

Coronagraphy from Balloons

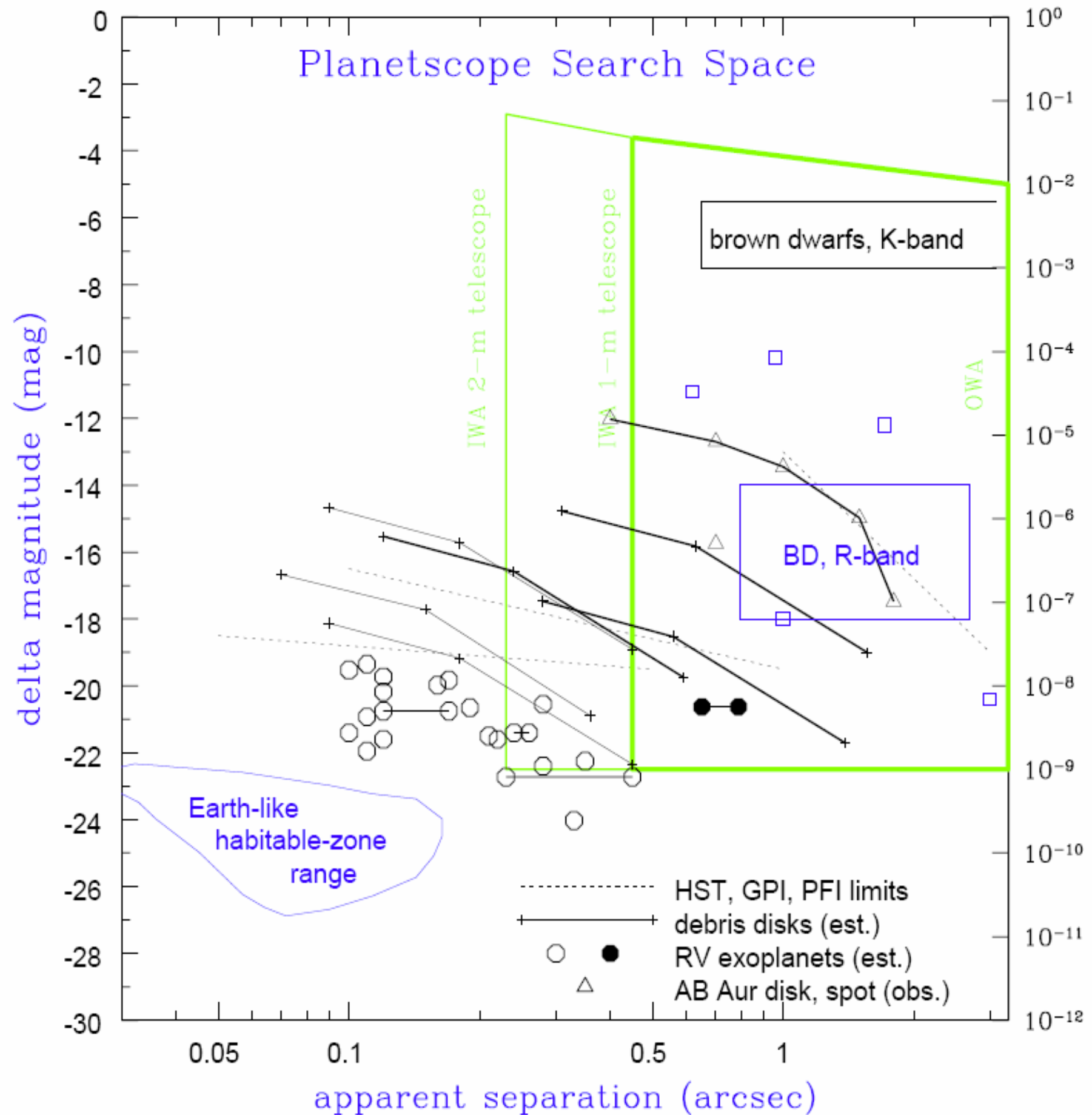
Rémi Soummer

KISS workshop "Innovative Approaches to Exoplanet Spectra"

