Subaru Telescope
An Introduction

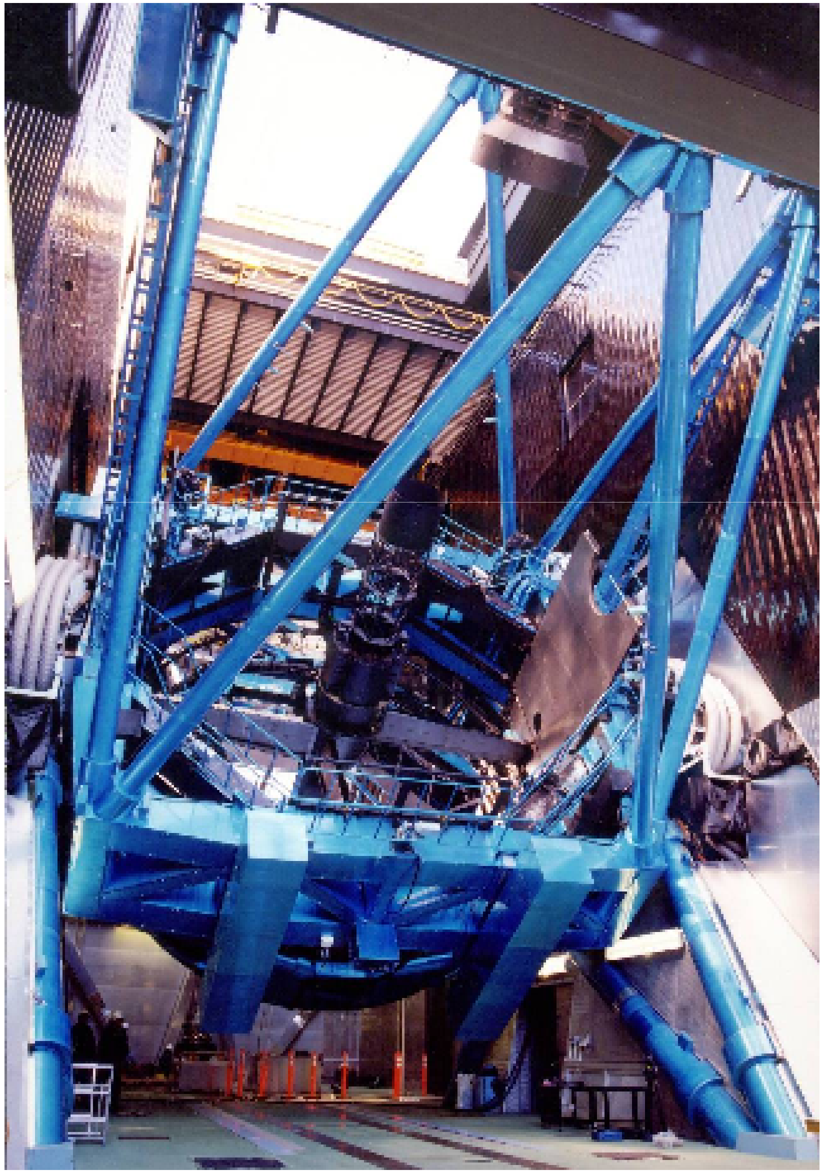
Masa Hayashi

(Subaru Telescope/NAOJ)

Joint Subaru-Gemini Conference

Kyoto, May 18, 2009

Overview



Construction
1991–1999 (9 years)

Total Budget
US$ 395 M (@ JYE/USD=100)

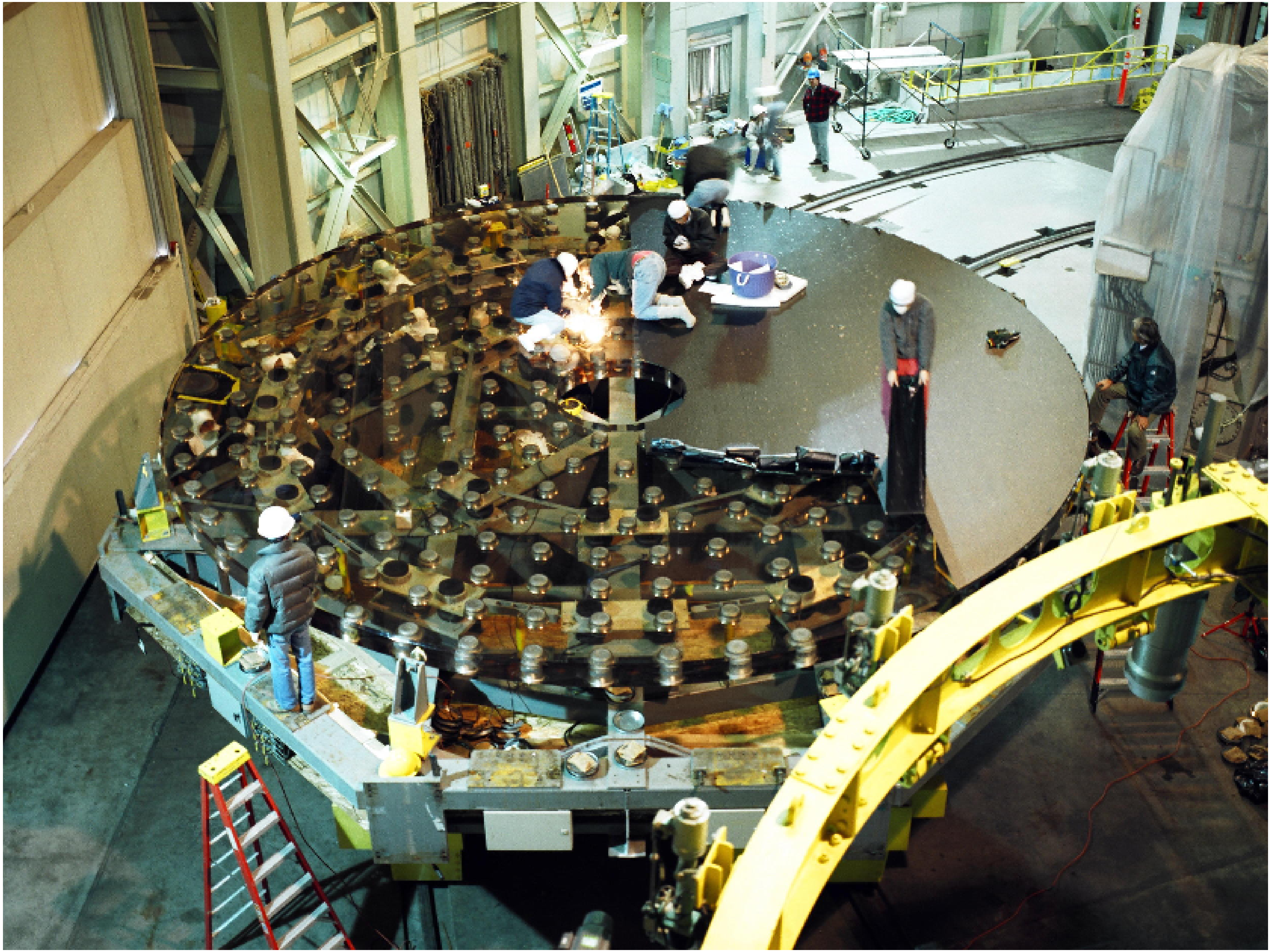
First Light
January 28, 1999

Open to Users
December 2000

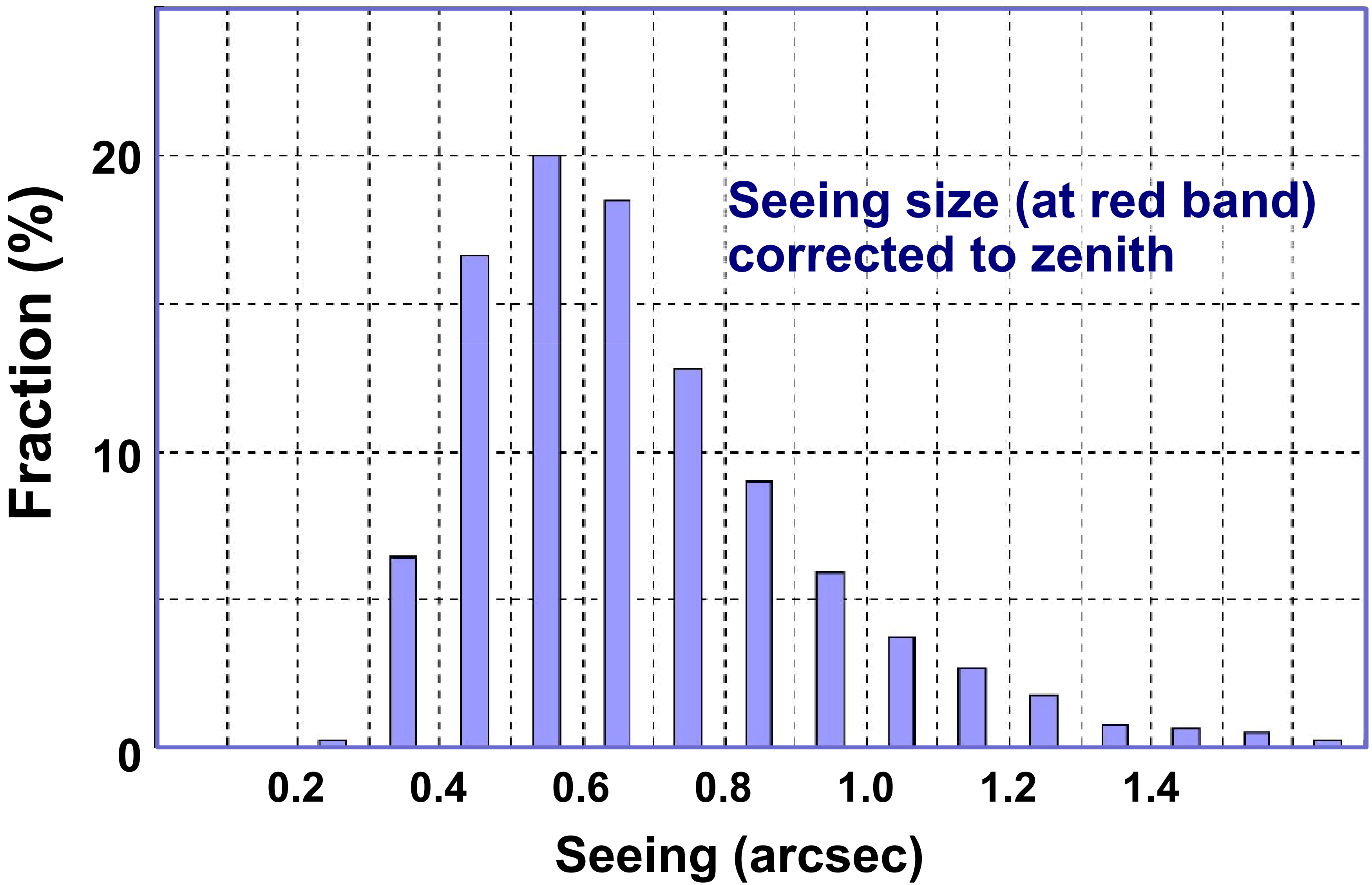
Mirror Diameter
8.2 m (effective)

