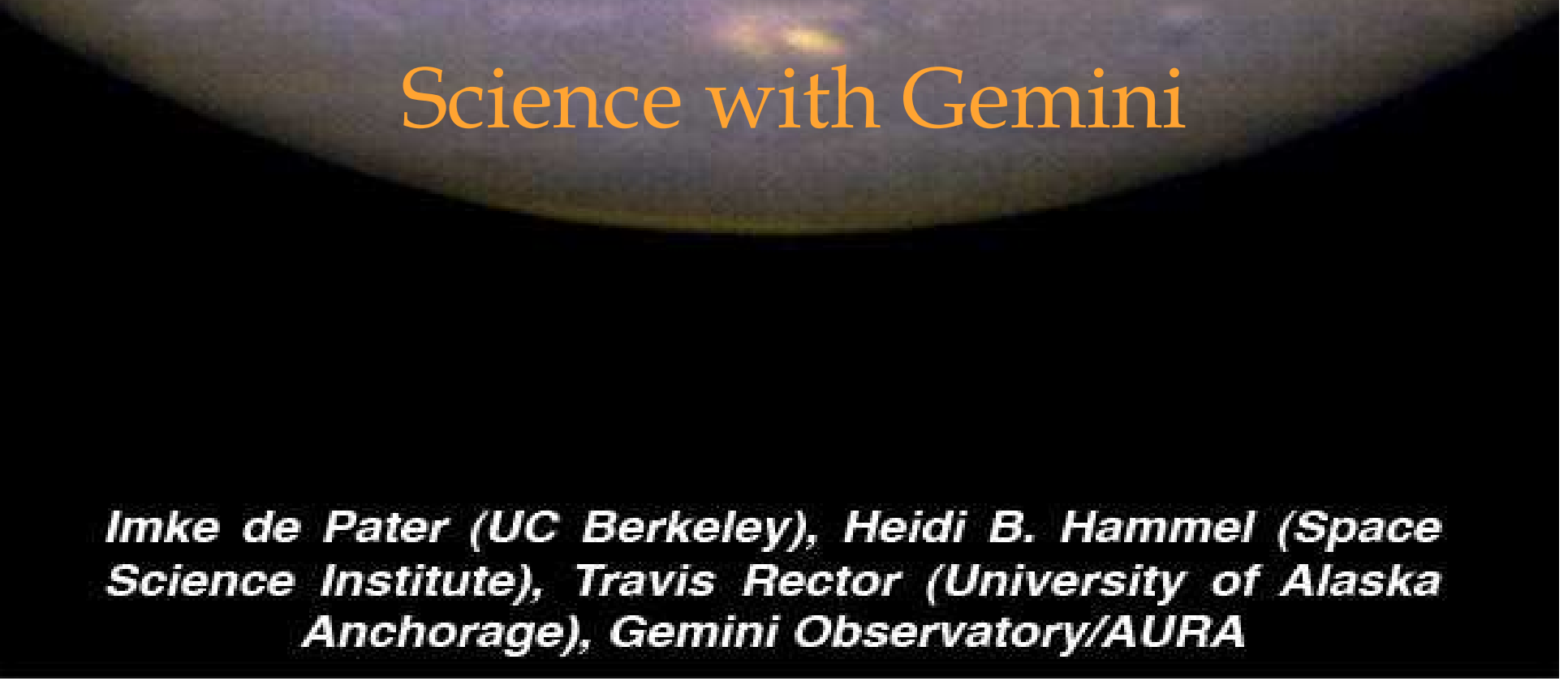
Science with Gemini



Imke de Pater (UC Berkeley), Heidi B. Hammel (Space Science Institute), Travis Rector (University of Alaska Anchorage), Gemini Observatory/AURA

Dennis Crabtree

Associate Director of Science Operations

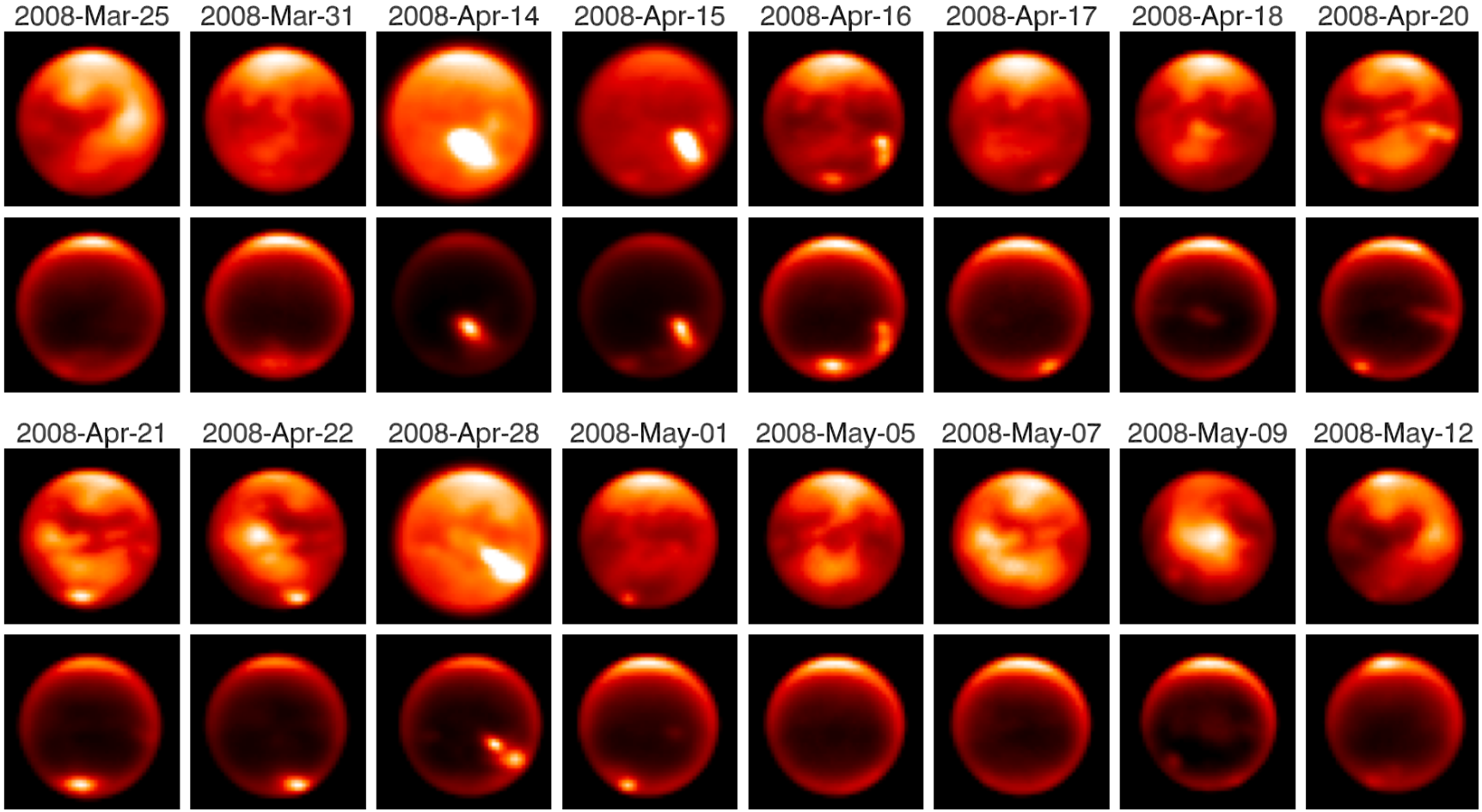
Campos do Jordao, March 2010

Outline

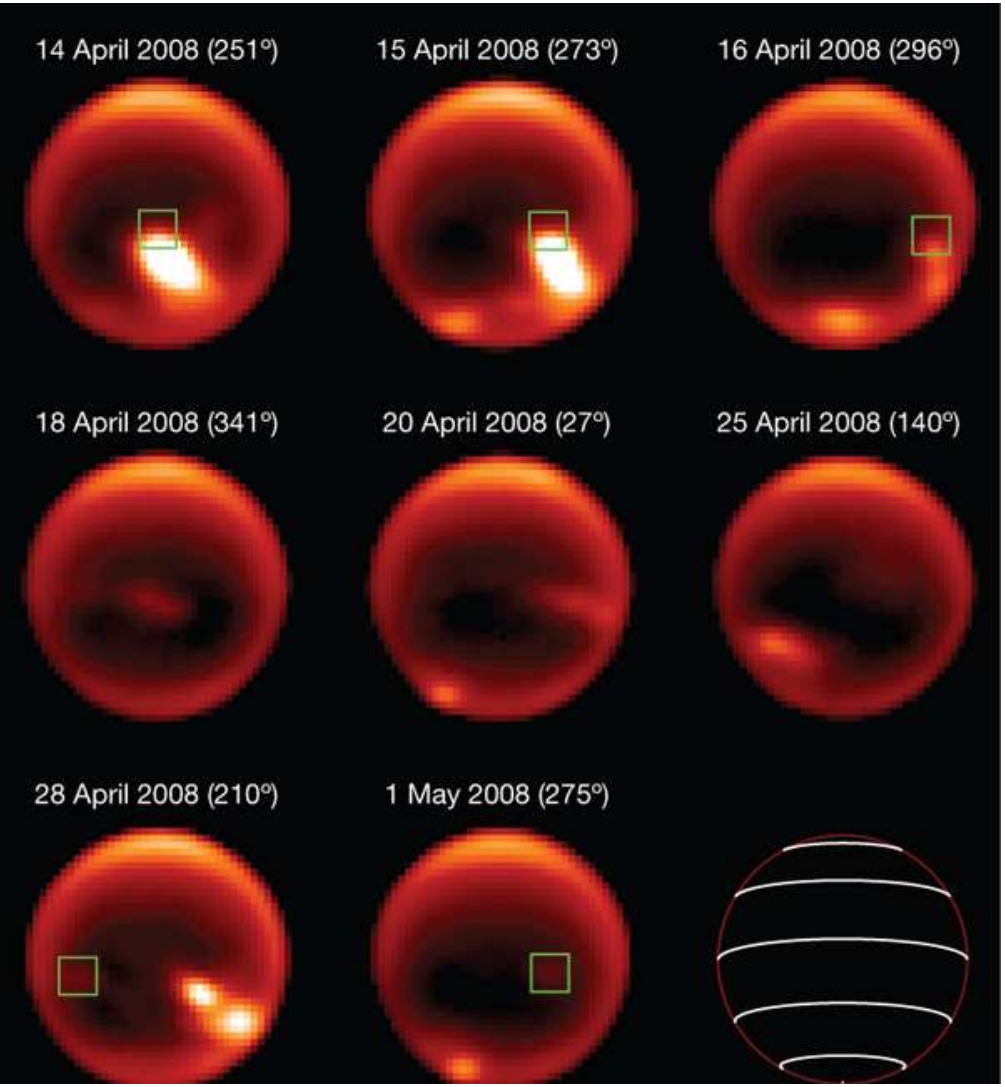
Gemini South: Cerro Pachón (2700m), Chile