11/11/09

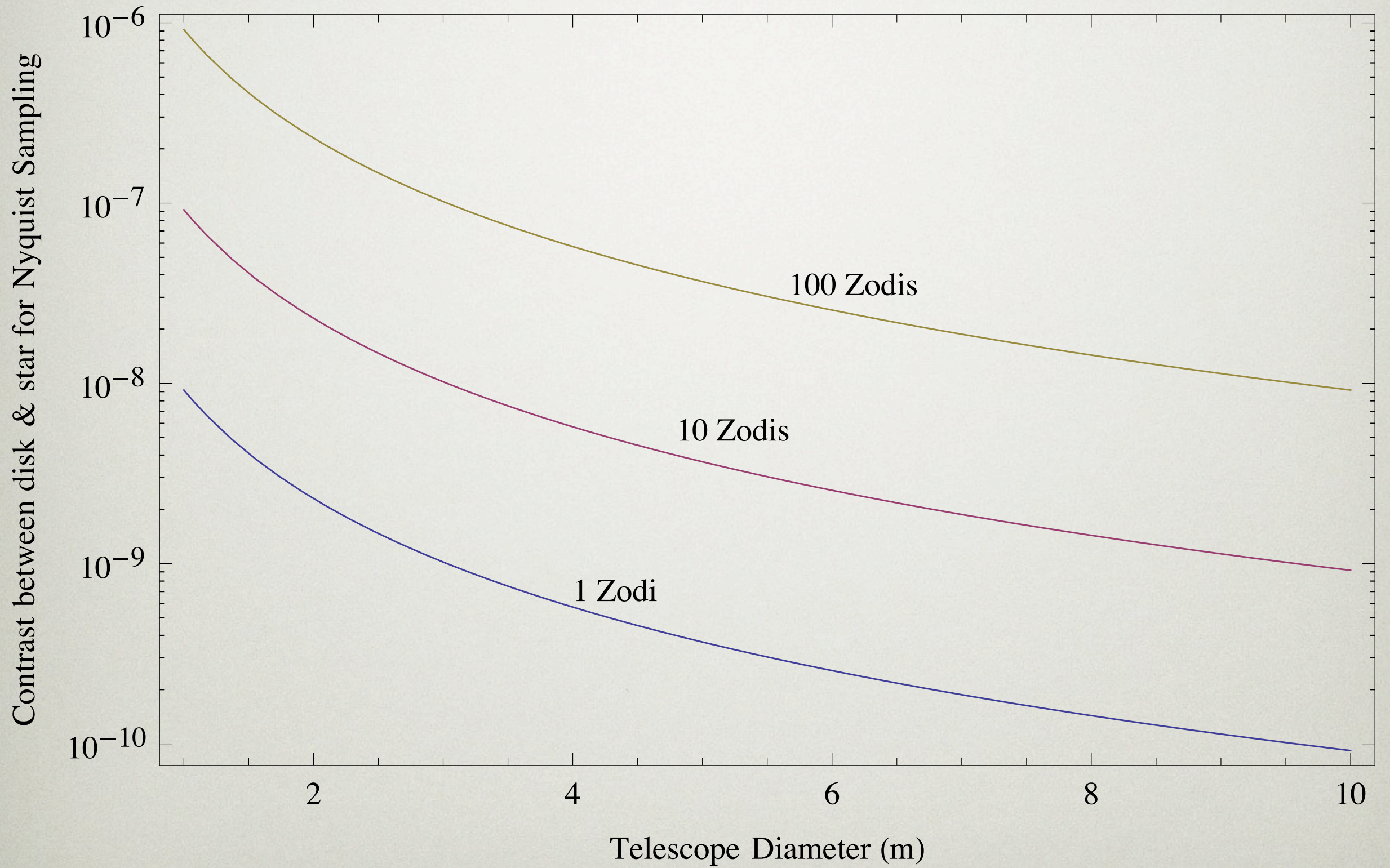
Balloons experiments

- Technology development / precursor to flagship?
 - ▶ cheap enough for technology only?
 - ▶ raising TRL levels
- Science
 - ▶ what science goals?
 - ▶ how does this compare and complement facilities available in ~5 years
 - GPI/SPHERE, JWST, etc
 - ▶ Zodiacal disks, overlap with RV planets
- Feasibility on balloon platforms?



Traub

Wes Traub et al. PlanetScope project



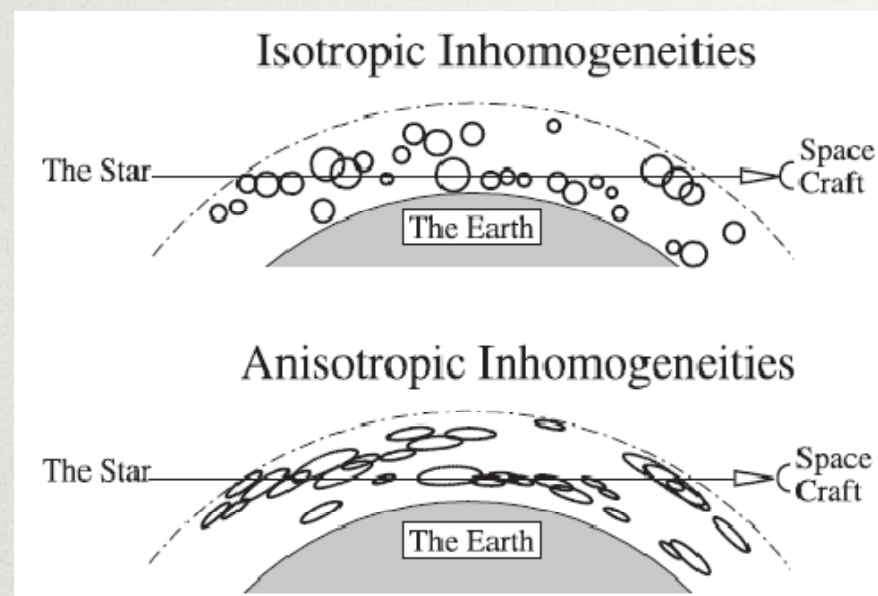
Planet Name	M sin i	Period (d)	a (AU)	sep''	Contrast (10 ⁻⁹)
Epsilon Eridani b	1.55	2502	3.39	1.06	1.6
55 Cnc d	3.84	5218	5.77	0.43	0.6
HD 160691 c	3.10	2986	4.17	0.27	1.1
Gj 849 b	0.82	1890	2.35	0.27	3.3
HD 190360 b	1.50	2891	3.92	0.25	1.2
47 UMa c	0.46	2190	3.39	0.24	1.6
HD 154345 b	0.95	3340	4.19	0.23	1.0
Ups And d	3.95	1275	2.51	0.19	2.9
Gamma Cephei b	1.60	903	2.044	0.17	4.4
HD 62509 b	2.90	590	1.69	0.16	6.4
HD 39091 b	10.35	2064	3.29	0.16	1.7
14 Her b	4.64	1773	2.77	0.15	2.4
47 UMa b	2.60	1083	2.11	0.15	4.1
HD 89307 b	2.73	3090	4.15	0.13	1.1
HD 10647 b	0.91	1040	2.1	0.12	4.2
HD 217107 c	2.50	3352	4.41	0.12	0.9
HD 117207 b	2.06	2627	3.78	0.12	1.3
HD 70642 b	2.00	2231	3.3	0.11	1.7
HD 128311 c	3.21	919	1.76	0.11	5.9