Wavelength
0.36 μm – 25 μm

Seeing
0.6″ (average at R)



Seeing



Seeing size (at red band)
corrected to zenith
Fraction (%)
20
10
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Seeing (arcsec)

Instruments

IRCS (AO188)
Infrared imager and spectrograph ($\lambda/\Delta\lambda$=20,000)

HiCIAO (AO188)
Coronagraphic imager with differential imaging capabilities

AO188
188-element curvature sensing adaptive optics system with a laser guide star capability

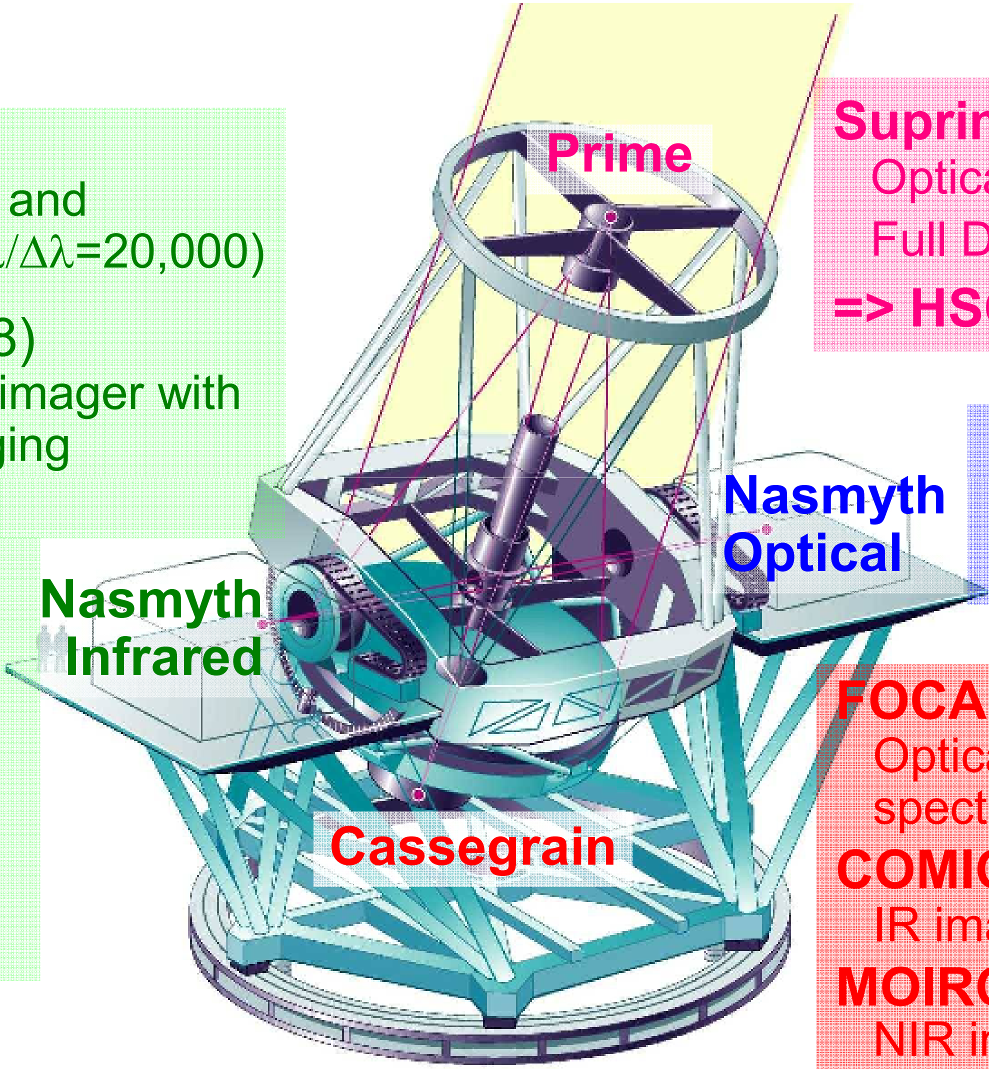


Illustration by Takaetsu Endo,
taken from Nikkei Science 1996

Suprime-Cam
Optical imager (34′×27′)
Full Depletion CCDs
=> HSC, WFMOS

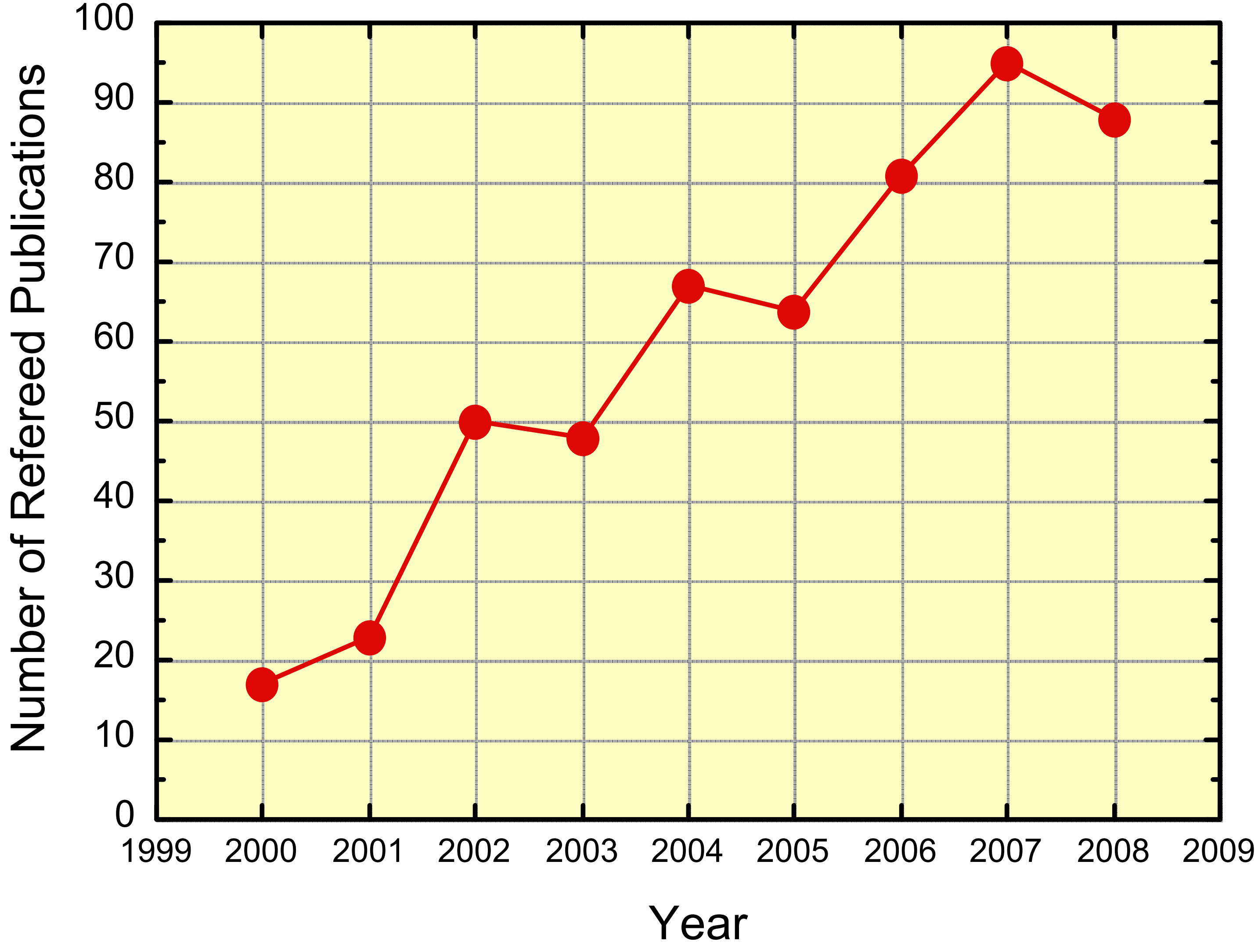
HDS
Optical spectrograph ($\lambda/\Delta\lambda$=100,000)

