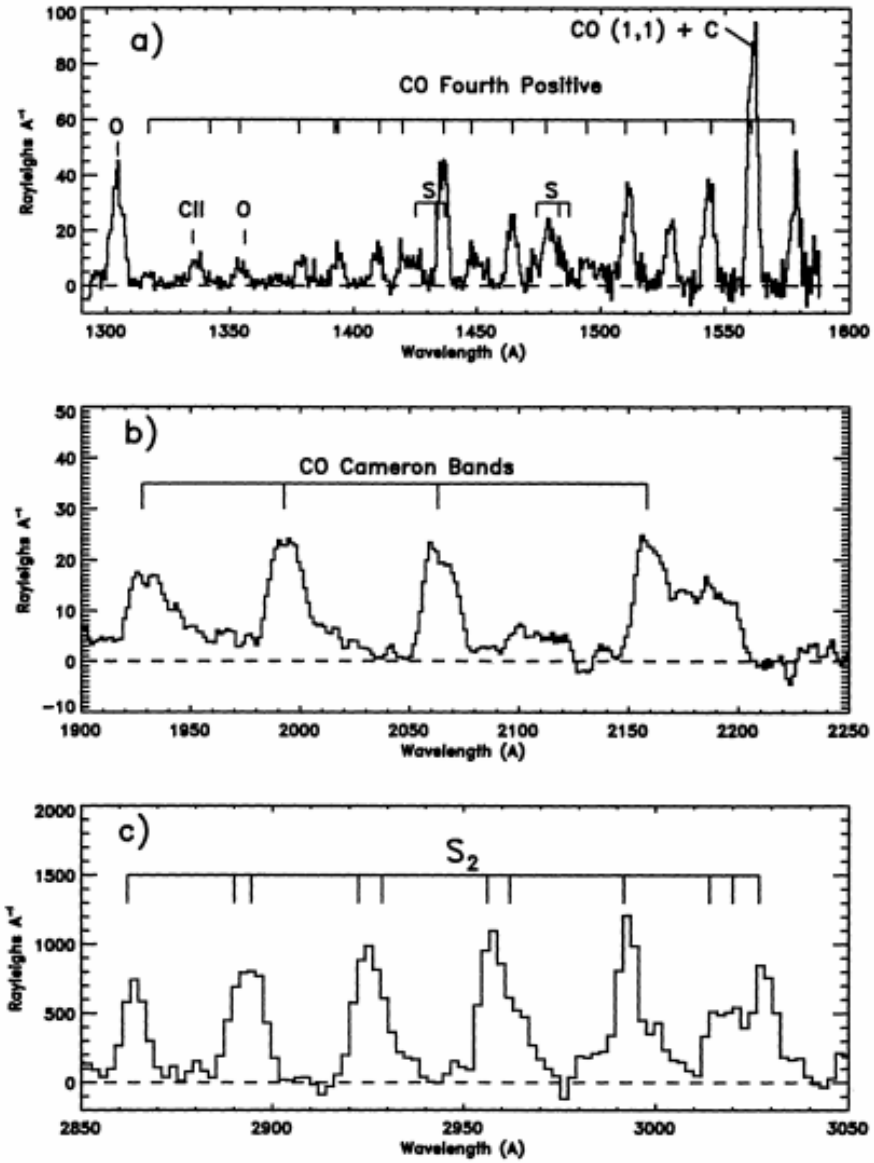
WUVS & FCU main parameters:

- **VUVES: R=50000, 115-176 nm**
- **UVES: R=50000, 174-310 nm**
- **LSS: R=1000, 115-305 nm**
- **FUV channel (FCU) with MCP detector, 115-176 nm**
  - Solar blind detector
  - Diffraction-limited imaging in FUV
  - High sensitivity in photon-counting mode
  - High time resolution
- **NUV channel (FCU) with CCD detector, 174-310 mn**
  - Wide field of view
  - High dynamic range
  - High angular resolution
  - Low resolution field spectroscopy
  - Possibility for extended spectral range: 115-1000 nm

A sample of comets observed by HST:

Comet	Albedo	R (km)	References
Hale Bopp	0.03-0.07	29-41	Lamy et al. (1999)
Encke	>0.04	<2.9	Campins (1988)
	0.02–0.08	2.2–4.9	Luu and Jewitt (1990)
	0.06	2.4	Fernández et al. (2000)
GS	0.08	1.5	Boehnhardt et al. (1999), Licandro et al. (2000)
Borelly	0.03	2.4	Britt (2001)
Hyakutake	0.01–0.015	2.1–2.4	Sarmecanic et al. (1997), Fernández et al. (1996), Lisse et al. (1999)
	>0.06	<1.05	Altenhoff et al. (1999)