Gemini North: Mauna Kea (4200m), Hawaii

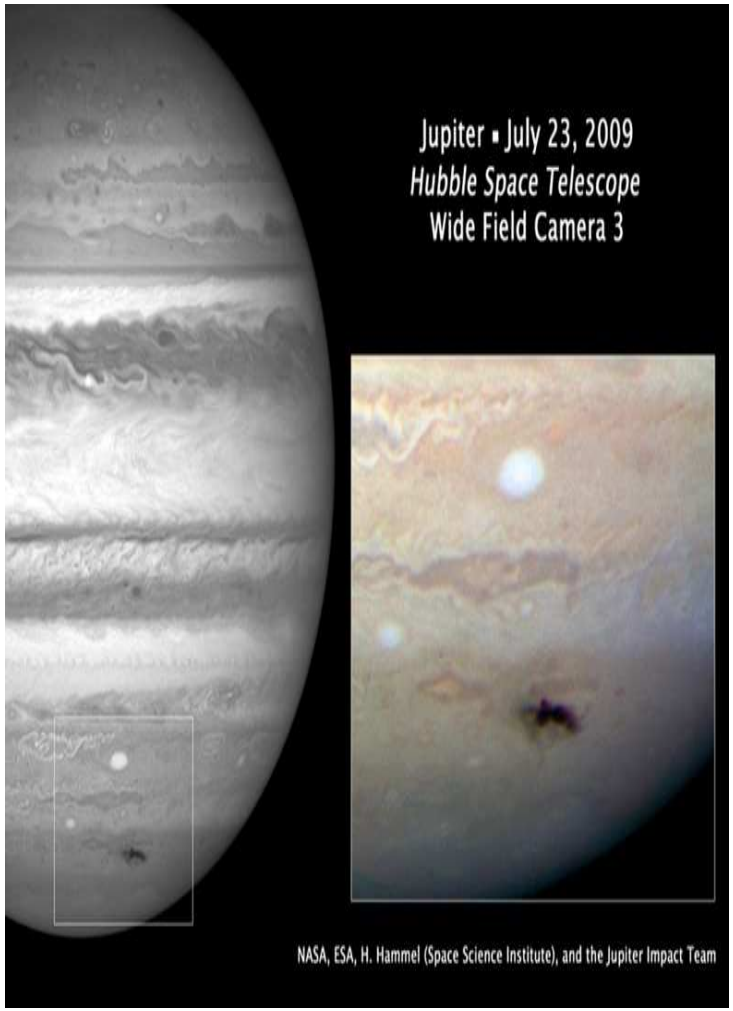
Monitoring weather on Titan



Monitoring weather on



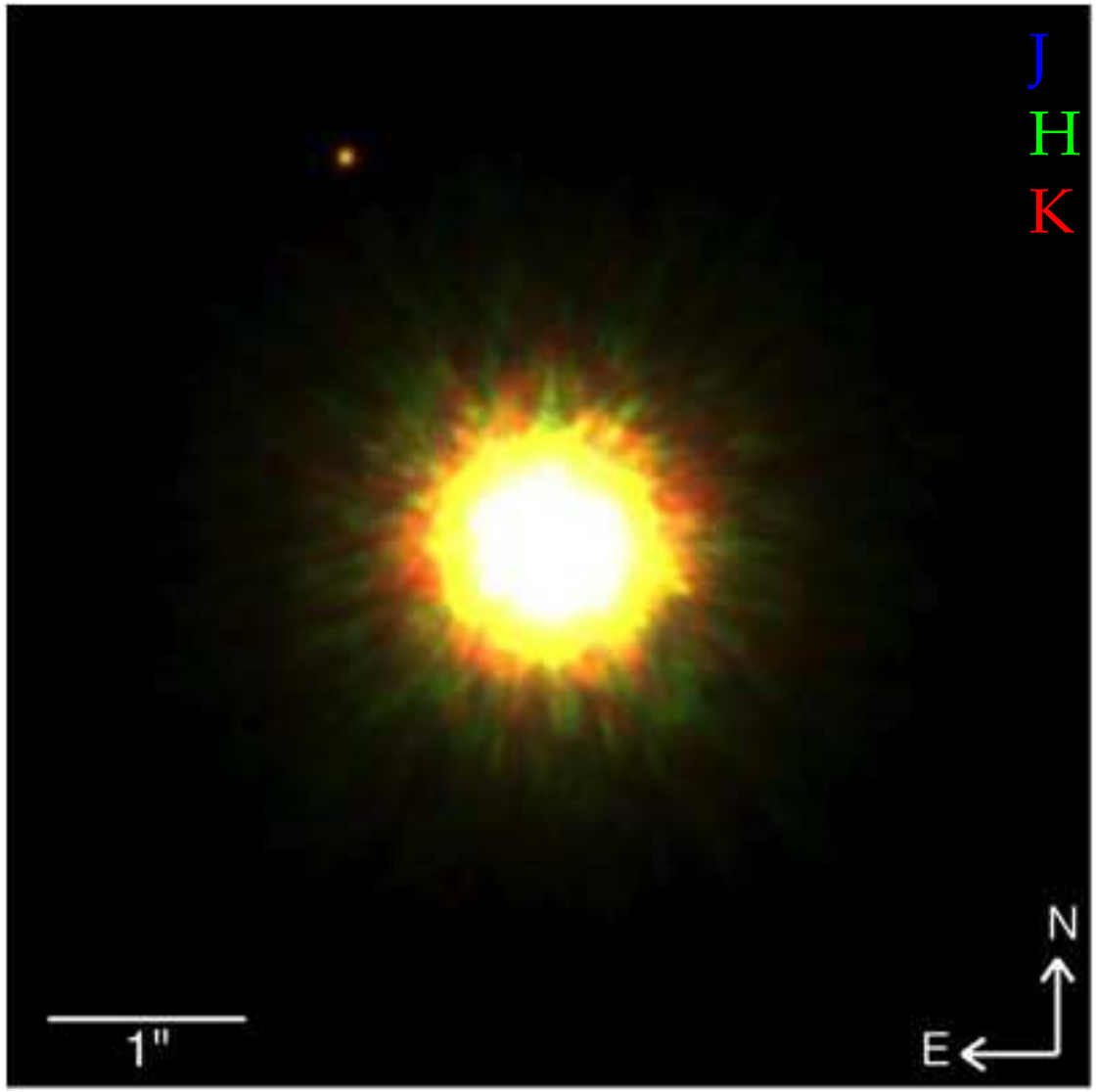
Crash on Jupiter



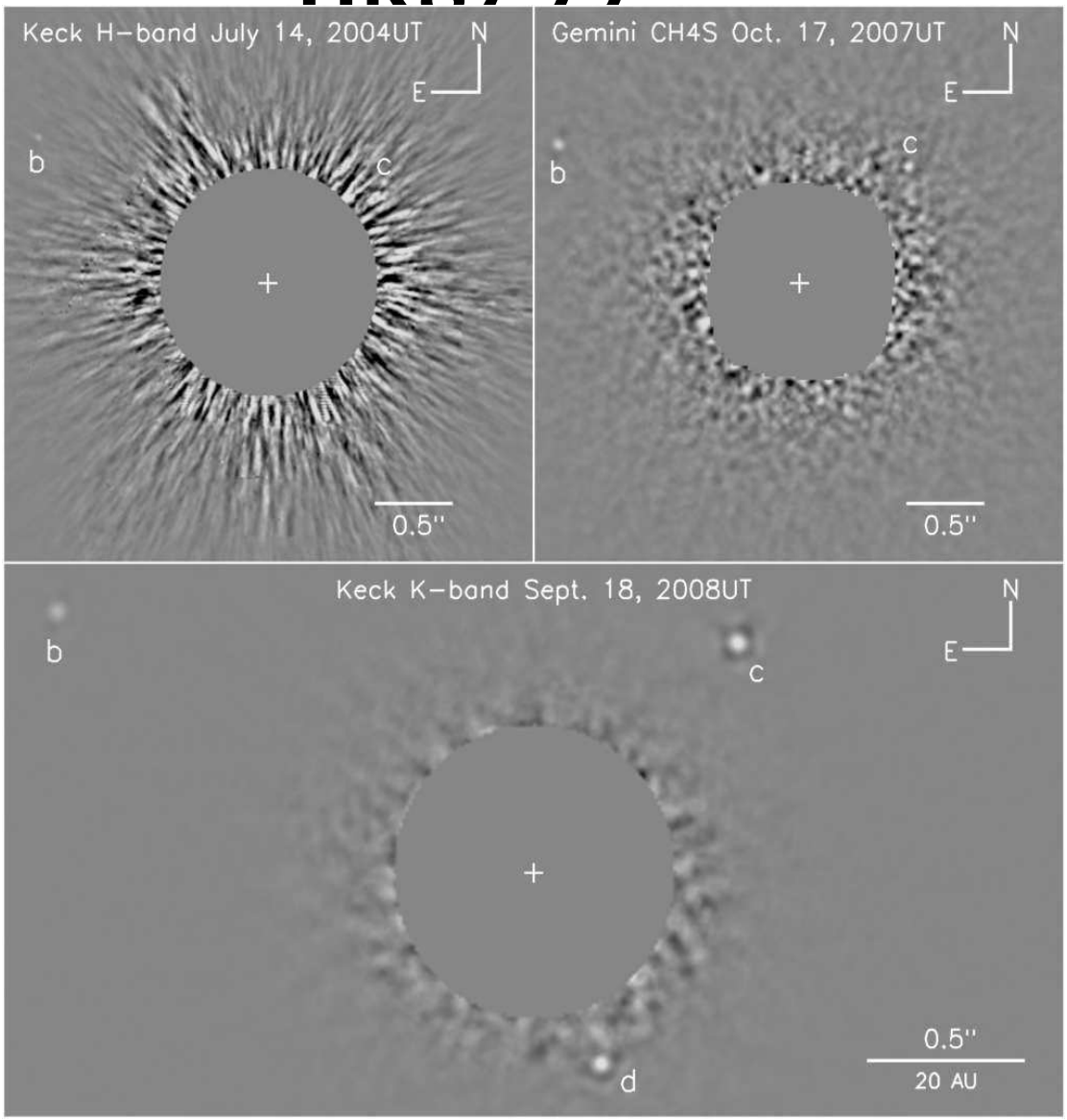
Crash on Jupiter

impact site

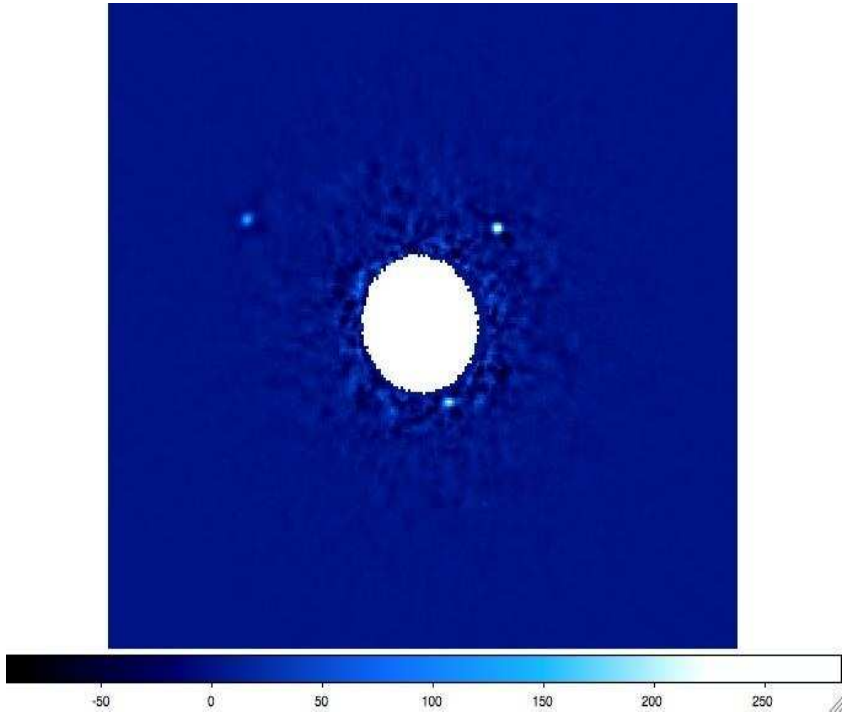
Direct images of planets



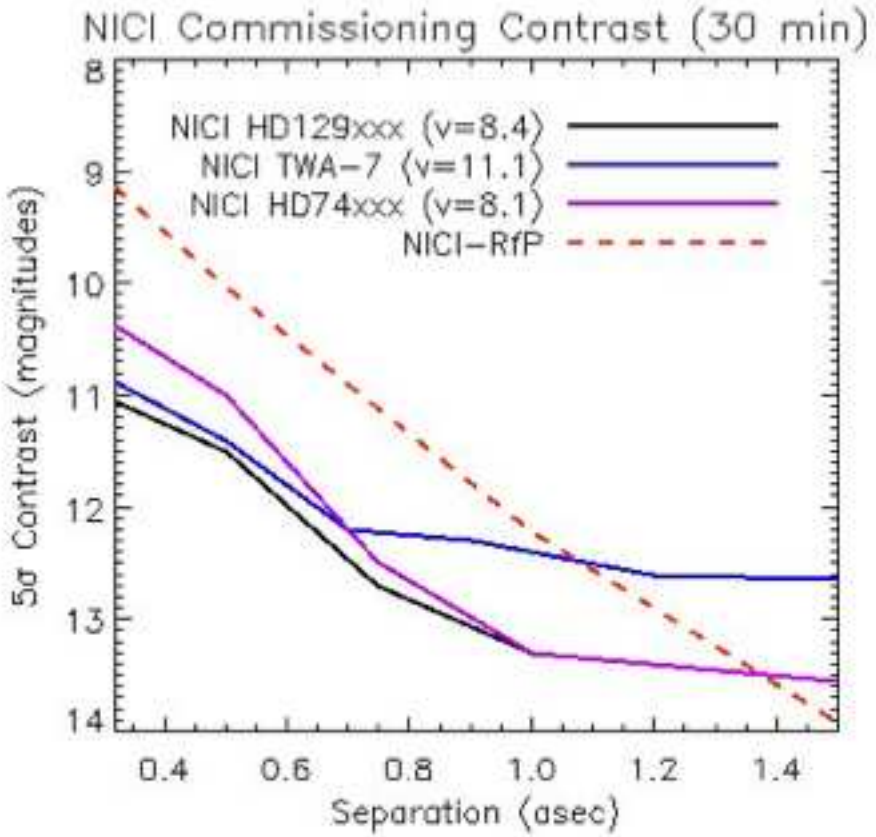
Three planets around HR8799

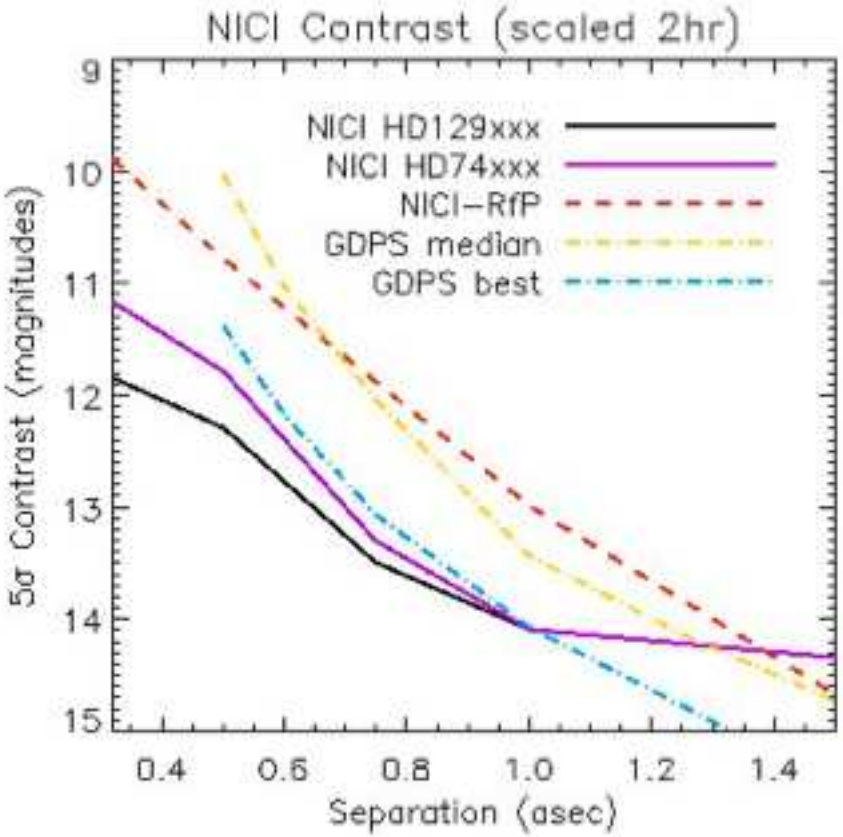


HR 8799: Gemini "reprocessed"