FOCAS
Optical imager and spectrograph

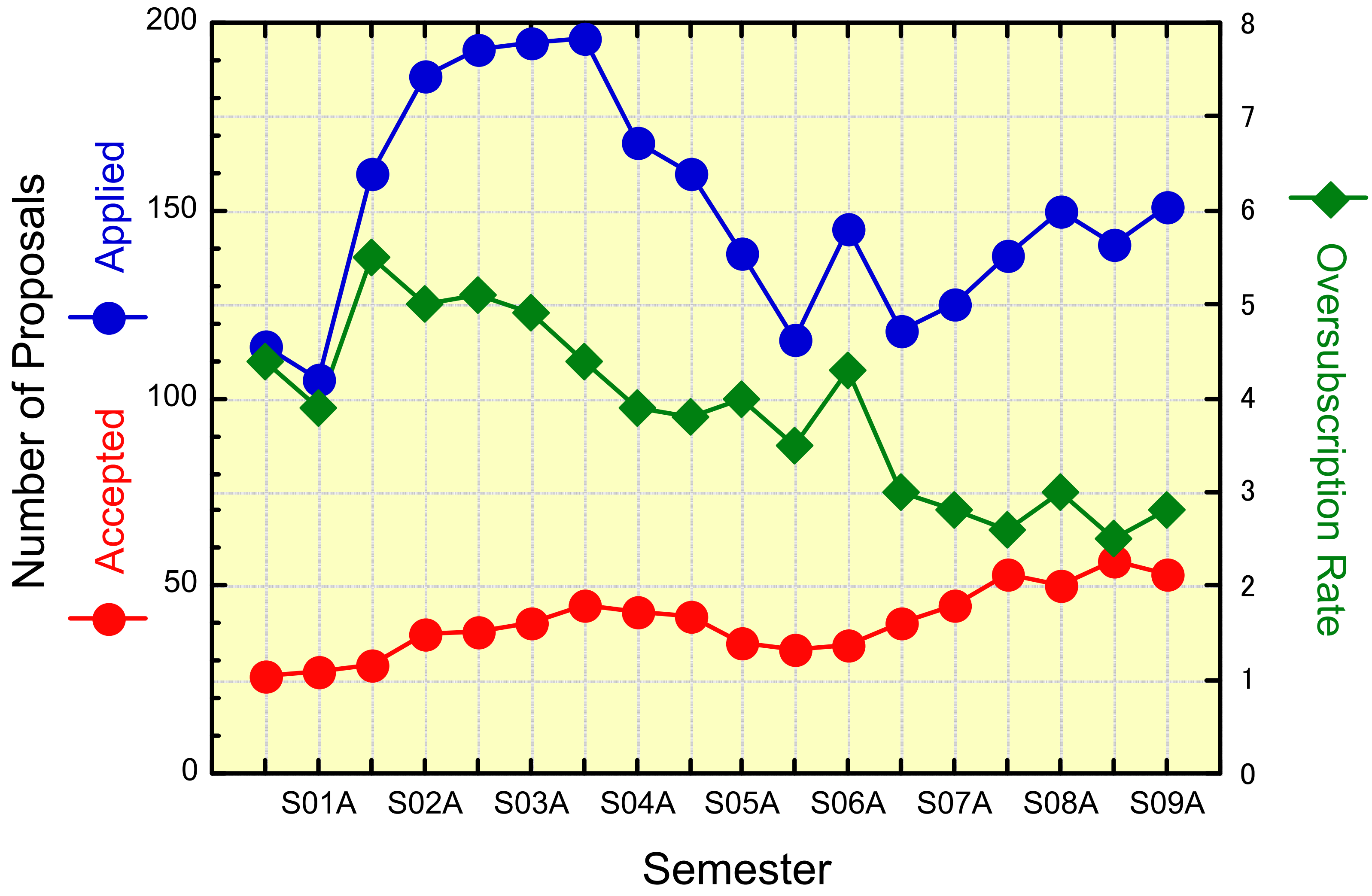
COMICS
IR imager and spectrograph

MOIRCS
NIR imager (7′×4′) &multi-object (50) spectrograph

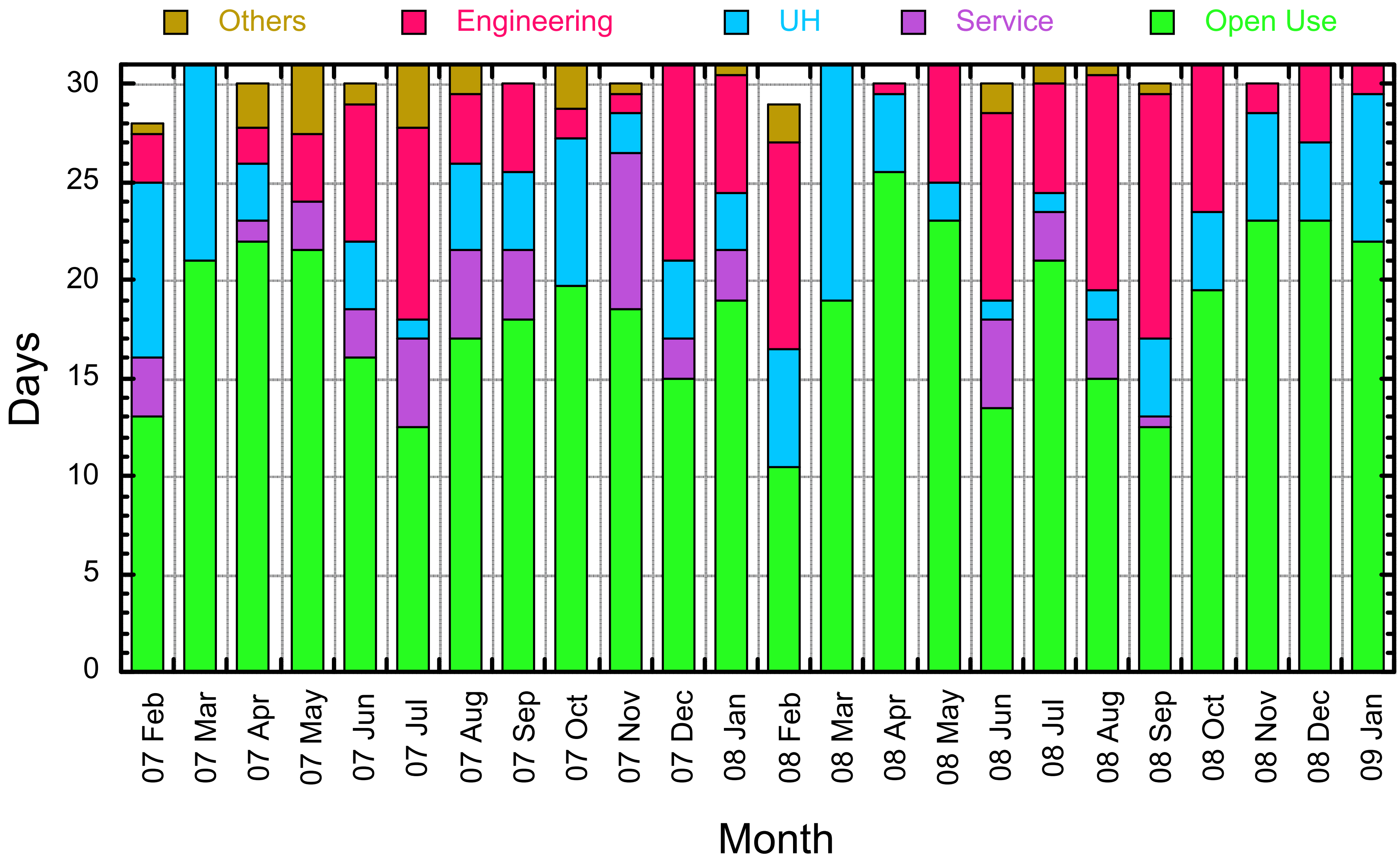
Publications



Proposal Statistics

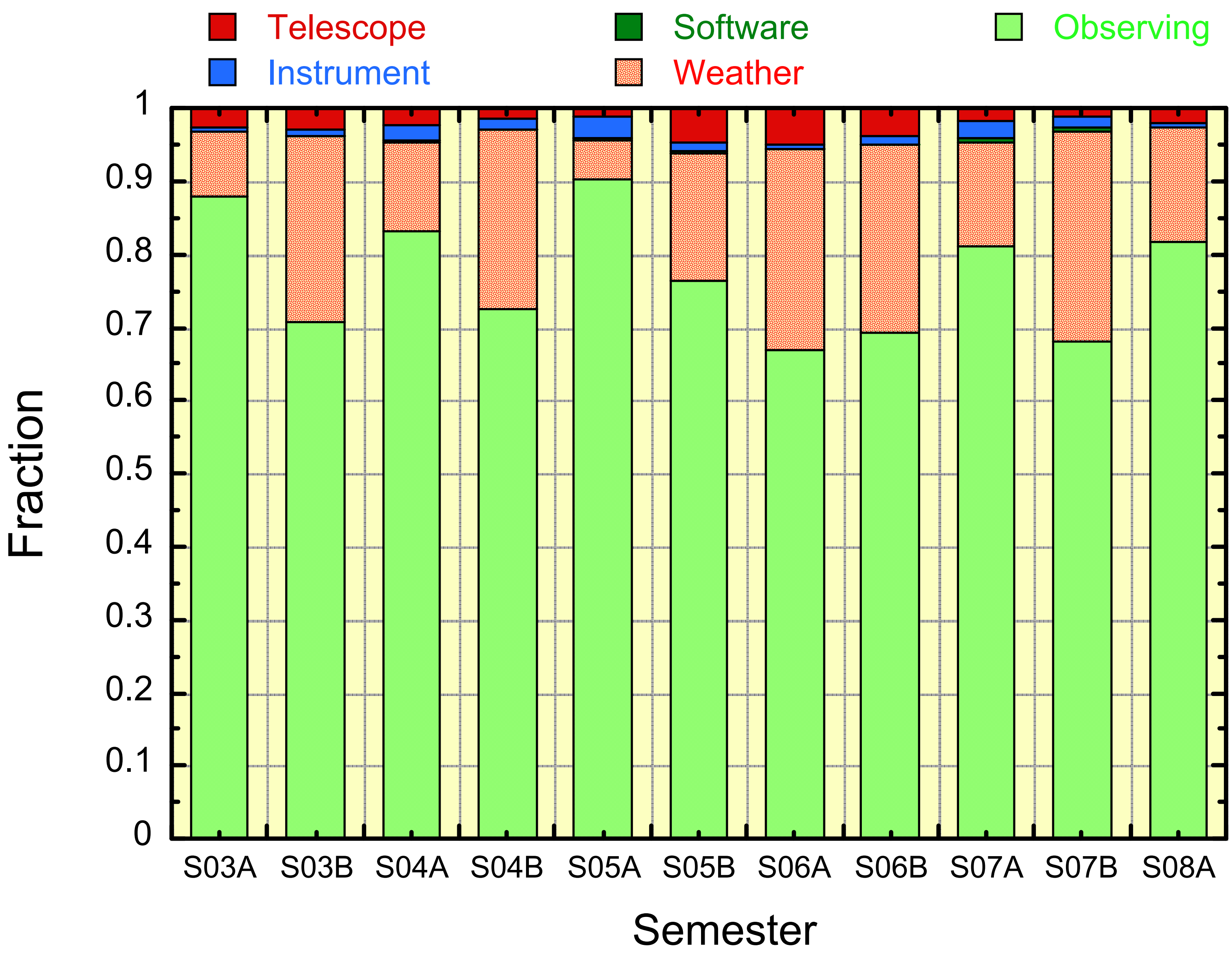