Spectra obtained by HST:



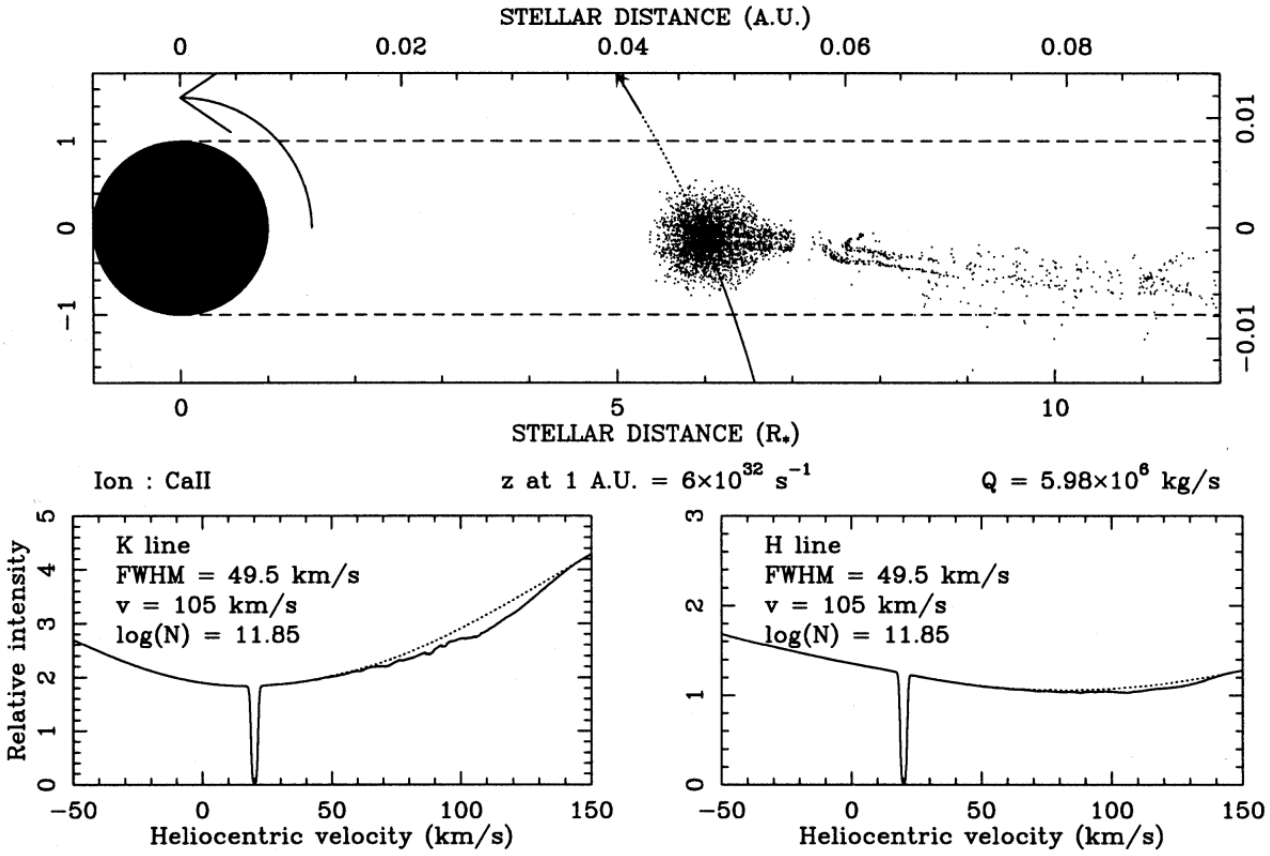
Volatile Abundances in Comets

Molecule	Abundance[a]	Relevant Remote Observations
H_2O	100	IR; OH from UV, radio
CO	1–10	IR, UV, radio
CO_2	2–9	IR from space; CO Cameron from UV
CH_3OH	0.8–7	IR, radio
CH_4	0.7–2	IR; CH from VIS
C_2H_6	0.4–1	IR
C_2H_2	0.3–0.9	IR
H_2CO	0.03–4	IR, radio
OCS	0.3	radio, IR
NH_3	0.1–1	radio; NH_2 from VIS
H_2S	0.1–0.3	radio
CS_2	$\sim$ 0.1	CS from UV, radio
HCN	0.03–0.3	radio; CN from VIS
HNC	0.002–0.02	radio
N_2	$\sim$ 0.01	N_2^+/CO^+ from VIS
S_2	0.005–0.03	UV

Weaver, 1998

HST Spectra of C/1996 B2 (Hyakutake)

Exocomets:



R=50000
exactly what is needed to detect
Mg II lines!