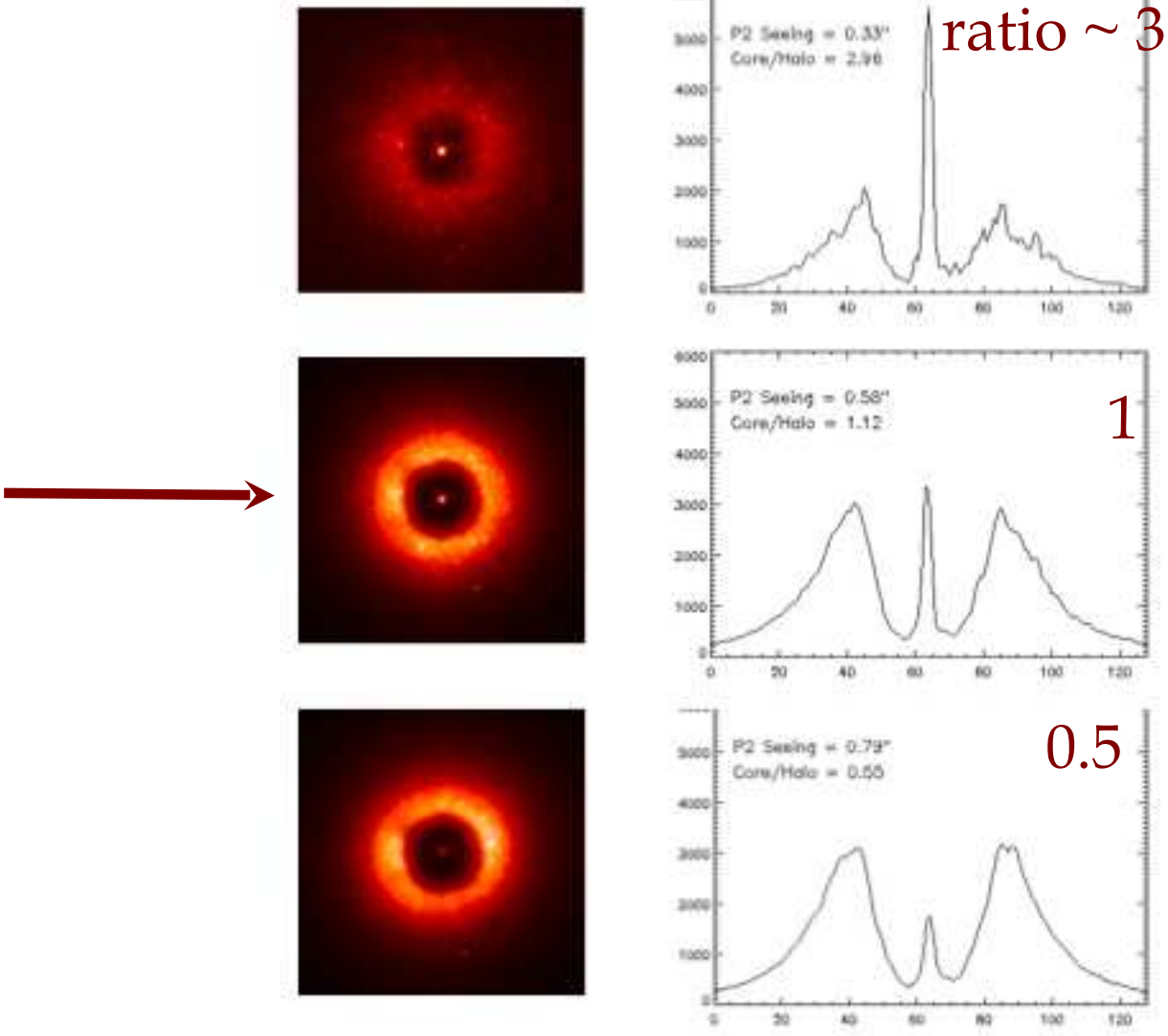
NICI


NICI Commissioning Contrast (30 min)
NICI HD129xxx (v=8.4)
NICI TWA-7 (v=11.1)
NICI HD74xxx (v=8.1)
NICI-RfP
5σ Contrast (magnitudes)
Separation (asec)
8
9
10
11
12
13
14
0.4
0.6
0.8
1.0
1.2
1.4

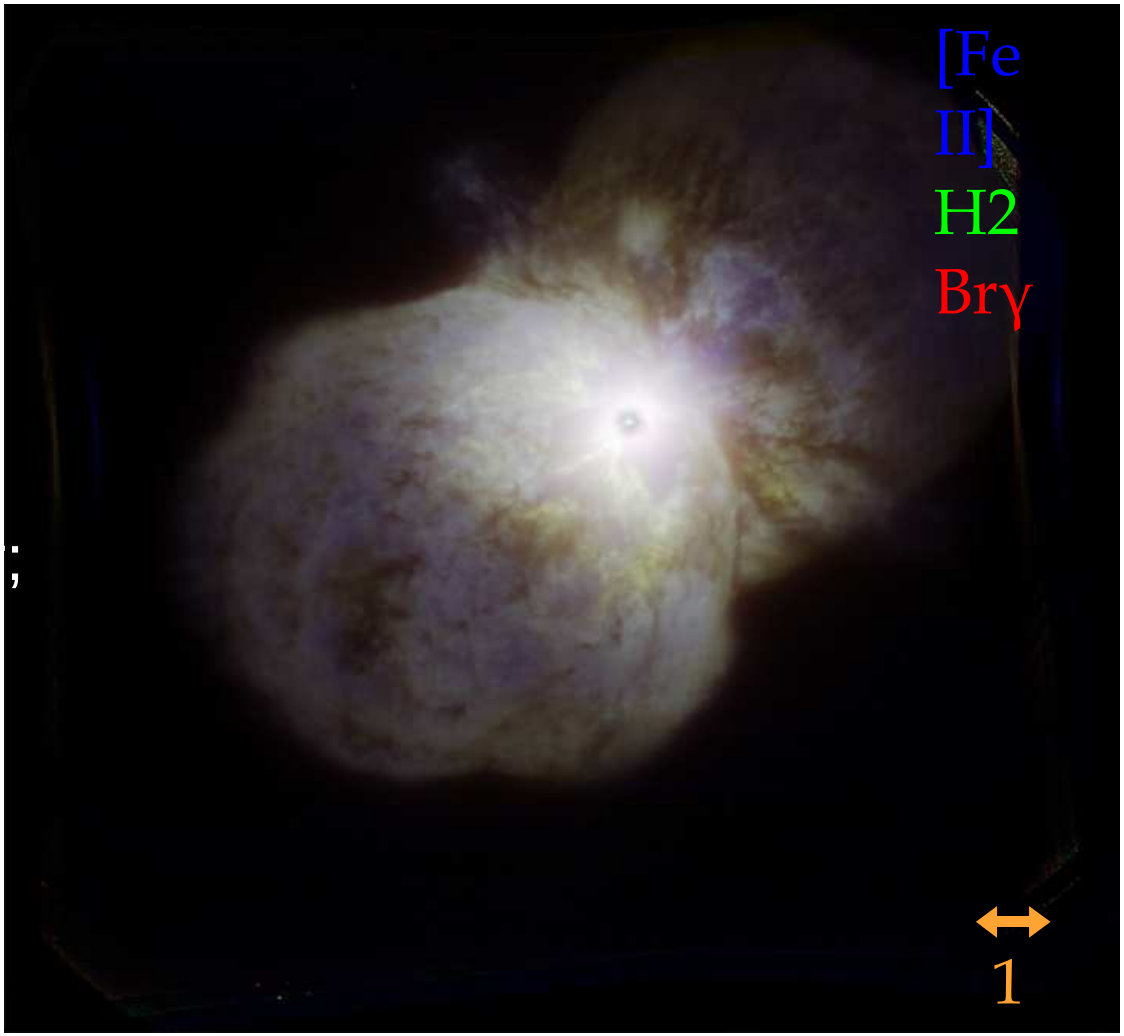

NICI Contrast (scaled 2hr)
NICI HD129xxx
NICI HD74xxx
NICI-RfP
GDPS median
GDPS best
5σ Contrast (magnitudes)
Separation (asec)
9
10
11
12
13
14
15
0.4
0.6
0.8
1.0
1.2
1.4