Telescope Time Usage

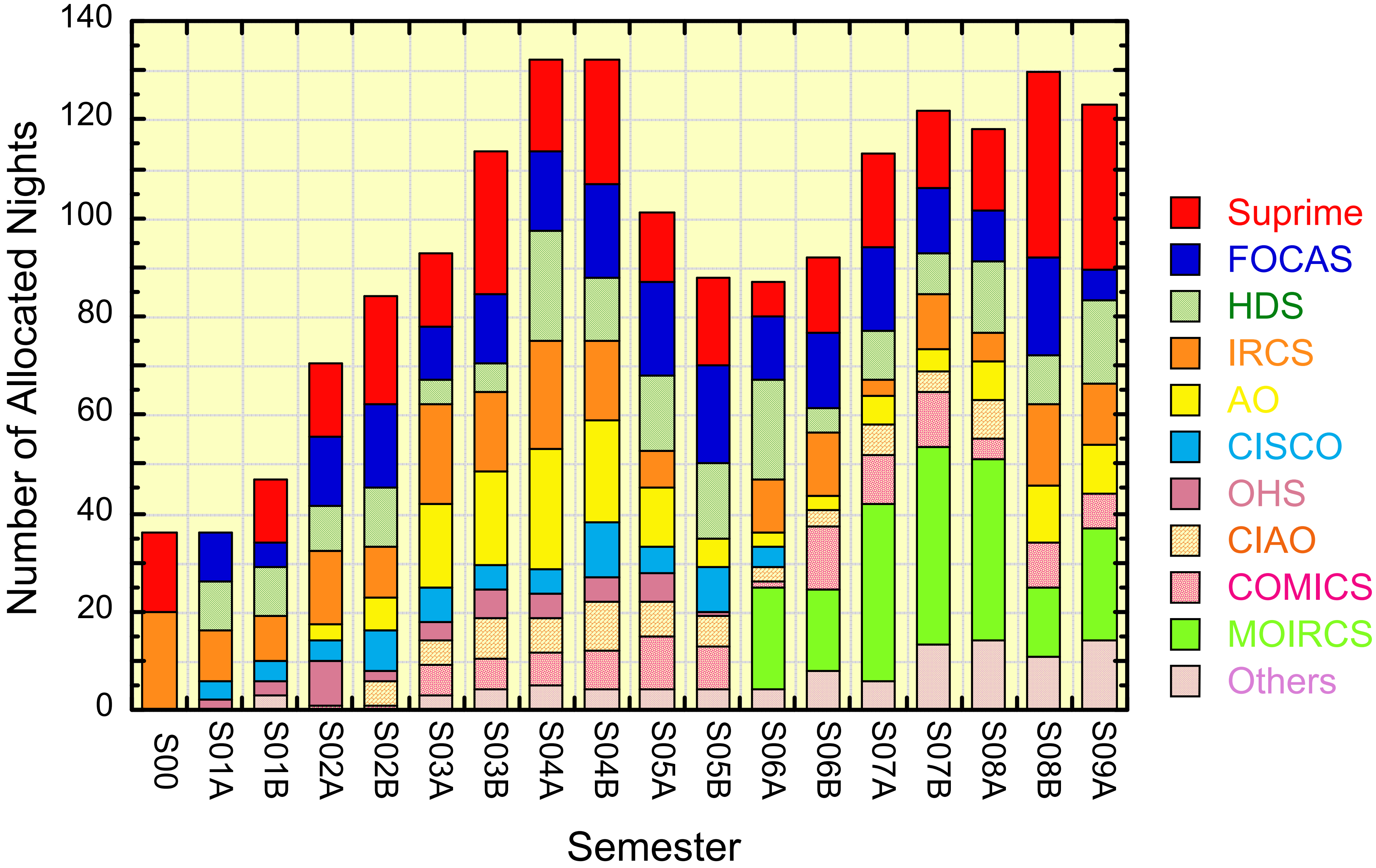


(Including time exchange programs with Gemini & Keck)

Downtime Statistics

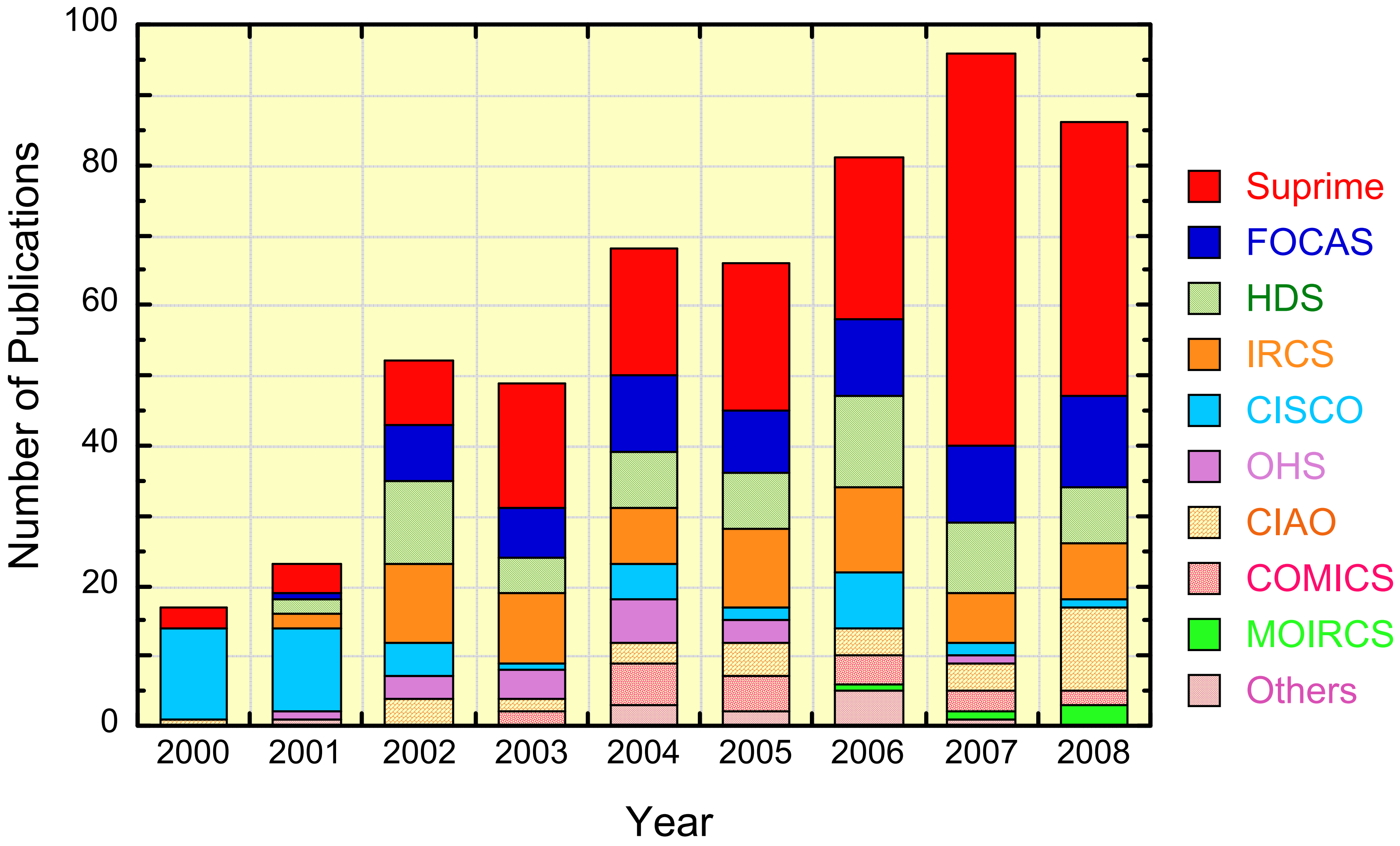


Instrument Usage



(Service observations are not included. AO nights are counted redundantly.)