- Detectable when a comet passes in front of a star
- A doppler-shifted absorption appears in volatile element lines (Ca II, NaI, Mg II...)
- Falling Evaporating Bodies: FEBs

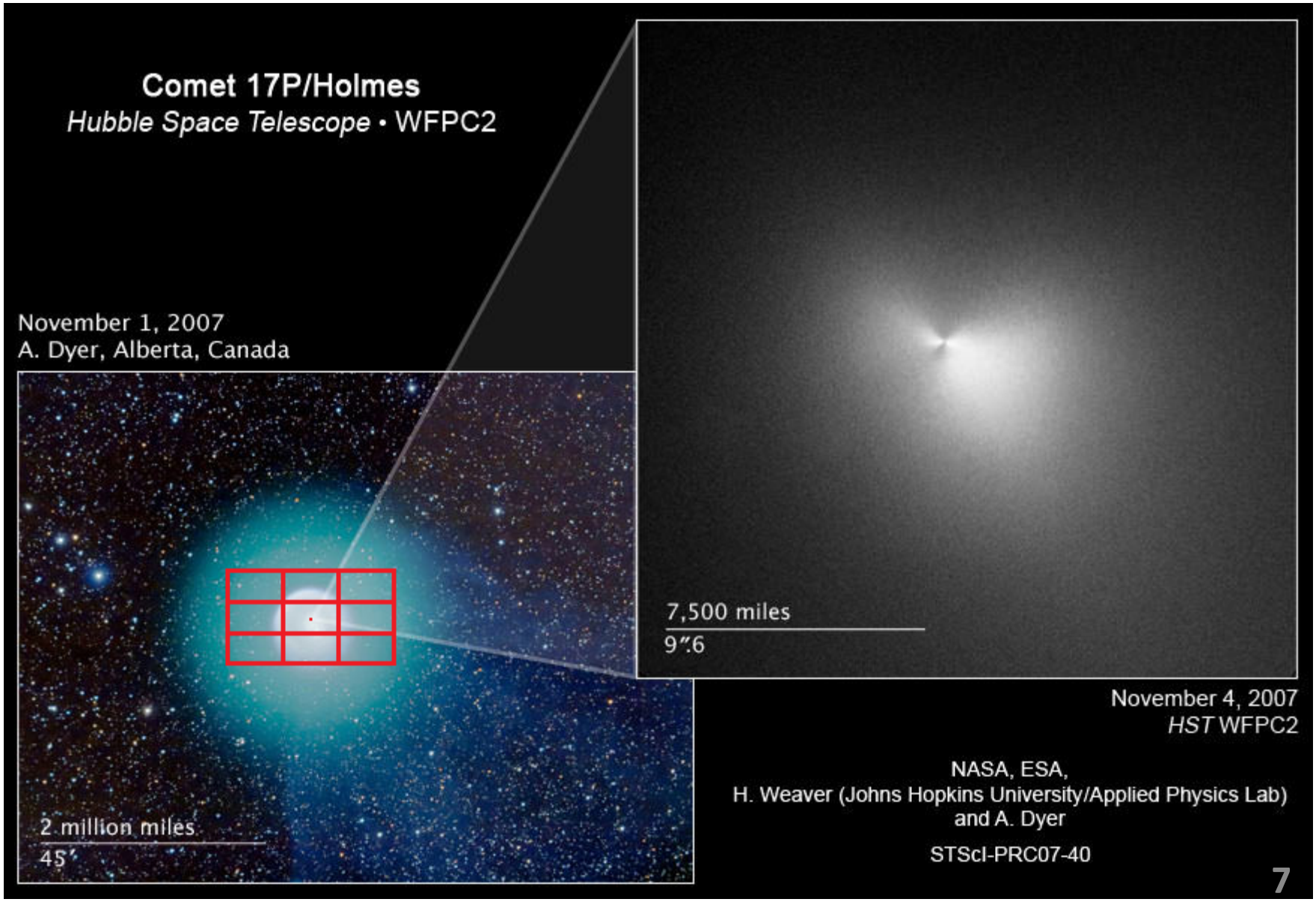
Beust et al. (1998)