NICI planet-finding campaign

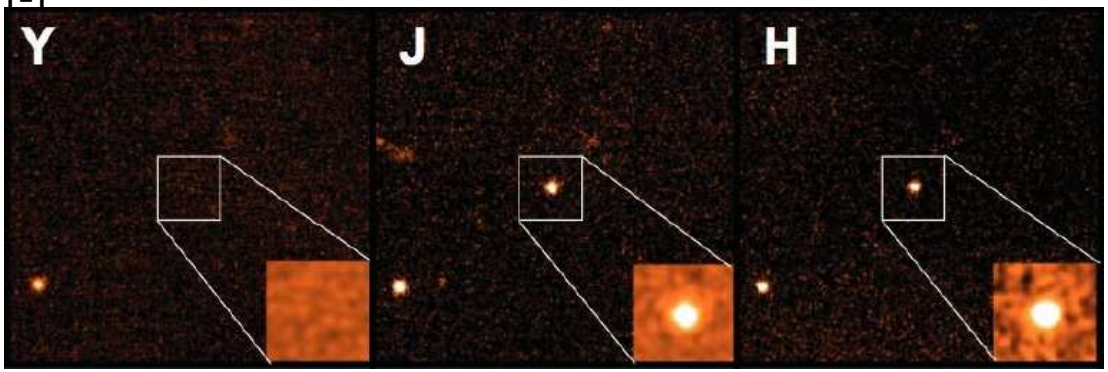
campaign requirement

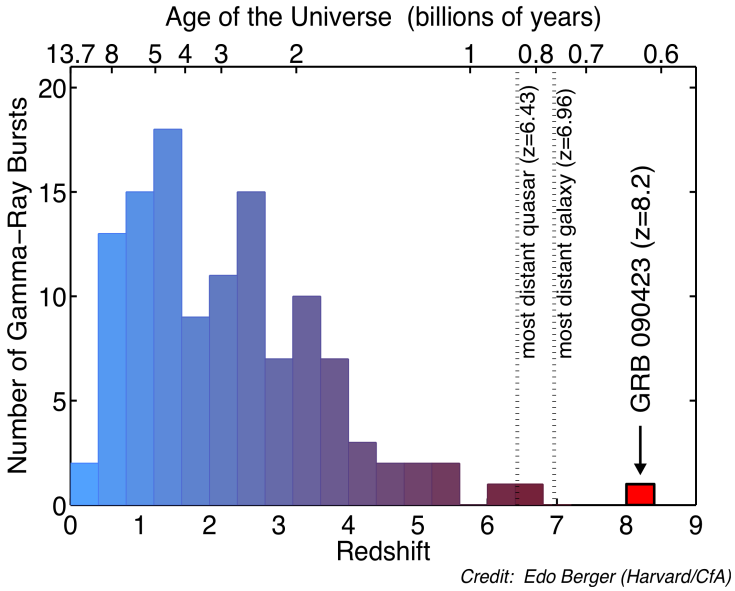


NICI imaging of Eta Car



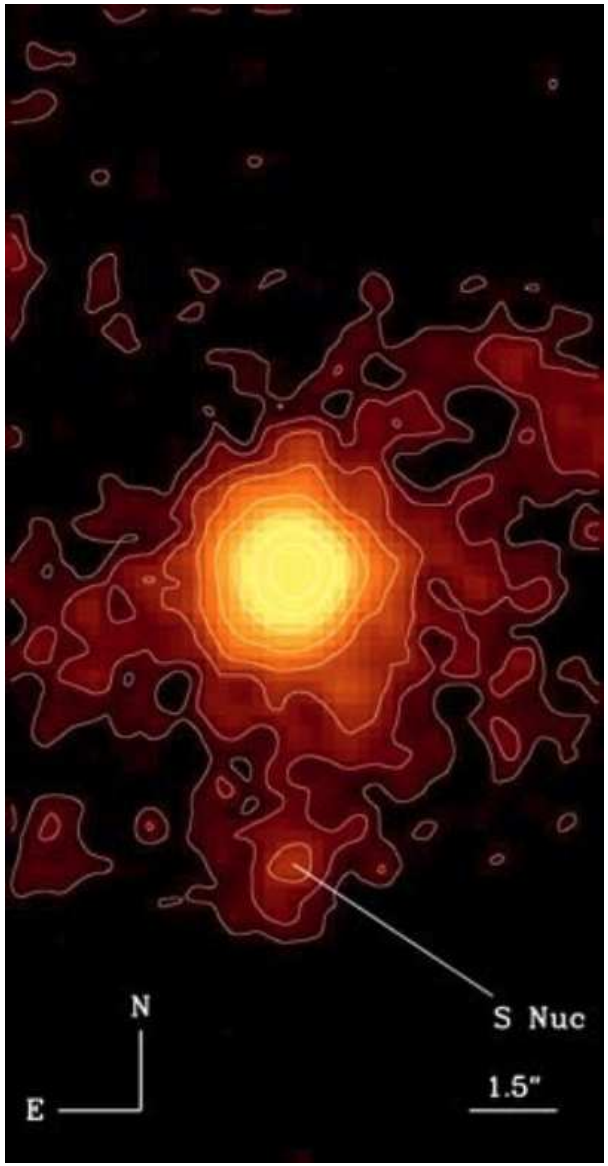
GRB 090423 at z ≈ 8.2



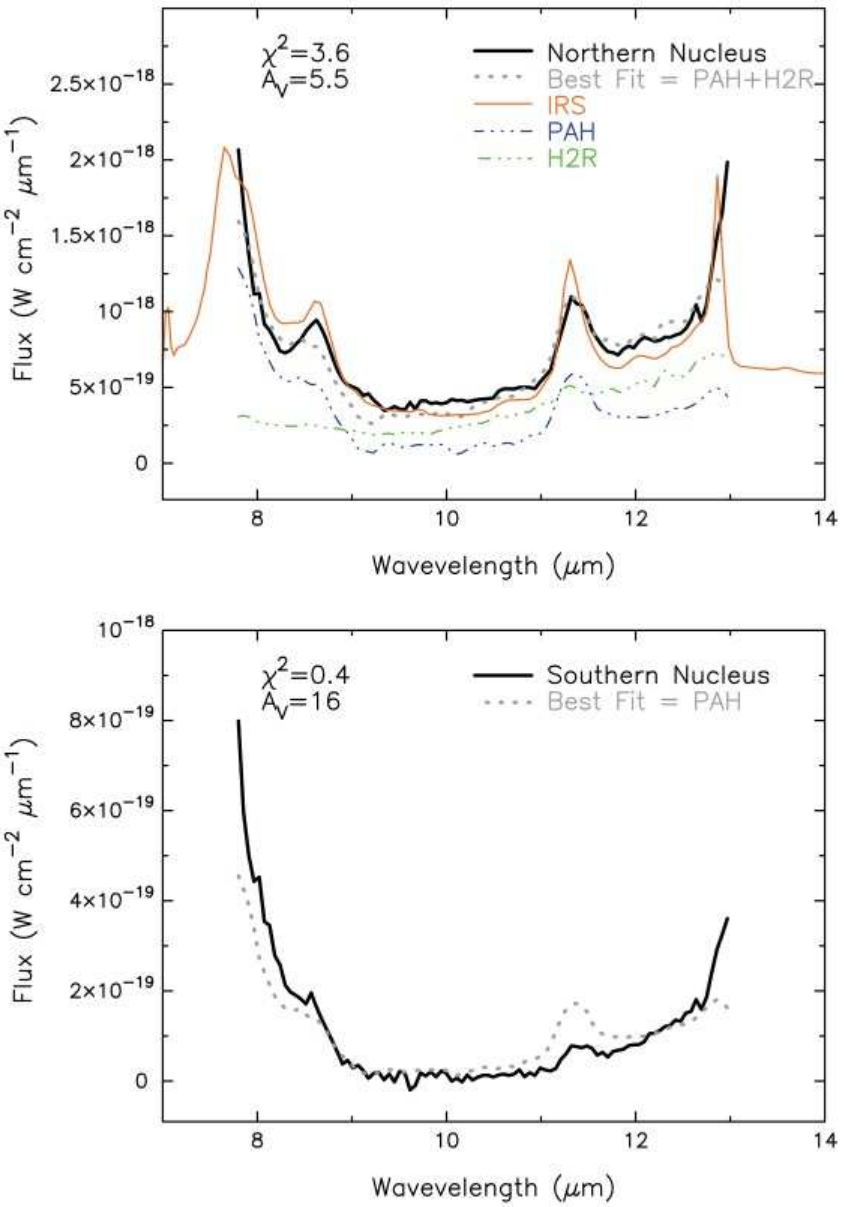


Credit: Edo Berger (Harvard/CfA)