1.5m, $4\lambda/D$ @ 500nm

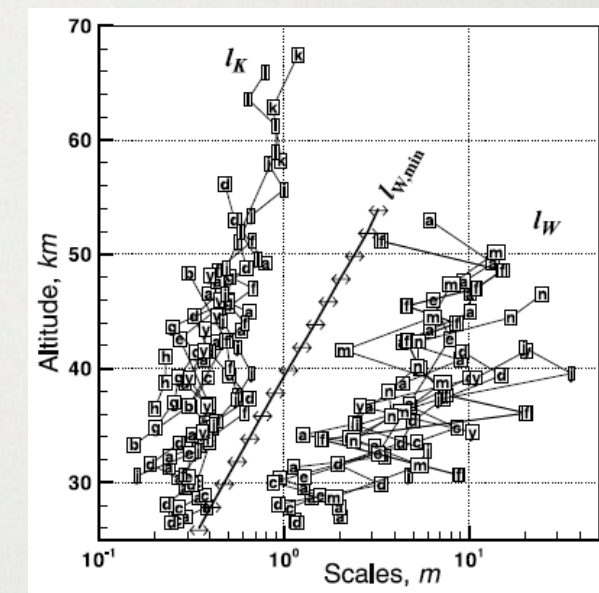
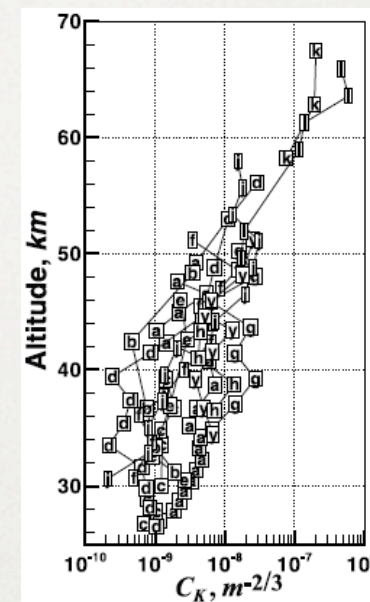
1.5m, $3\lambda/D$ @ 500nm