Features of the FCU, compared with peers:

Parameters	**Far-UV**	**Near-UV**	HST/ACS/SBC	HST/WFC3/UVIS
Detector	**MCP, analogue of UVIT (Spain)**	**CCD**	MCP, MAMA	CCD
Spectral range, nm	**115-176**	**174-310 (115-1000)**	115-170	200–1000
D (primary mirror), m	**1.7**	**1.7**	2.4	2.4
Total throughput, %	**3**	**12**	4	10
Effective area, m^2	**0.068**	**0.27**	0.18	0.45
Field of view, arcsec×arcsec	**121×121**	**597×451**	34.59×30.8	162×162
Ω, $degree^2$	**8.9×10^{-4}**	**0.021**	5.8×10^{-5}	0.002
GRASP (etendue), $deg^2 \times m^2$	**6×10^{-5}**	**5.7×10^{-3}**	1.1×10^{-5}	9×10^{-4}
Scale, arcsec/pixel	**0.08 (20μm)**	**0.146**	0.033×0.030 telescope: 0.1	0.0395
Transmittance *	**0.5 3 reflections**	**0.8 1 reflections**	0.64 2 reflections	0.5* 3 reflections
Detector size, mm	**30**	**49×37**	25	61×61
Detector format	**2k×2k ***	**4k×3k**	1k×1k	4k×4k
Number of filters	**Up to 10**	**Up to15**	6 + 2 prism	42+5

*Chamber transmittance without a telescope

Field of view:

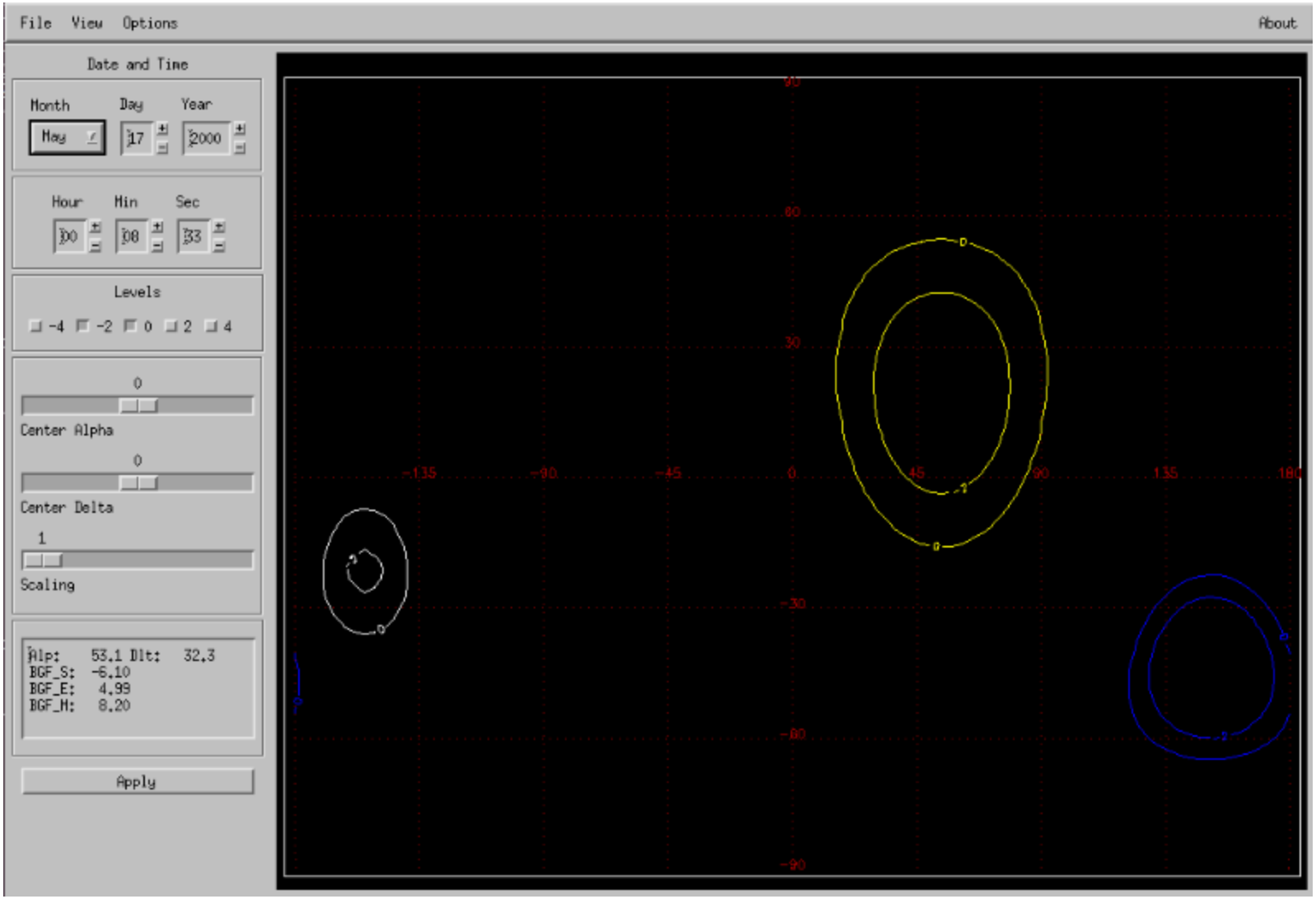


Comets:

- move
- rotate
- vary

So they should be observed many times. The most important phase is close to periastre.

Avoiding zones:



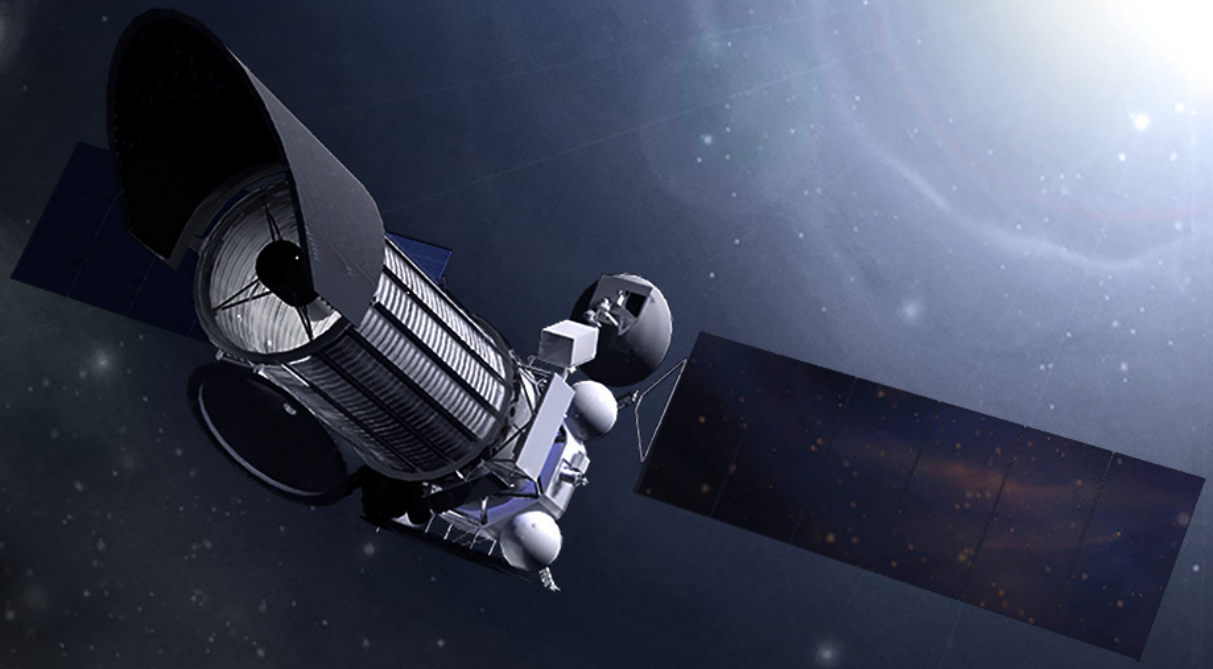
Limitations related to orbital properties of HST and WSO-UV :

	HST	WSO-UV
Avoiding angles:		
- Sun	50 deg	40 deg
- Earth	>180 deg	20-24 deg
- Moon	9 deg	9 deg
Orbital Period	95.47 min	24h
Maximum exposition	~6 min	6 min x 100 times continuously

INASAN

WSO-UV

World Space Observatory – Ultraviolet



Thank you for attention!

Gracias por su atención