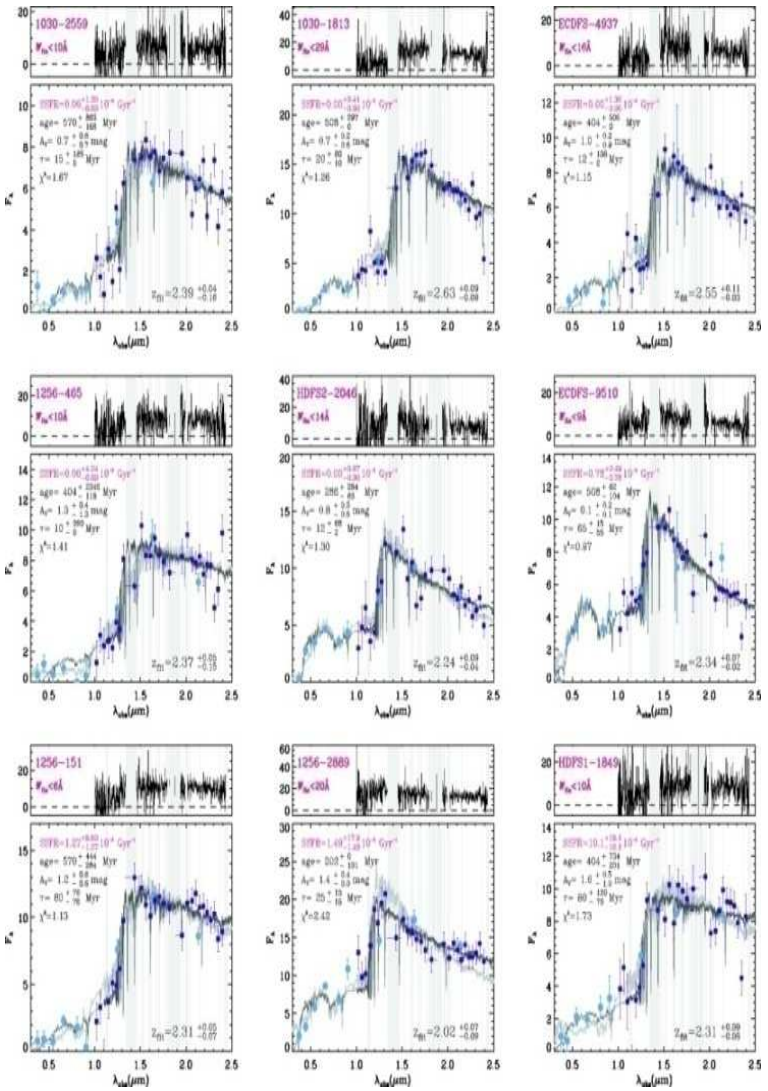
Star formation in merging galaxies



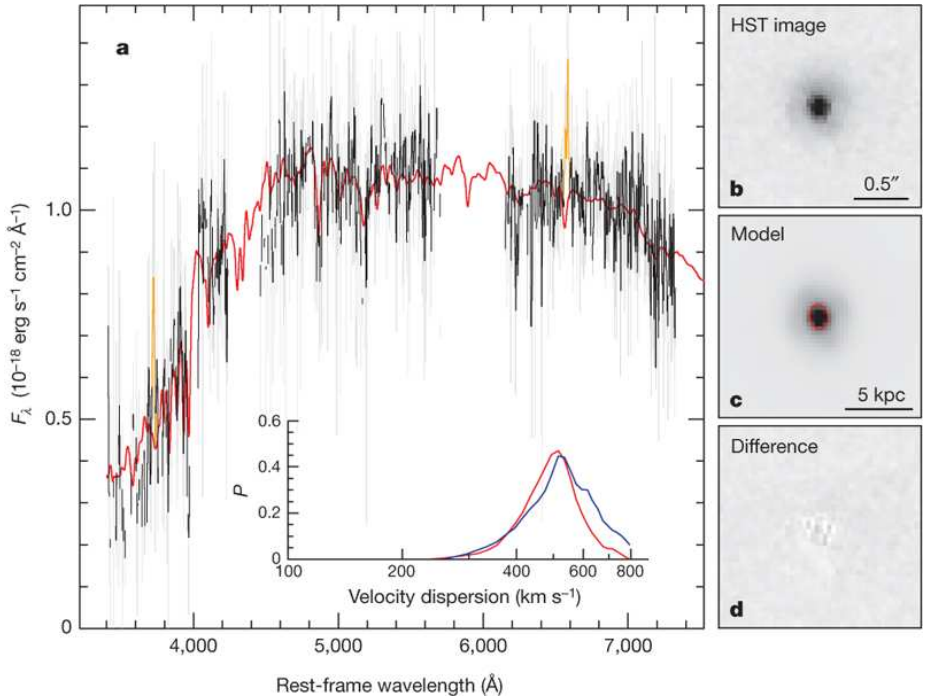
Star formation in merging galaxies



Massive “dead” galaxies at z >2



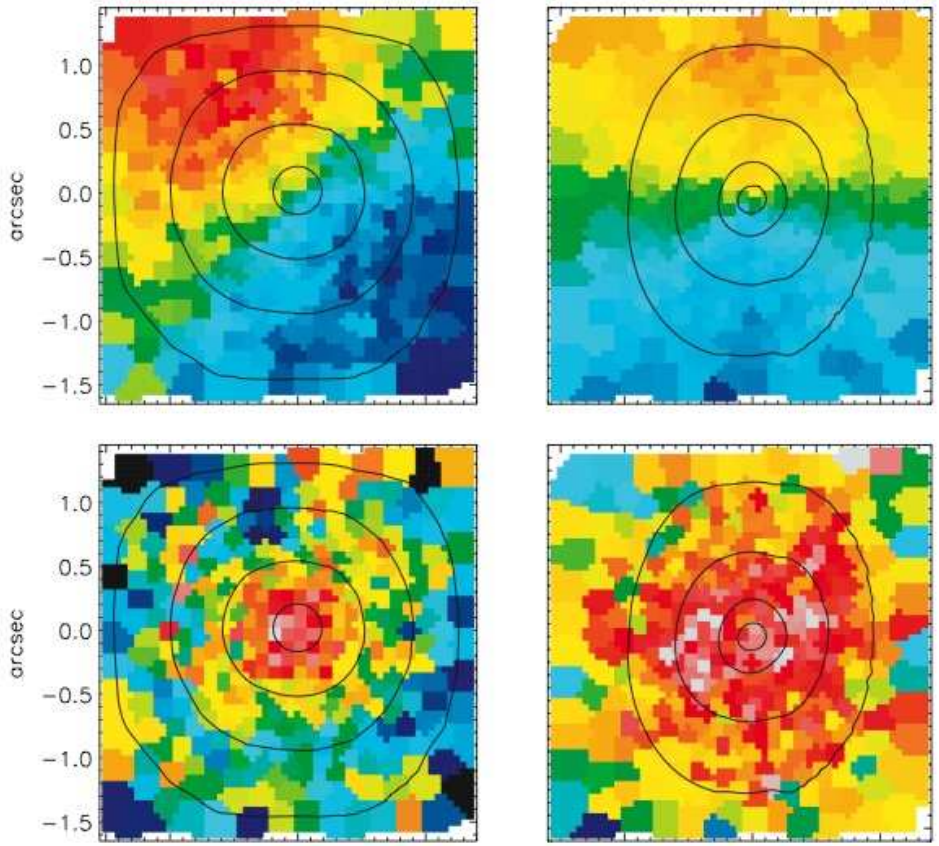
Massive “dead” galaxies at z >2



Black hole masses in galaxies

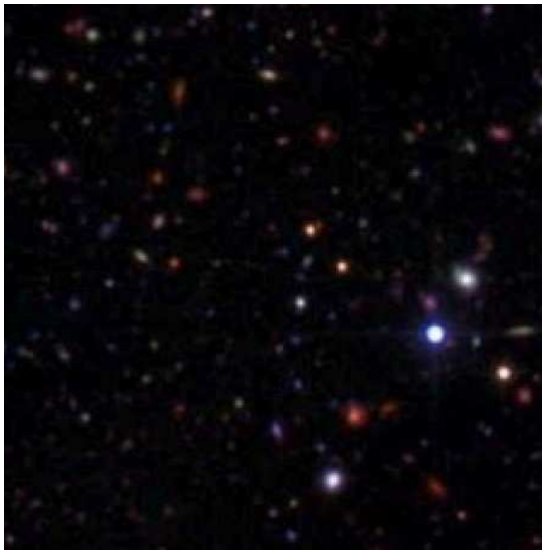
velocity

σ

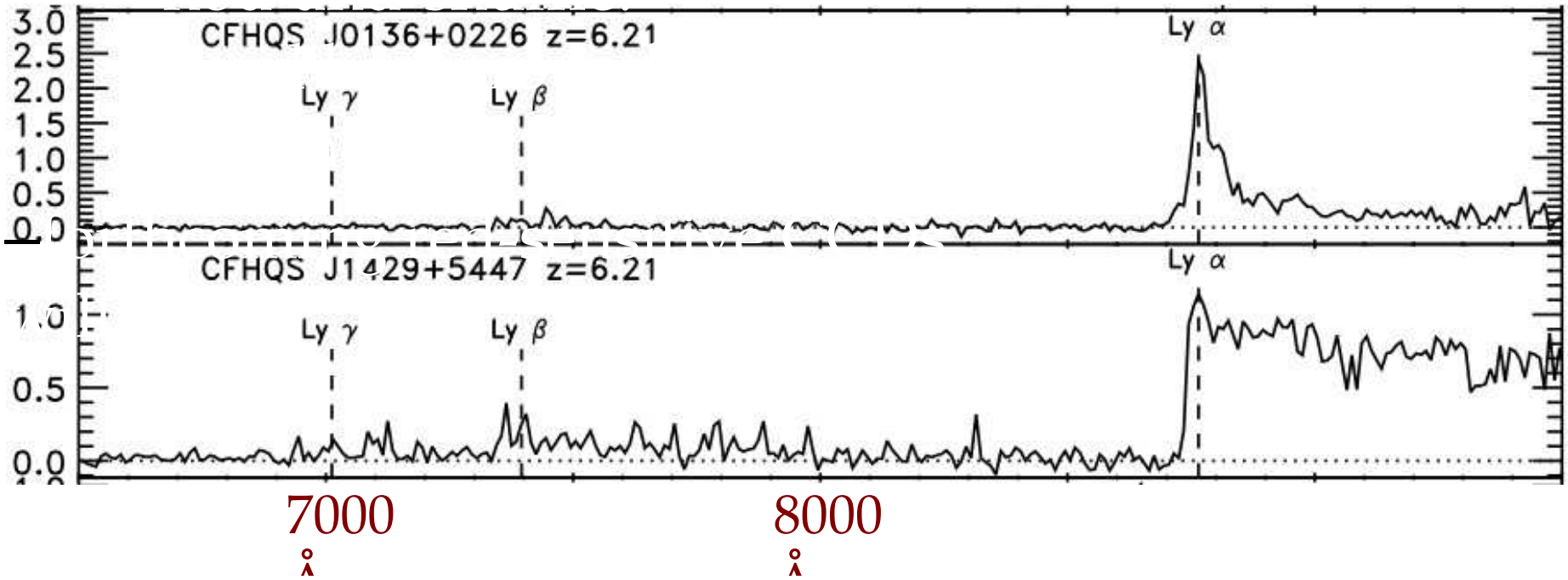


NGC 524 NGC 2549

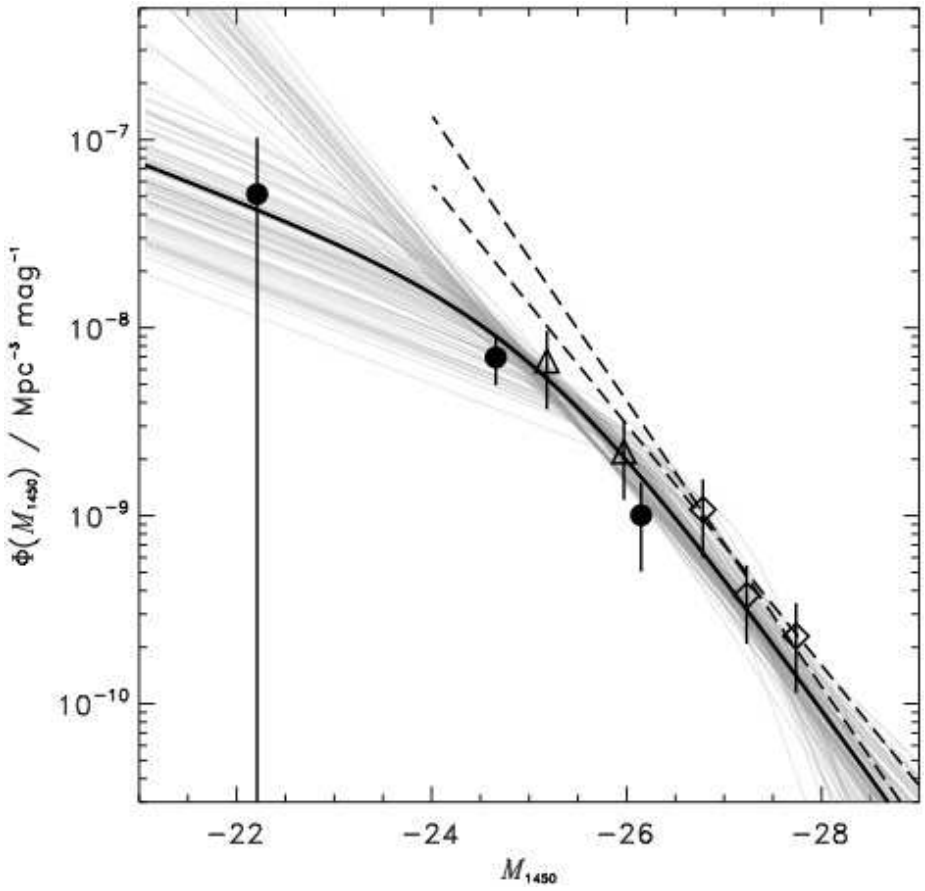
Quasar luminosity function at z=6



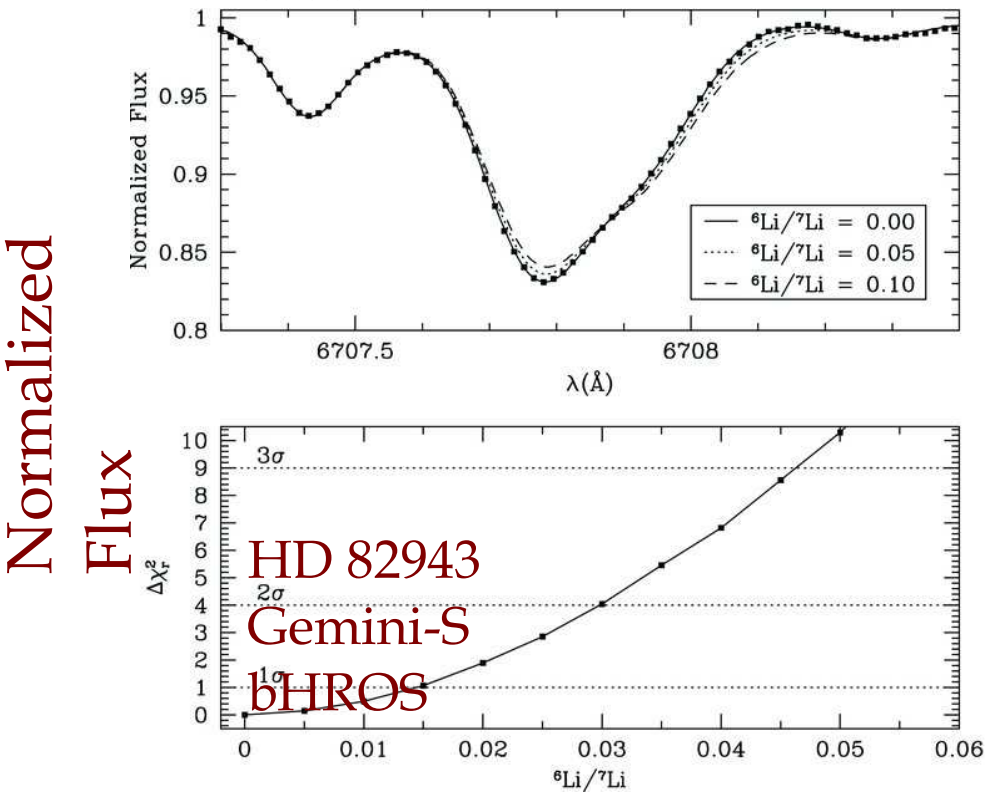
-
-
-



Quasar luminosity function at z=6

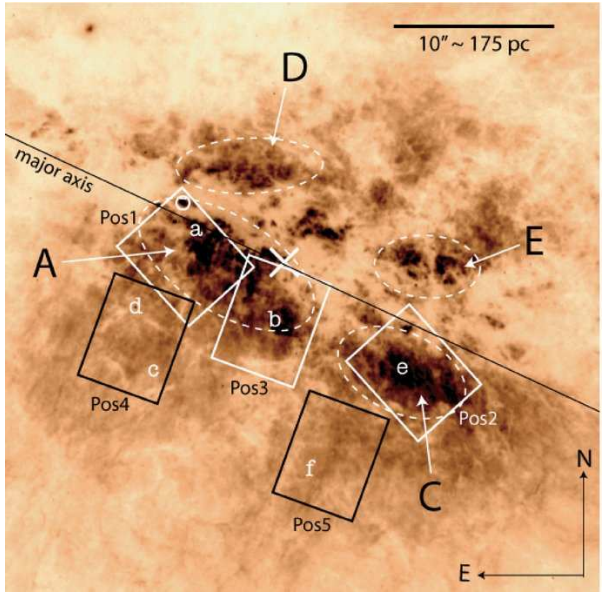


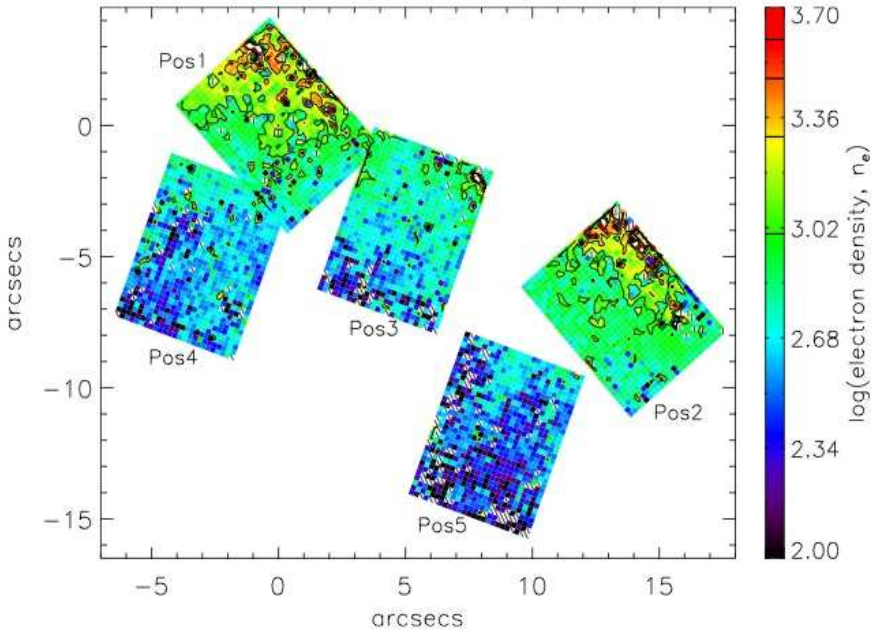
No 6Li in exoplanet host stars



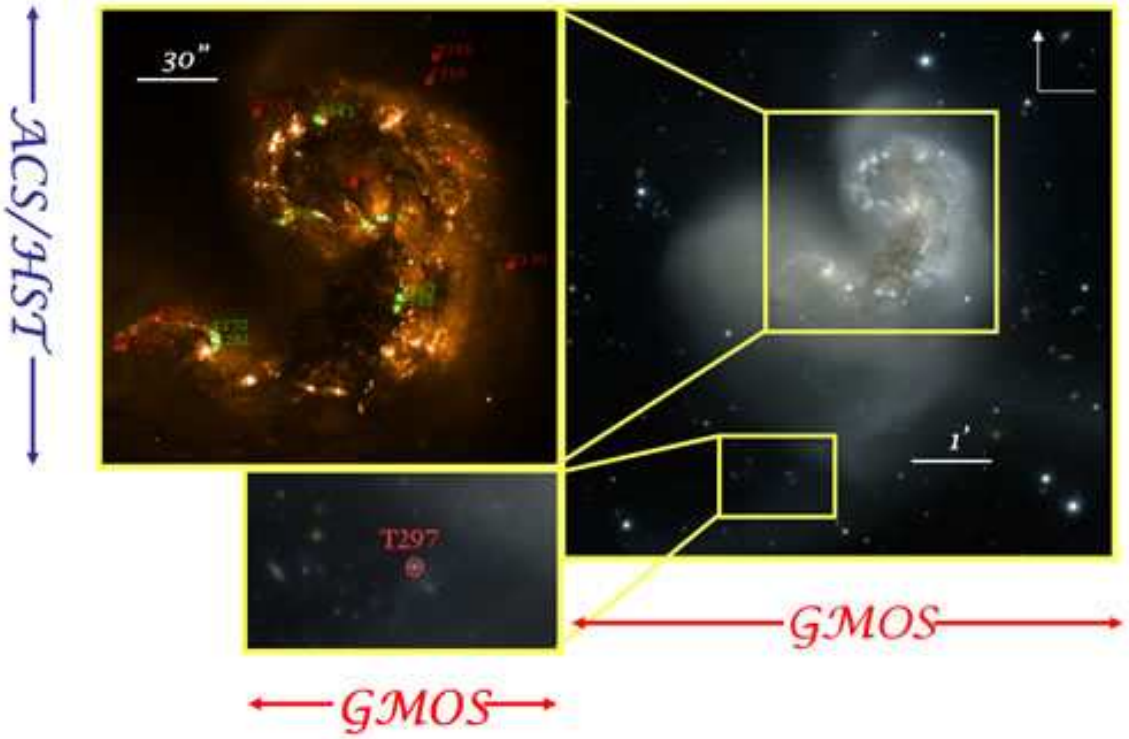
High-pressure outflow in M82

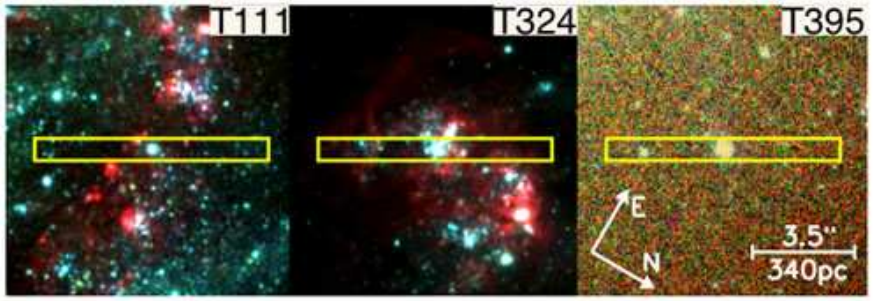
-
-
-

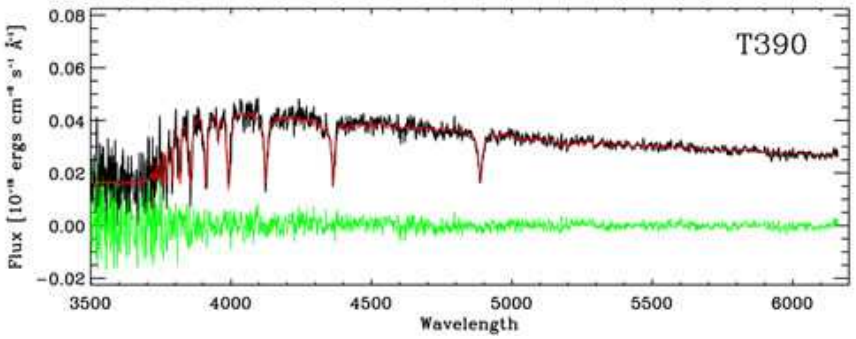