Publications by Instruments



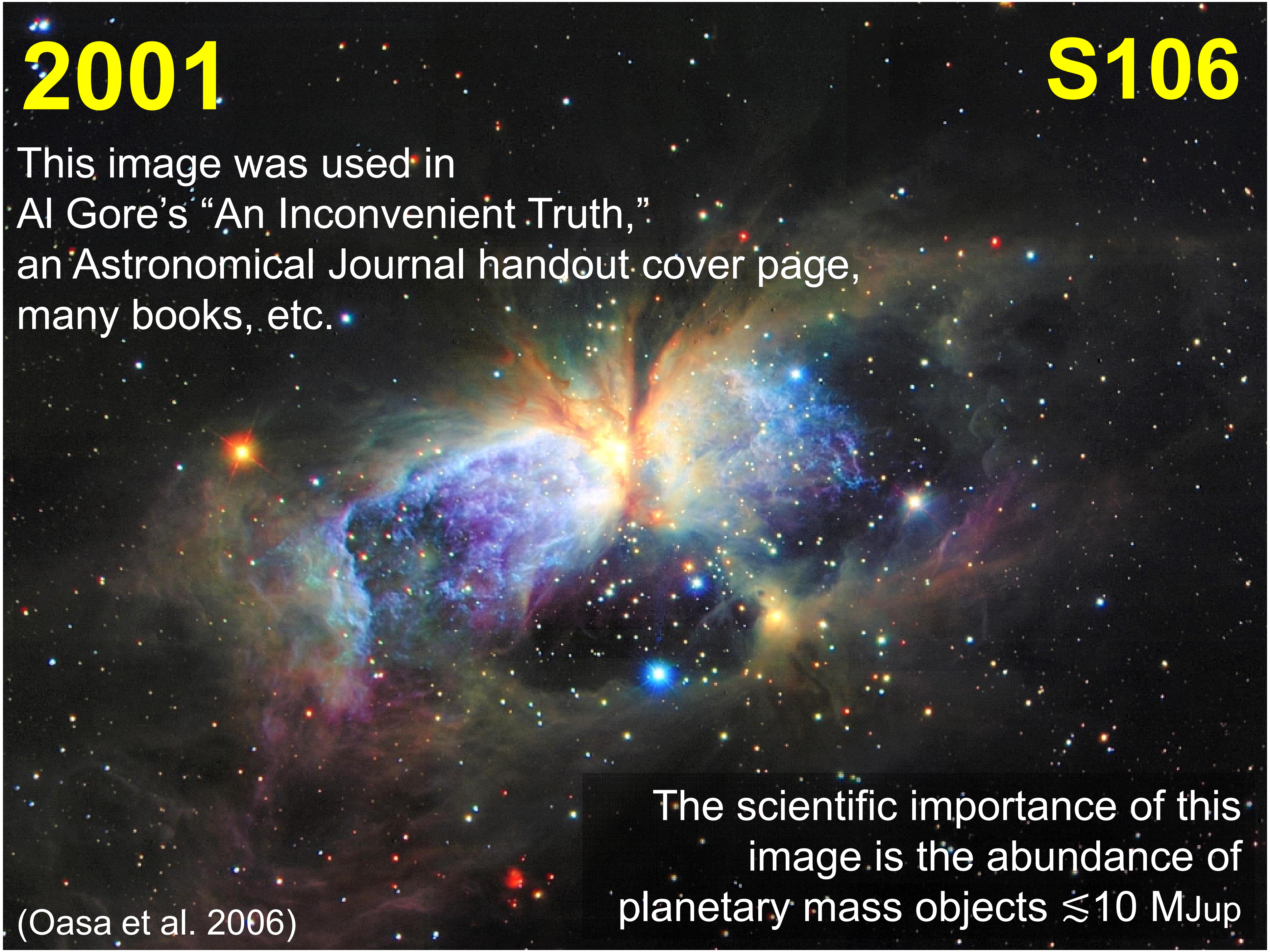
The Past 10 Years of Subaru Telescope

1999 – First Light

2000

Open-Use

began


2001
S106
This image was used in
Al Gore's "An Inconvenient Truth,"
an Astronomical Journal handout cover page,
many books, etc.
The scientific importance of this
image is the abundance of
planetary mass objects ≲10 MJup
(Oasa et al. 2006)

Planetary Mass Objects

Planetary mass objects, either free-floating or bound to other stars, are crucial to understand “exoplanets,” now that direct detection of planetary mass companions is possible.

What is their formation mechanism?

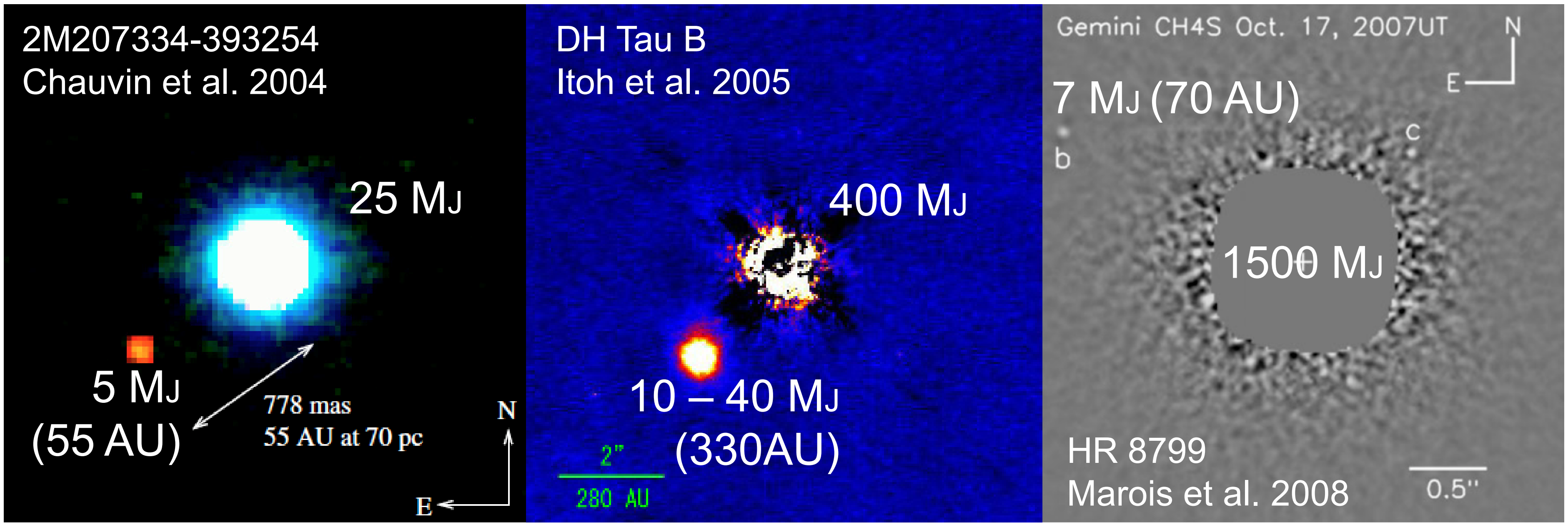
Fragmentation of molecular cloud cores.

(~10 Jupiter mass corresponds to an opacity limited fragmentation size)

Gravitational instabilities of circumstellar disks.