1.5m, $2\lambda/D$ @ 500nm

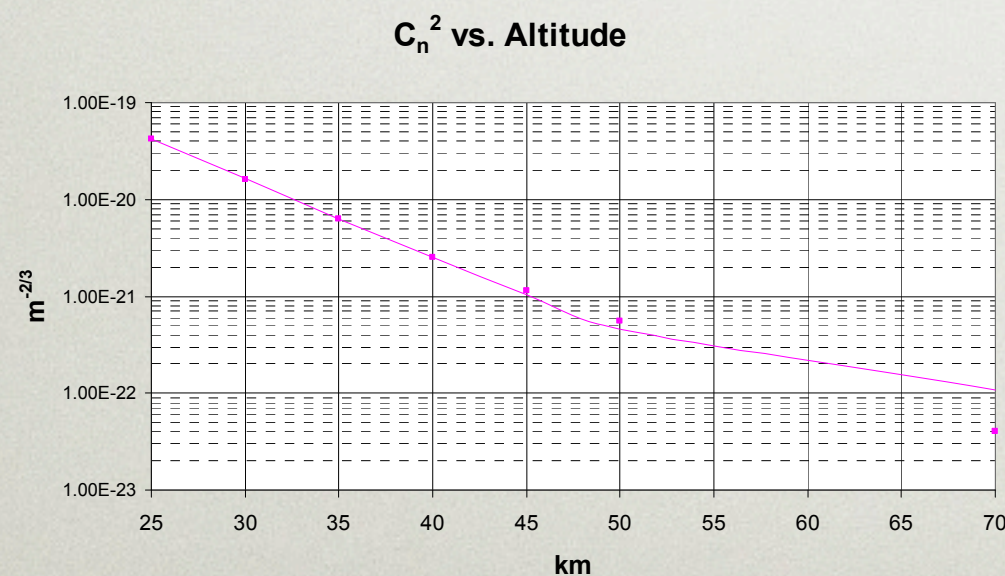
Seeing in the free-air stratosphere



Gurvich & Brekhovskikh,
Waves in Random Media, 2001



Gurvich & Chunchuzov,
JGR, 2003



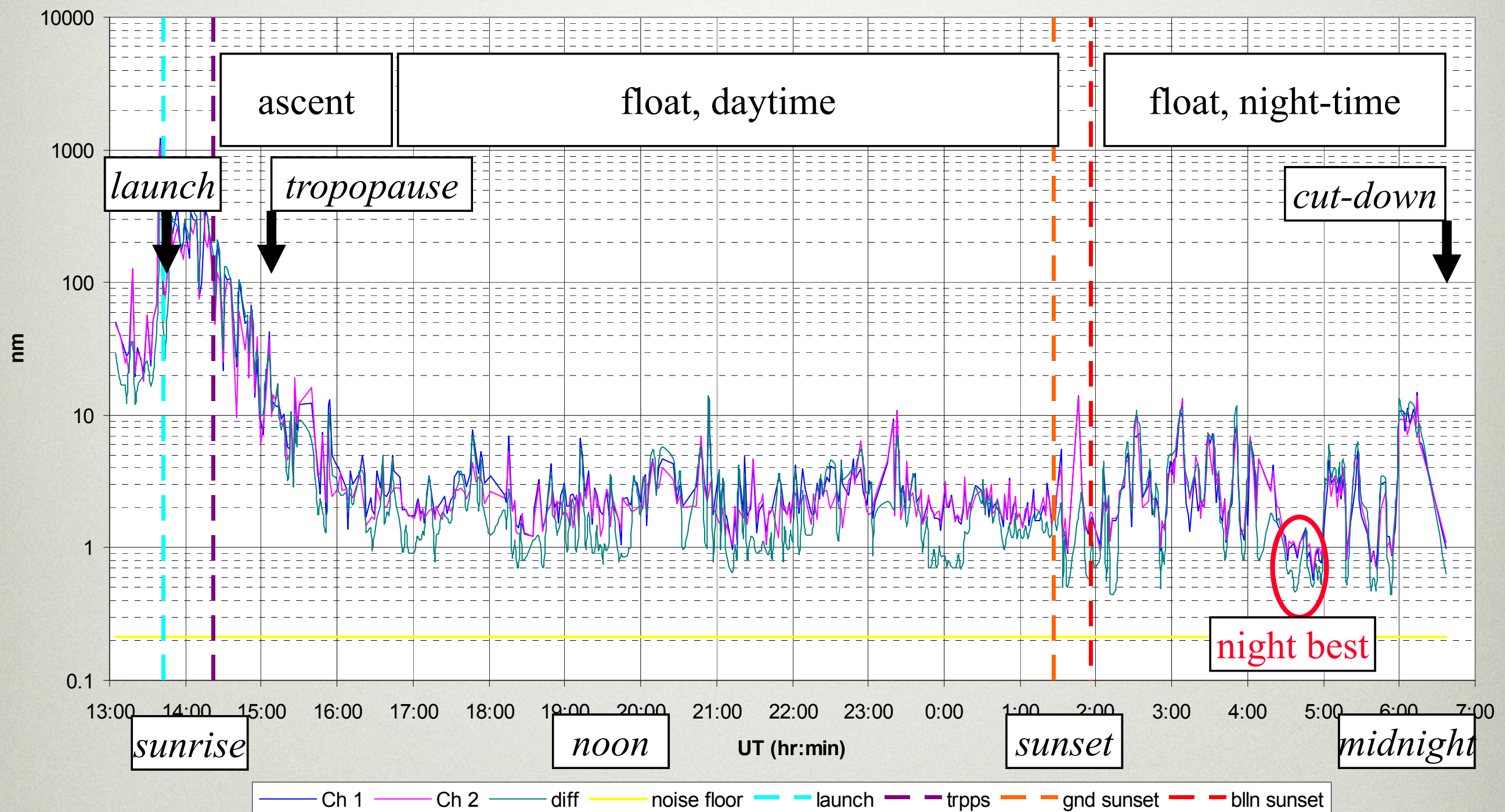
At 38-km altitude	Ground-based
$r_0 = 57$ m	~ 0.2 m
Inner scale = 2.7 m	~ 0.006 m
Outer = 69 m	~ 27 m