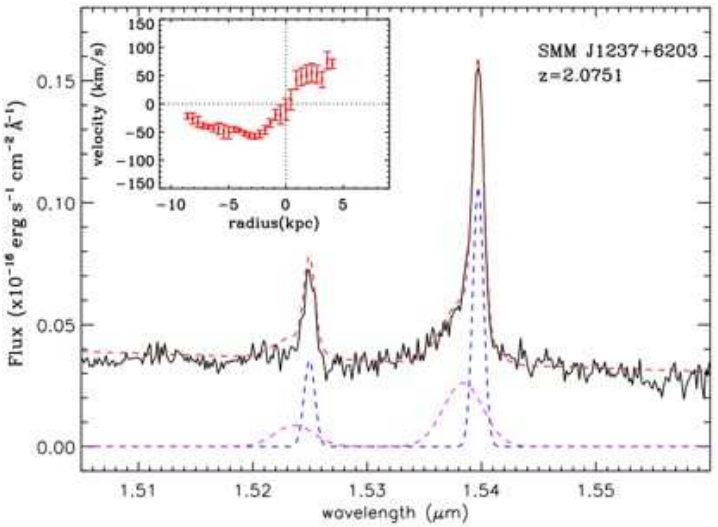
Cluster formation in the Antennae



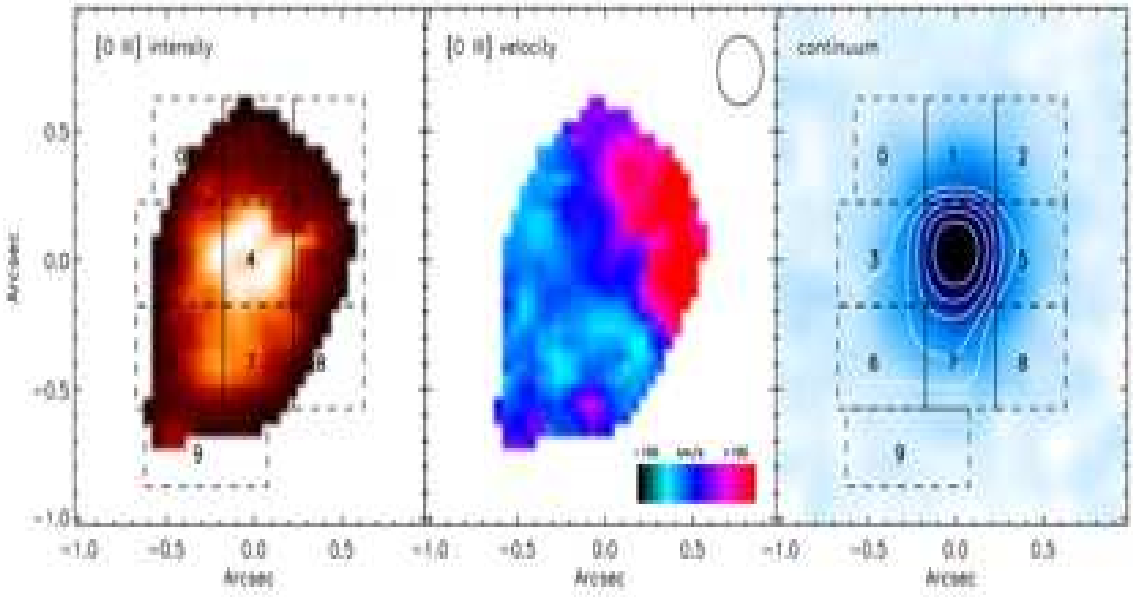




Galactic superwind outflow at z=2



line profiles and velocity field



intensity

velocity

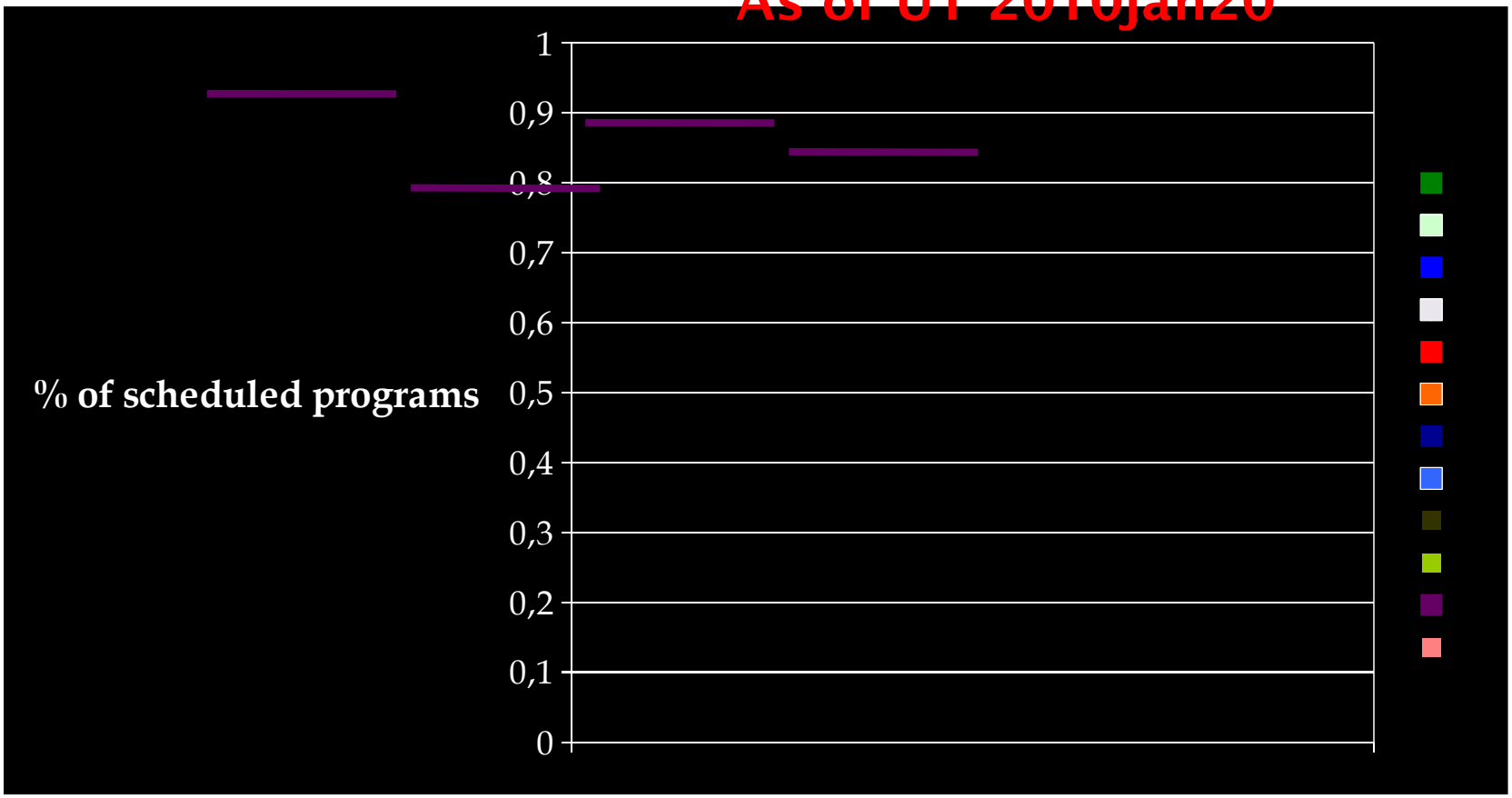
-
-
-
-
-

Scientific Effectiveness of the Queue

Advantages of the Queue

Completion rates - all partners

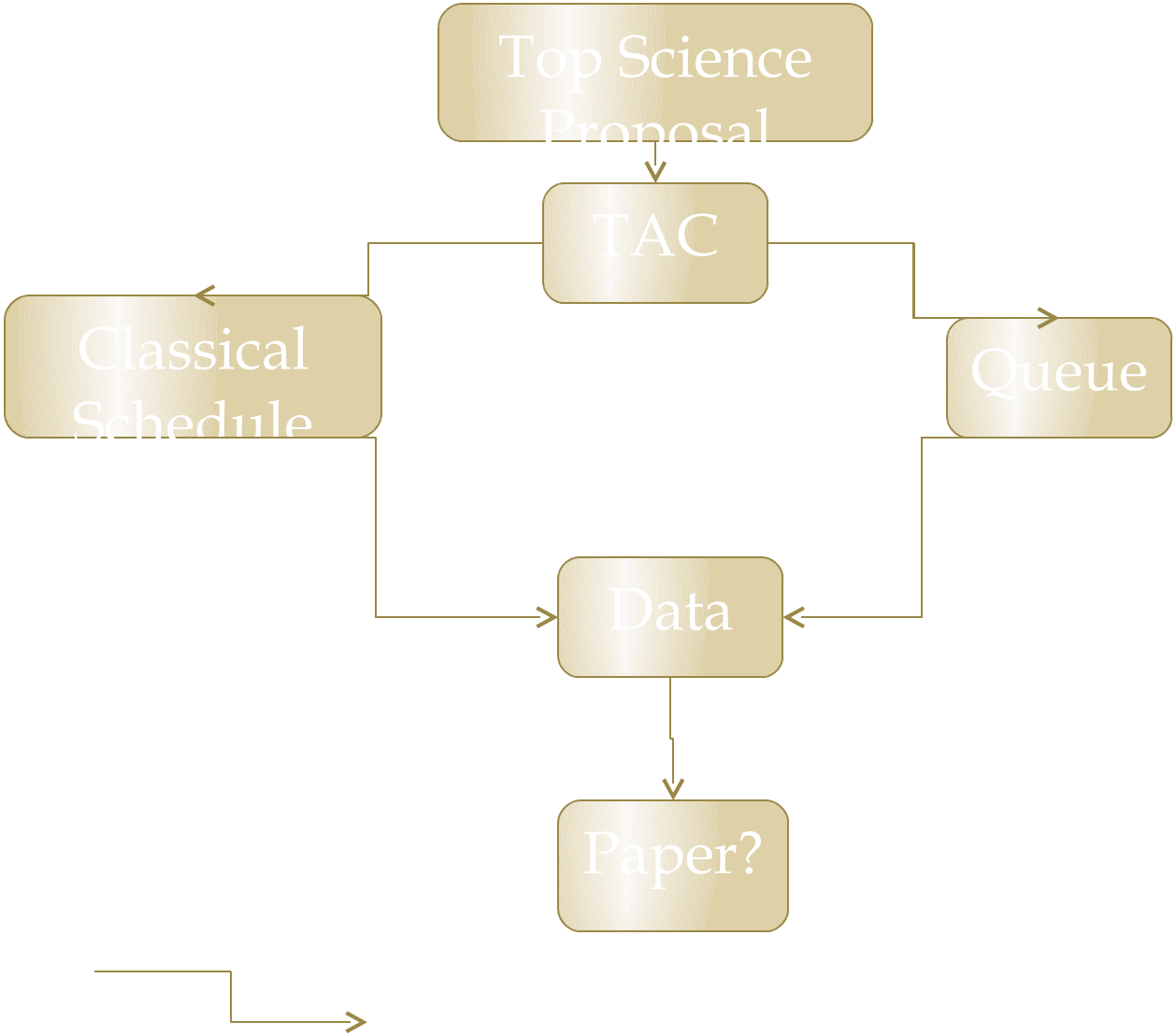
As of UT 2010jan20



Lines mark the requirements

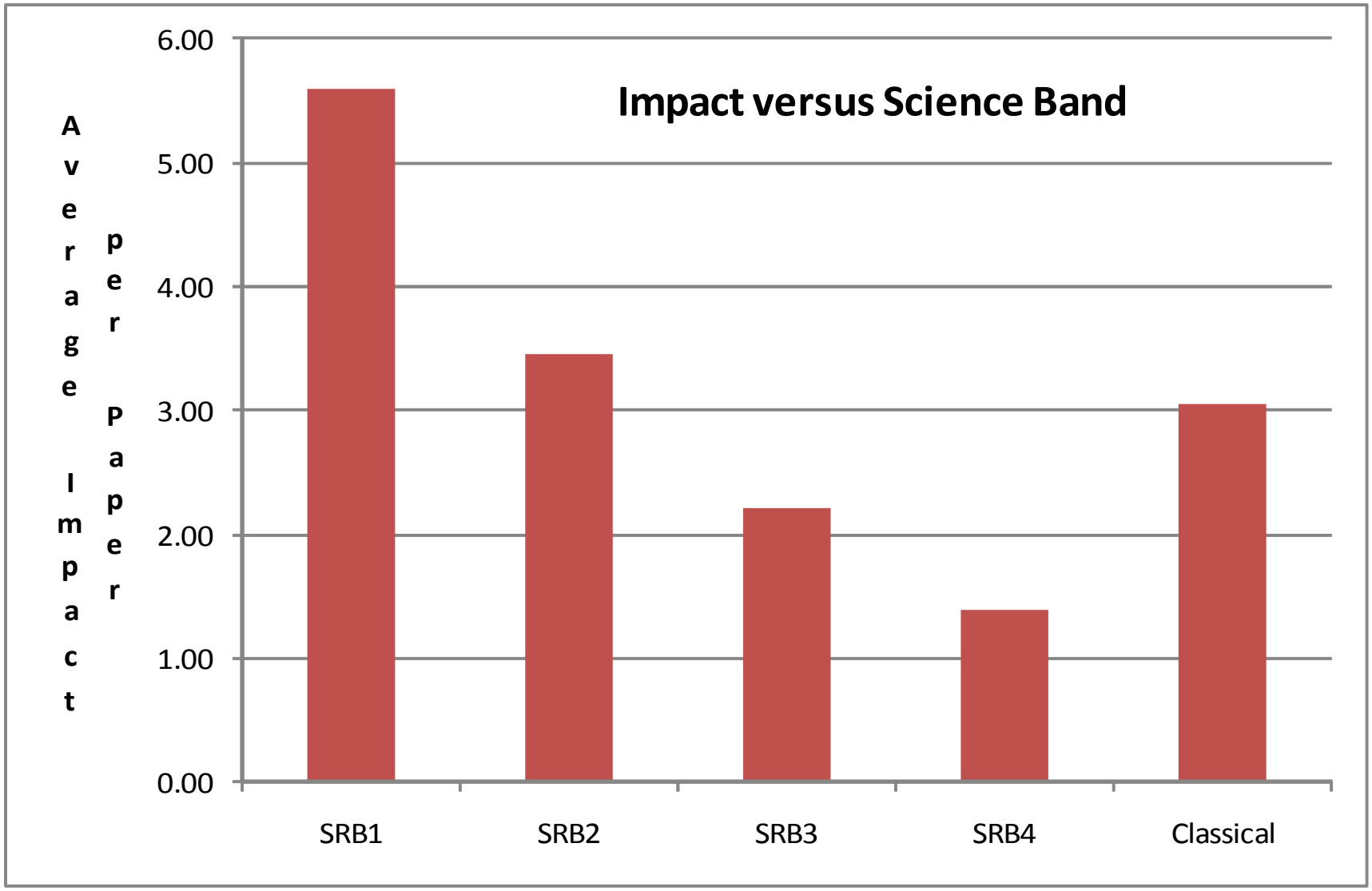

Classical
ON
OFF
Queue
ON
OFF

Proposal to Publication – Top Science



High Impact Science

2005-2008 Papers



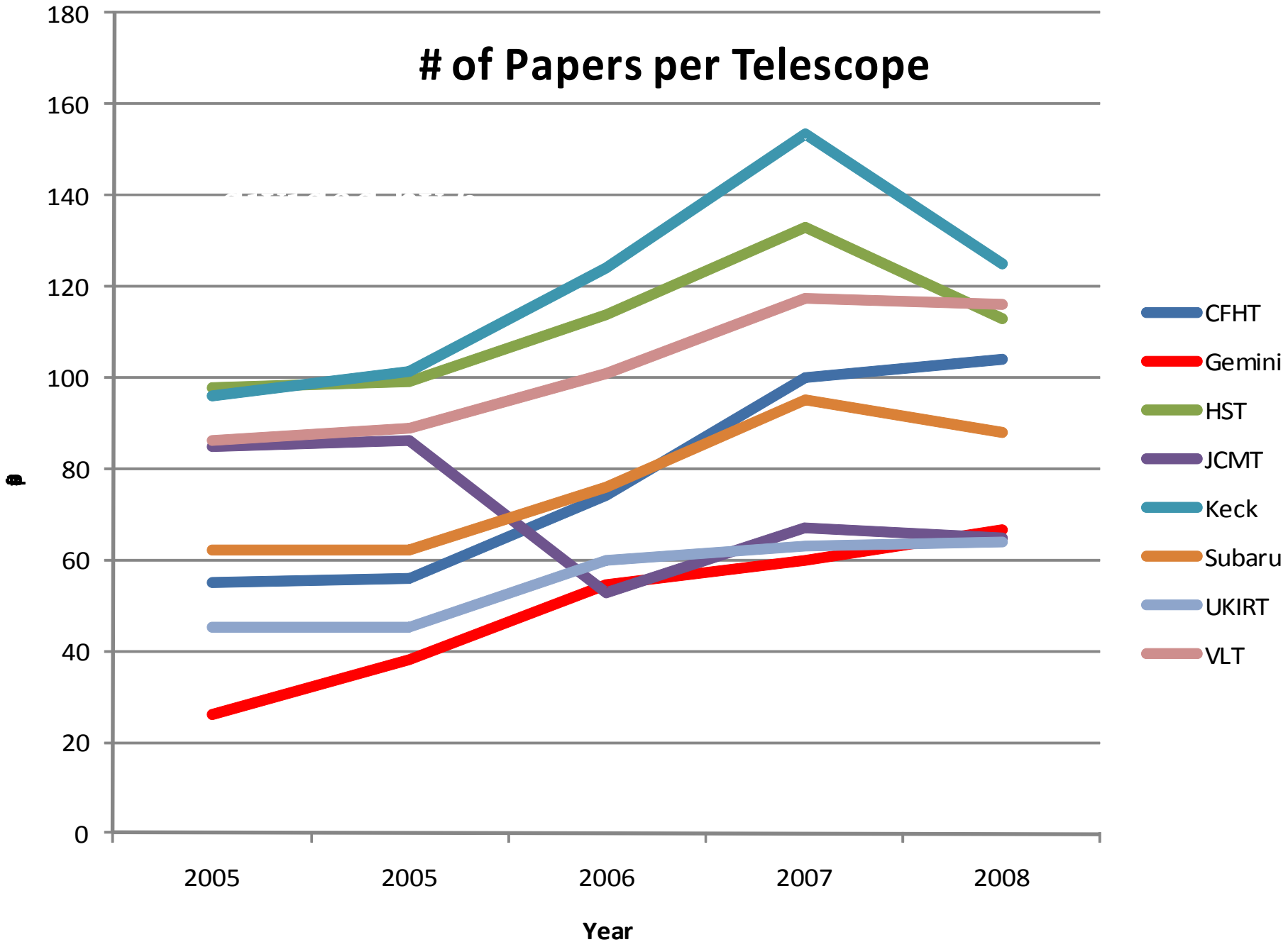
Science Enabled by the Queue

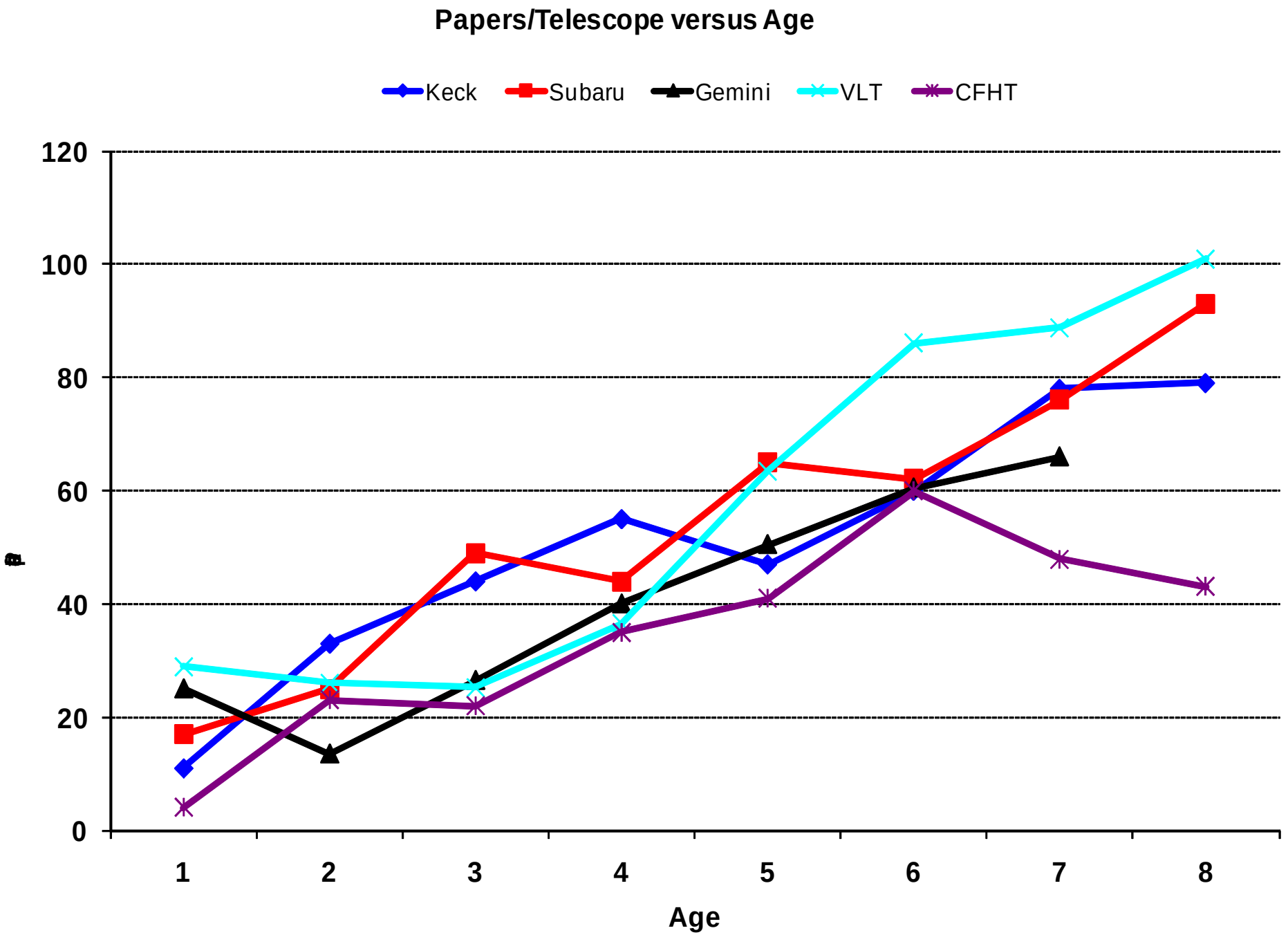
The Top 20 Most Cited Gemini Publications as of January 19, 2010

Authors	Title	Year	Journal	Total citations	Refereed citations	Instrument	Mode