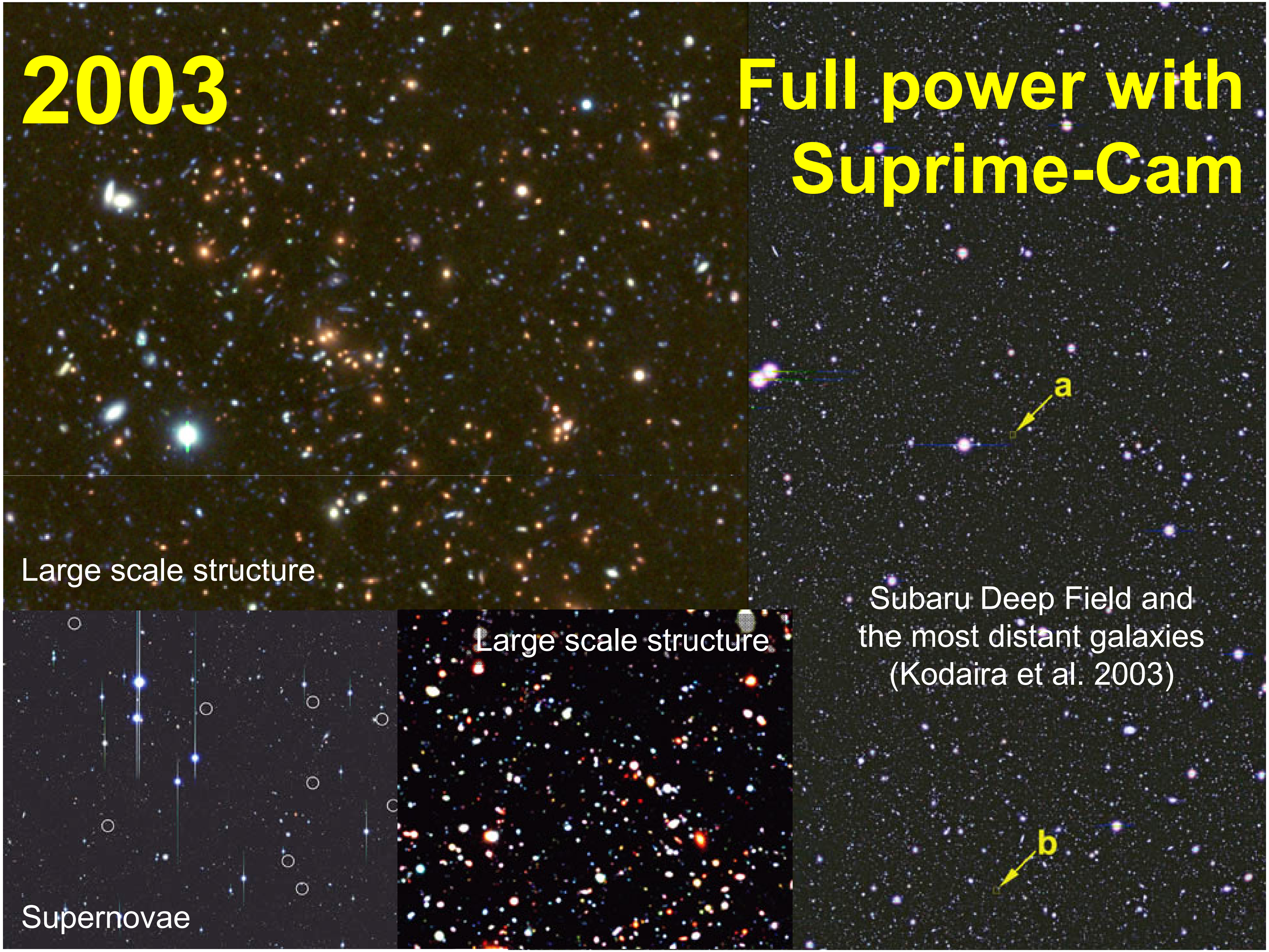
Gas accretion by rocky cores. (expelled “real” planets?)

Relation to the “brown dwarf desert”

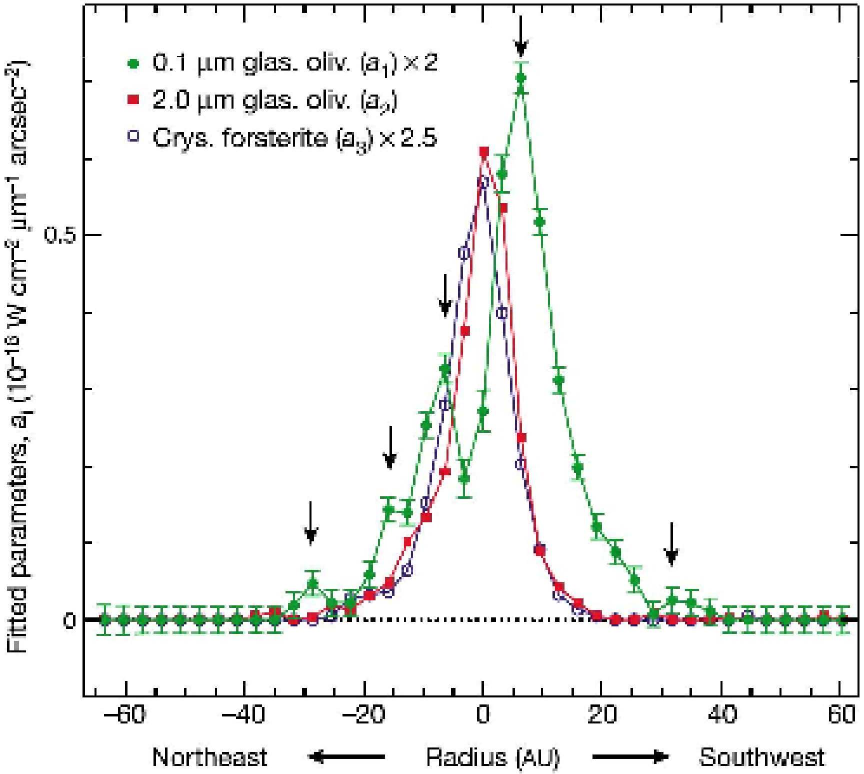


2002

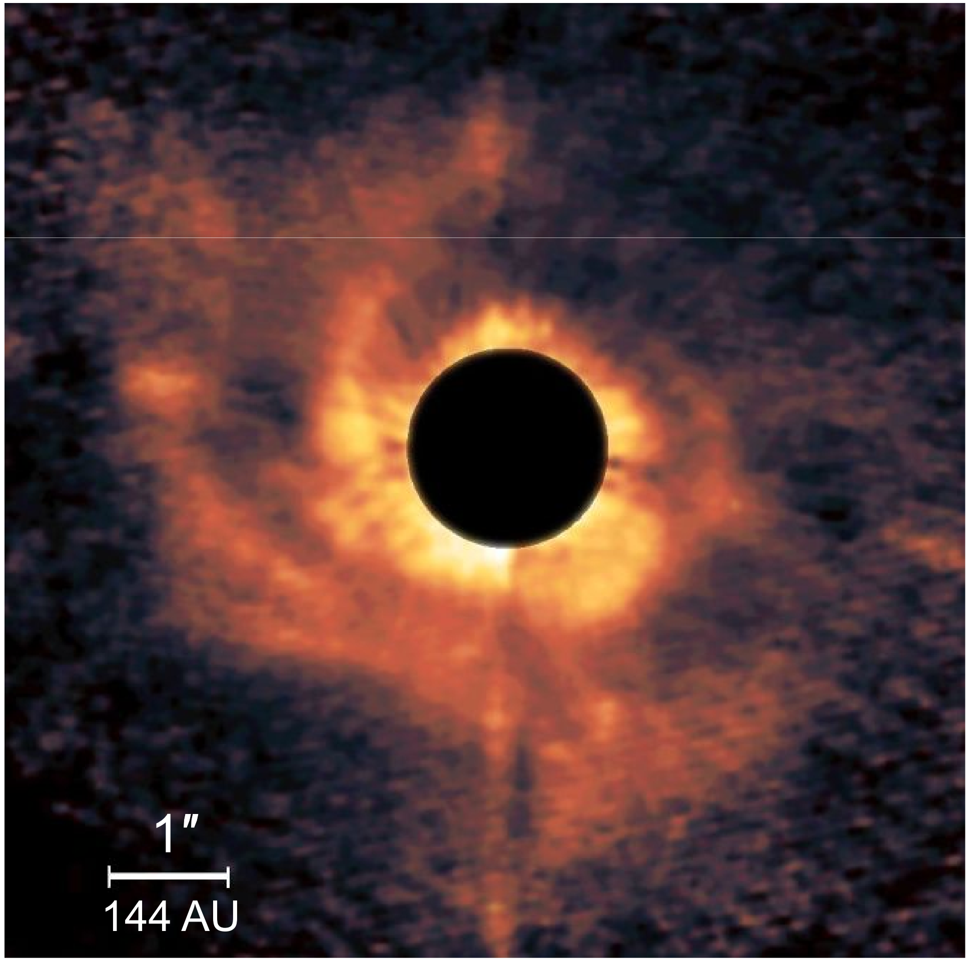
All first-generation instruments commissioned