Traub

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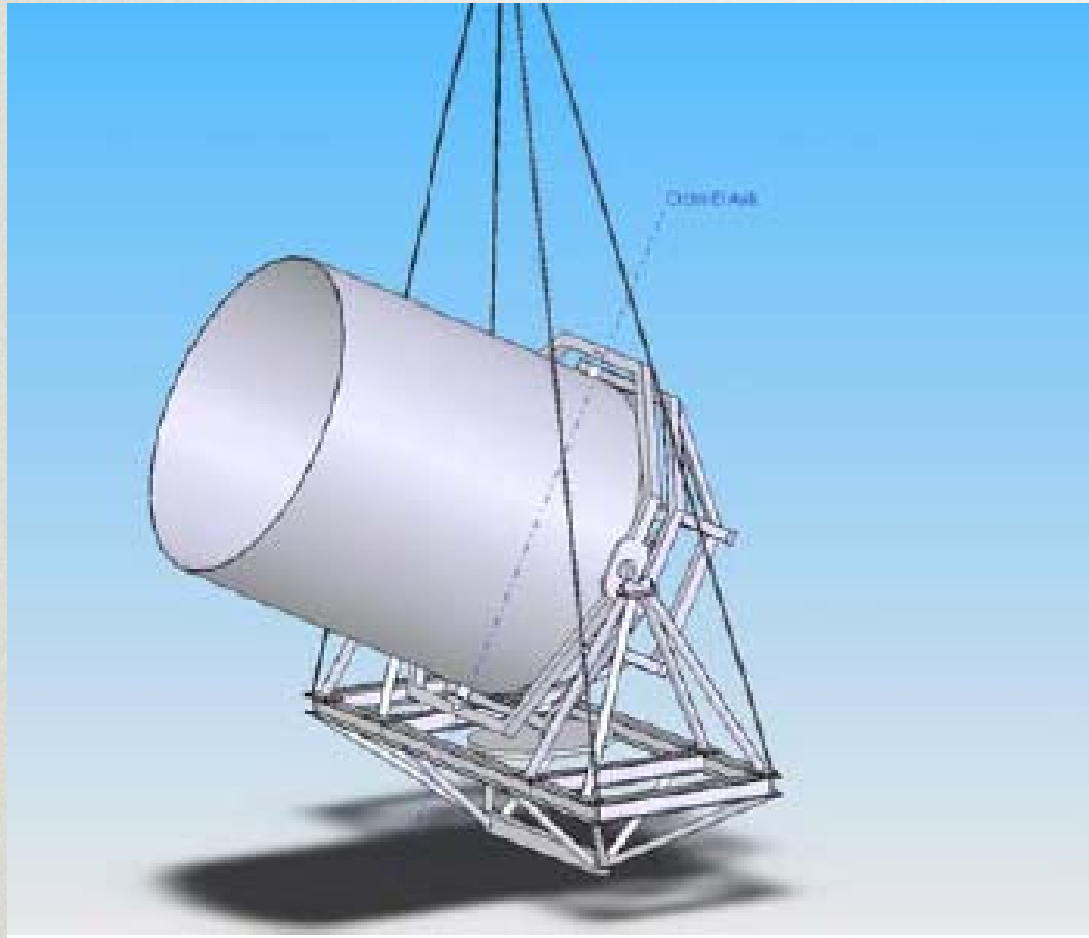
Wes Traub et al. Planetscope project