Astier, P. + 41	The Supernova Legacy Survey: measurement of …	2006	A&A	1130	868	GMOS	Q
Wood-Vasey, W. + 36	Observational Constraints on the Nature of …	2007	ApJ	410	315	GMOS	Q
Genzel, R. + 14	The Stellar Cusp around the Supermassive Black Hole …	2003	ApJ	276	210	Hokupaa	DD
Schodel, R. + 5	Stellar Dynamics in the Central Arcsecond …	2003	ApJ	226	167	Hokupaa	DD
Fox, D. + 35	The afterglow of GRB 050709 and the nature …	2005	Nature	212	164	GMOS	Q
Glazebrook, K. + 11	A high abundance of massive galaxies 3-6 billion years …	2004	Nature	199	159	GMOS	Q
Juneau, S. + 13	Cosmic Star Formation History and Its Dependence …	2005	ApJ	183	150	GMOS	Q
Berger, E. + 23	The afterglow and elliptical host galaxy of the short …	2005	Nature	164	137	GMOS	Q
Bloom, J. + 27	Closing in on a Short-Hard Burst Progenitor …	2006	ApJ	161	136	GMOS	Q
Abraham, R. + 11	The Gemini Deep Deep Survey. I. …	2004	AJ	141	120	GMOS	Q