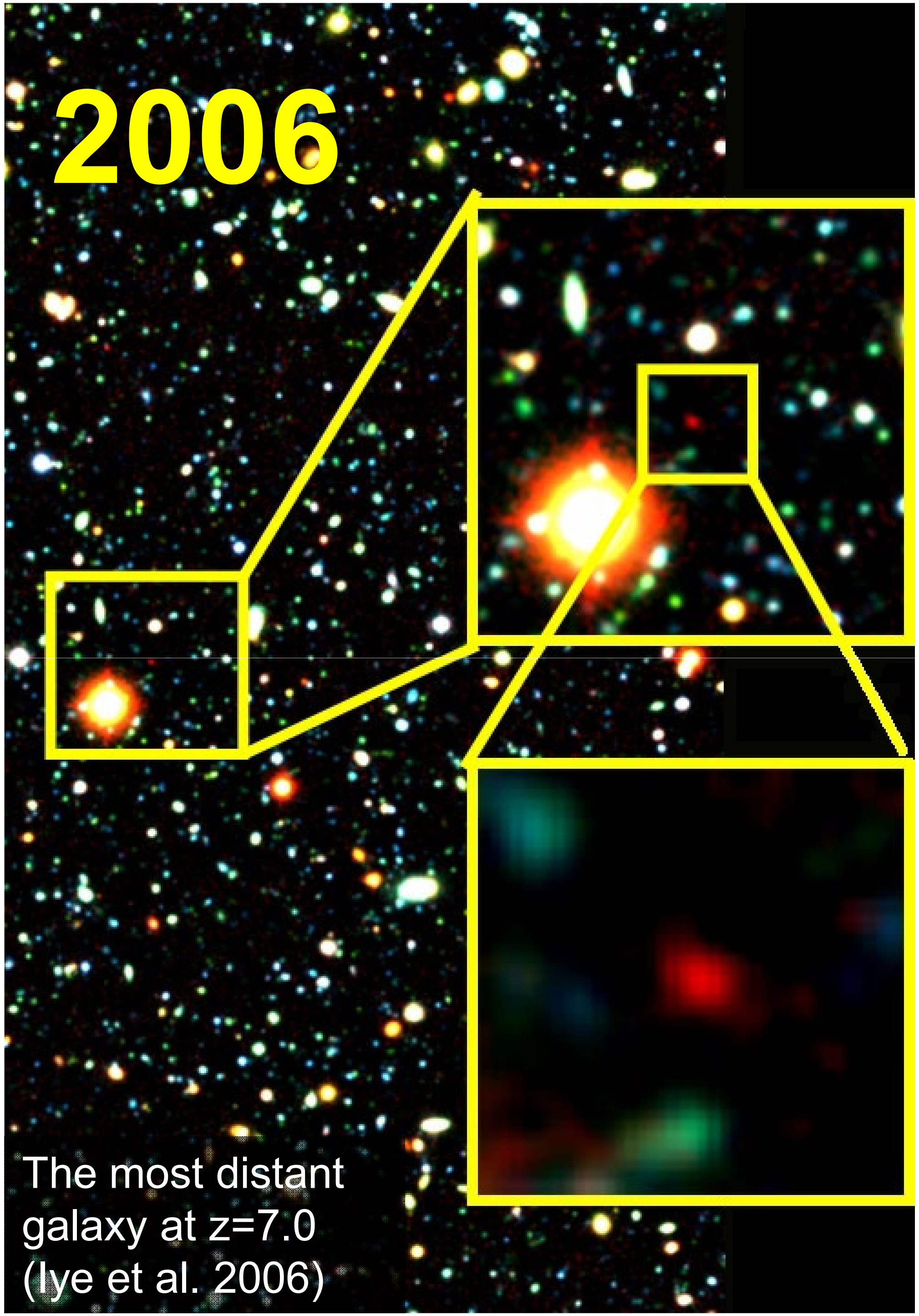

2003
Full power with
Suprime-Cam
Large scale structure
a
Subaru Deep Field and
the most distant galaxies
(Kodaira et al. 2003)
Large scale structure
b
Supernovae

Evidence of planetesimal belts around β Pic (Okamoto et al. 2004)

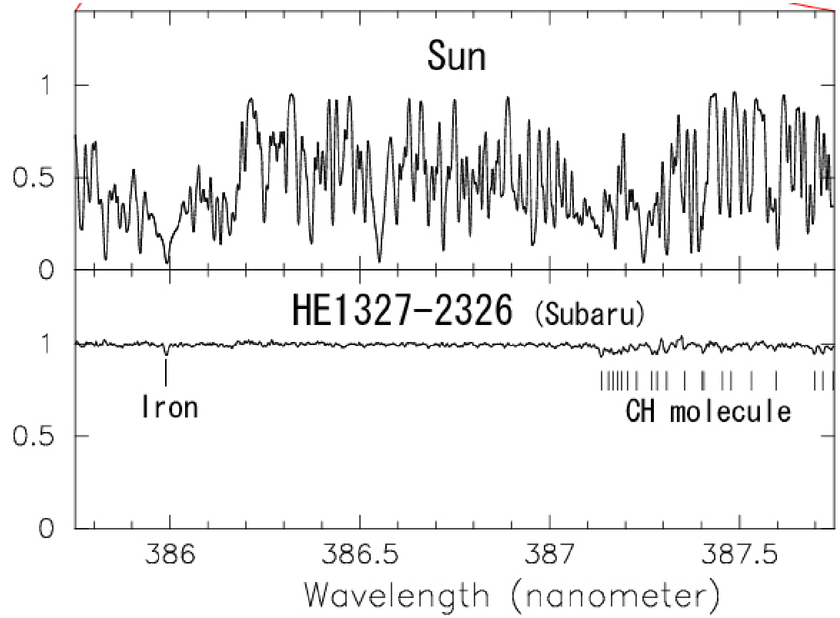


Spiral arms in the protoplanetary disk around AB Aur (Fukagawa et al. 2004)

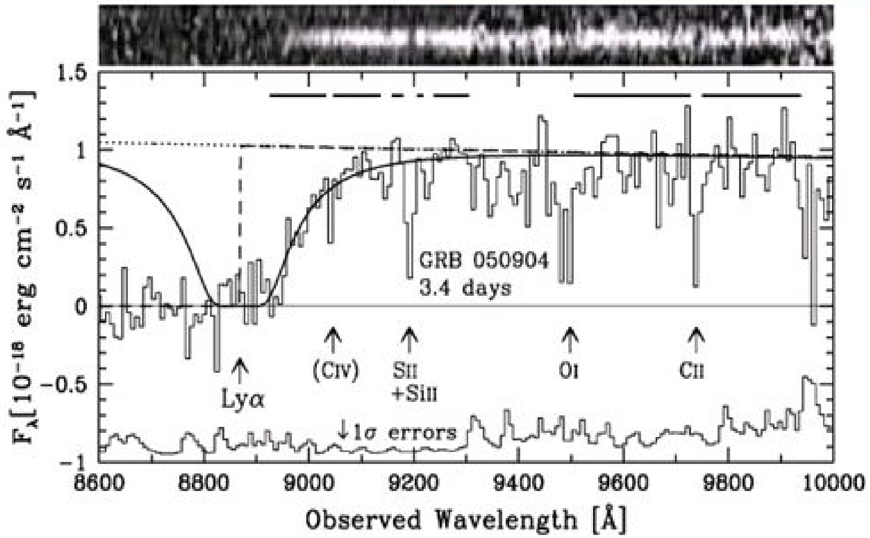




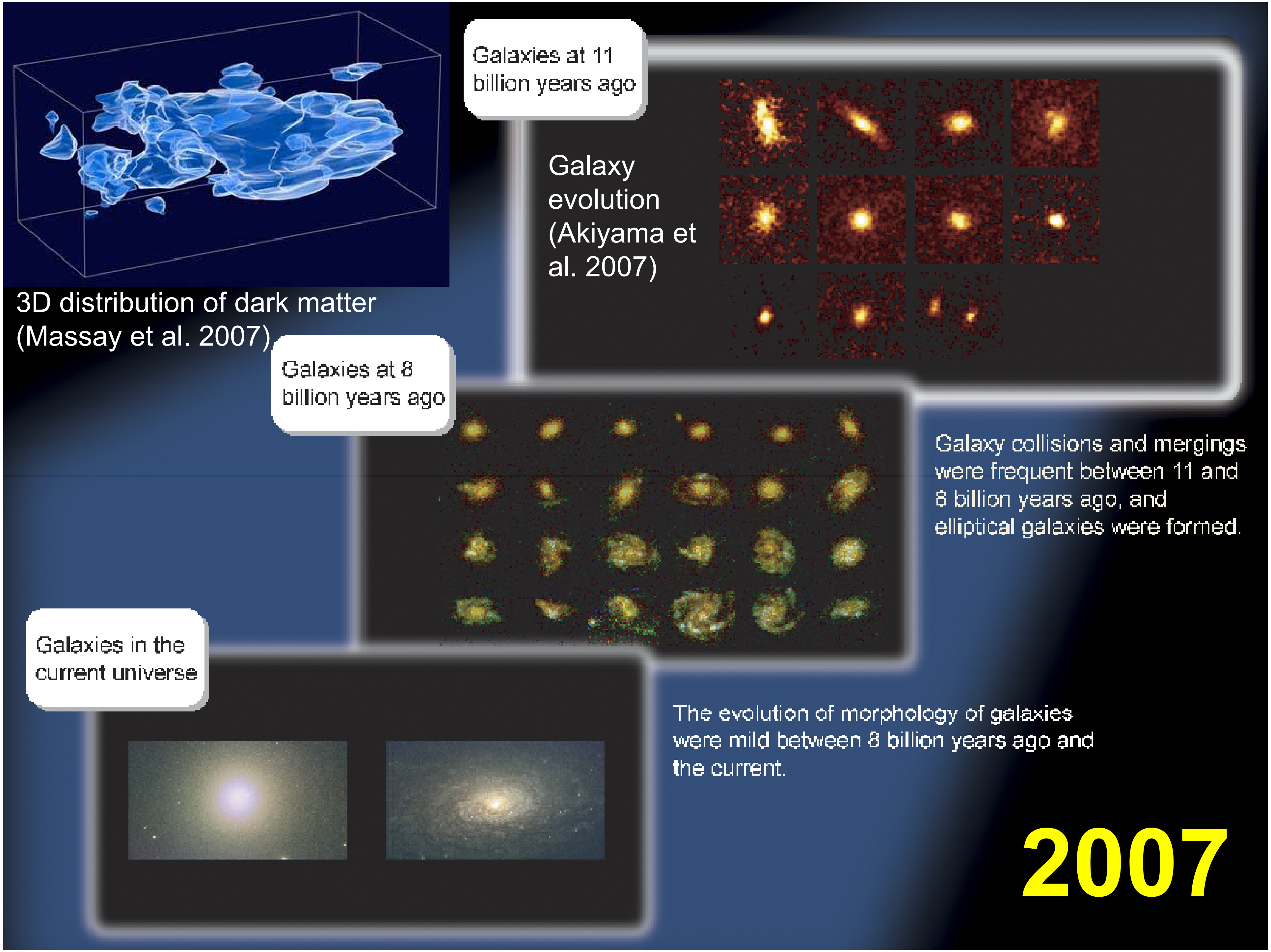
The most distant galaxy at z=7.0 (Iye et al. 2006)