RMS amplitude (nm) of optical path, in 0.3 to 3.0 Hz band

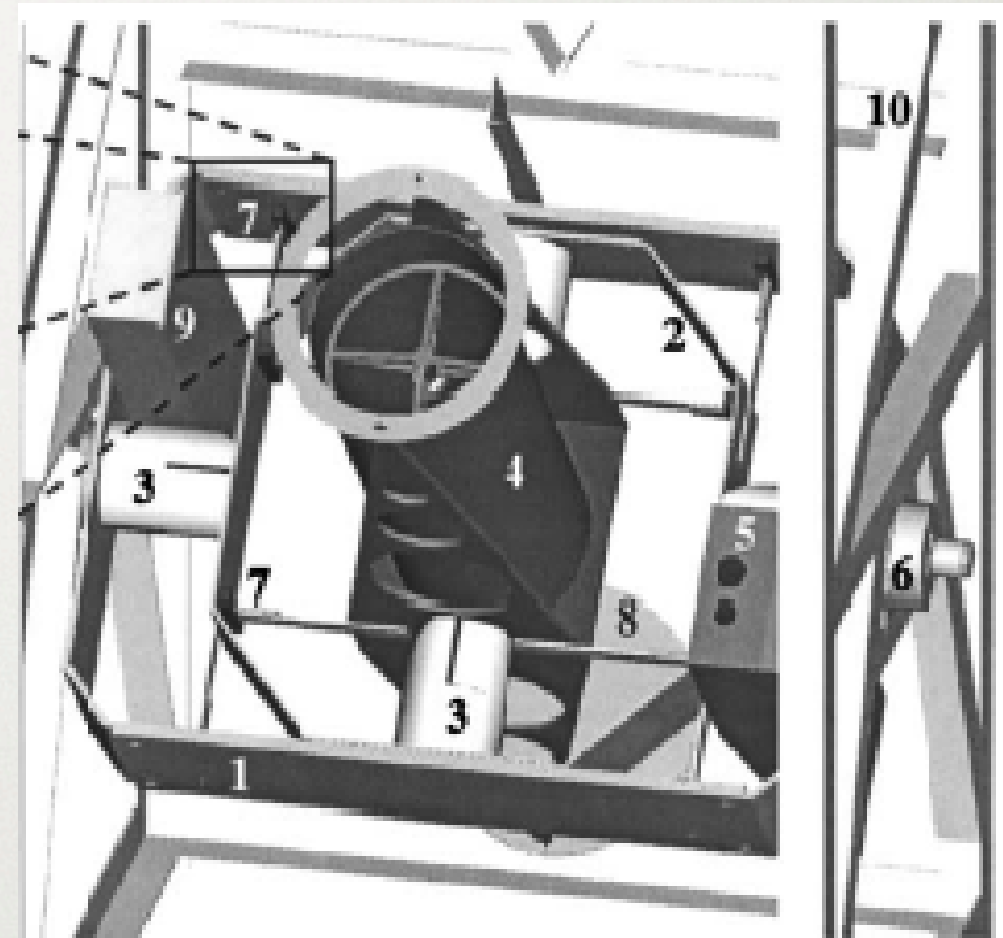


Pointing Platforms

2/3 axis frame, tip-tilt mirror, magnetically levitated bearings.



Planetscope concept



Solar Bolometric Imager
Bernasconi et al., Adv. Sp. Res. 2004

The Planetscope Precursor package will occupy the bottom 0.5x2x2 m³ volume of the Solar Bolometric gondola (Pietro Bernasconi, PI), and will incorporate a Mars-prototype anemometer from Ball Aerospace (Dissly, mgr.) and Cornell Univ. (Don Banfield, PI).

discussion