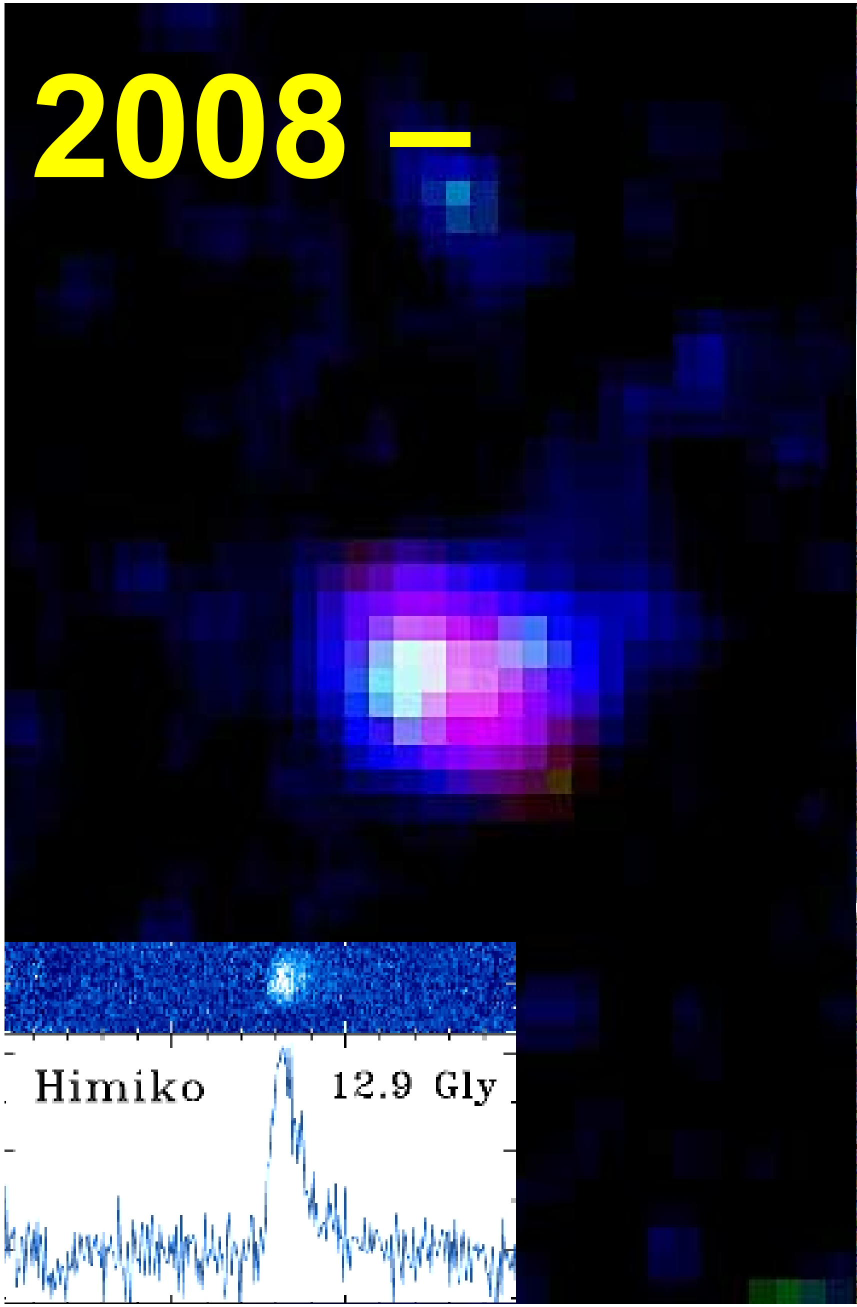
The most metal deficient star (Frebel et al. 2005; Aoki et al. 2006)



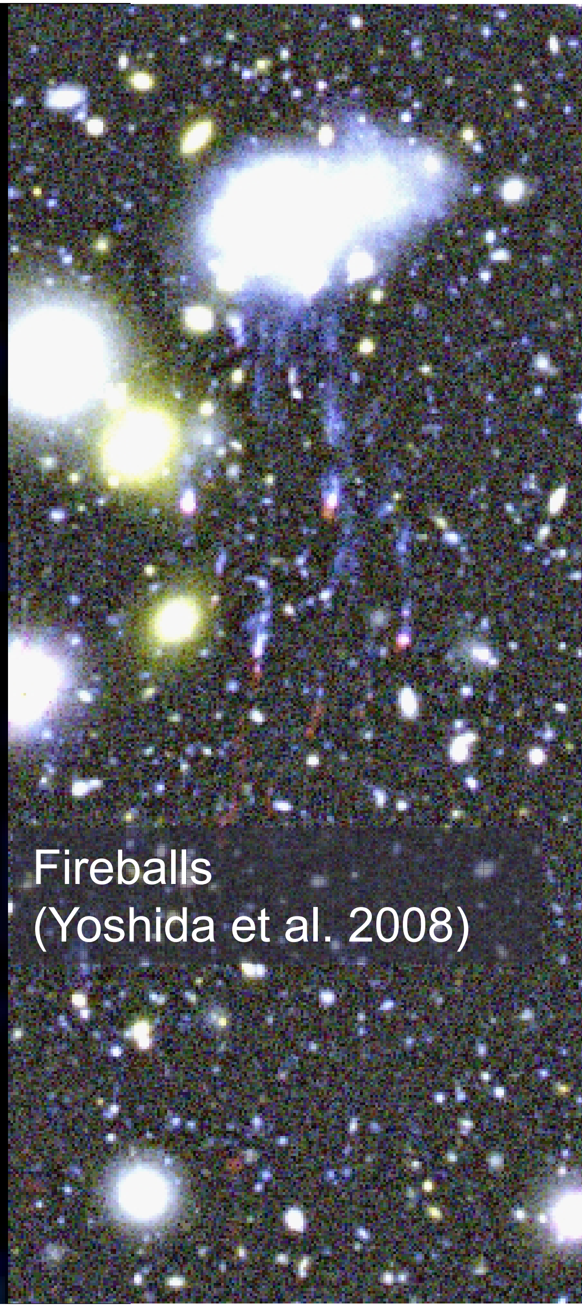
The most distant gamma-ray burst at z=6.3 (Kawai et al. 2006)


Galaxies at 11
billion years ago
Galaxy
evolution
(Akiyama et
al. 2007)
3D distribution of dark matter
(Massay et al. 2007)
Galaxies at 8
billion years ago
Galaxy collisions and mergings
were frequent between 11 and
8 billion years ago, and
elliptical galaxies were formed.
Galaxies in the
current universe
The evolution of morphology of galaxies
were mild between 8 billion years ago and
the current.
2007

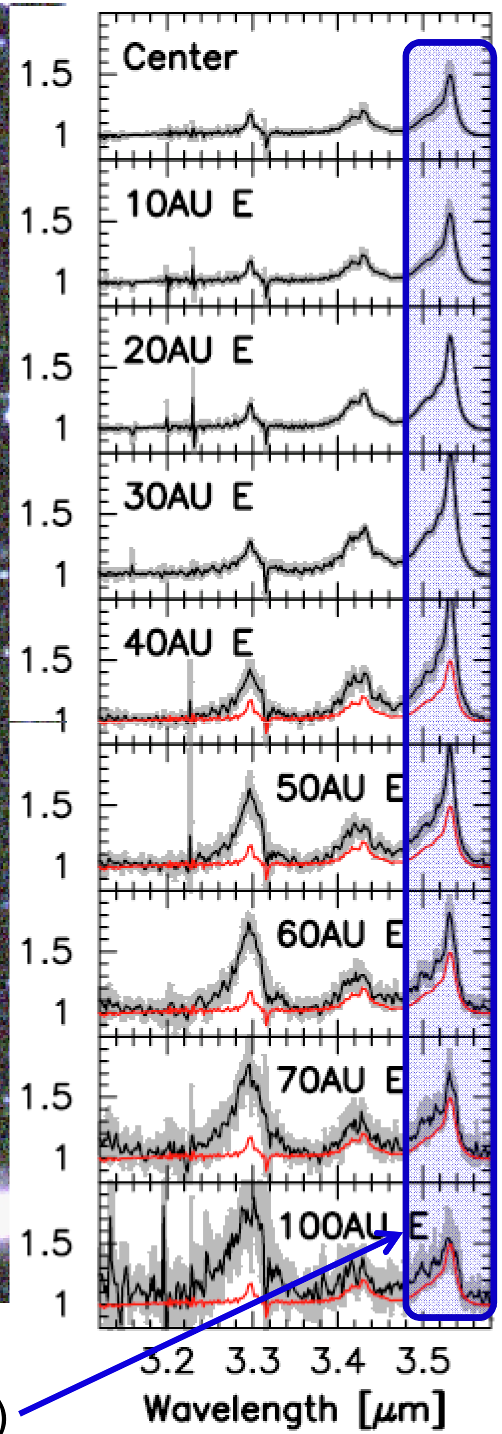
2008 –



Himiko, the most distant Lyα blob
(Ouchi et al. 2009)



Fireballs
(Yoshida et al. 2008)



Diamonds (Goto et al. 2008)