Close, L. + 3	Detection of Nine M8.0-L0.5 Binaries: …	2003	ApJ	140	130	Hokupaa	C
LeFloch, E. + 13	Are the hosts of gamma-ray bursts sub-luminous …	2003	A&A	140	114	Hokupaa	Q
Simon, J. + 2	Constraints on the redshift dependence of …	2005	PhRvD	139	108	GMOS	Q
Fynbo, J. + 30	No supernovae associated with two long-duration …	2006	Nature	139	100	GMOS	
Sullivan, M. + 29	Rates and Properties of Type Ia Supernovae as …	2006	ApJ	134	109	GMOS	Q
Savaglio, S. + 12	The Gemini Deep Deep Survey. VII. The Redshift …	2005	ApJ	132	95	GMOS	Q
Vreeswijk, P. + 31	The host of GRB 030323 at z=3.372 …	2004	A&A	119	98	ACQCAM	Q
Kaspi, V. + 5	A Major Soft Gamma Repeater-like Outburst and …	2003	ApJ	119	93	NIRI	DD
Gal-Yam, A. + 25	A novel explosive process is required for …	2006	Nature	116	84	GMOS	Q
Miknaitis, G. + 35	The ESSENCE Supernova Survey: …	2007	ApJ	110	92	GMOS	Q

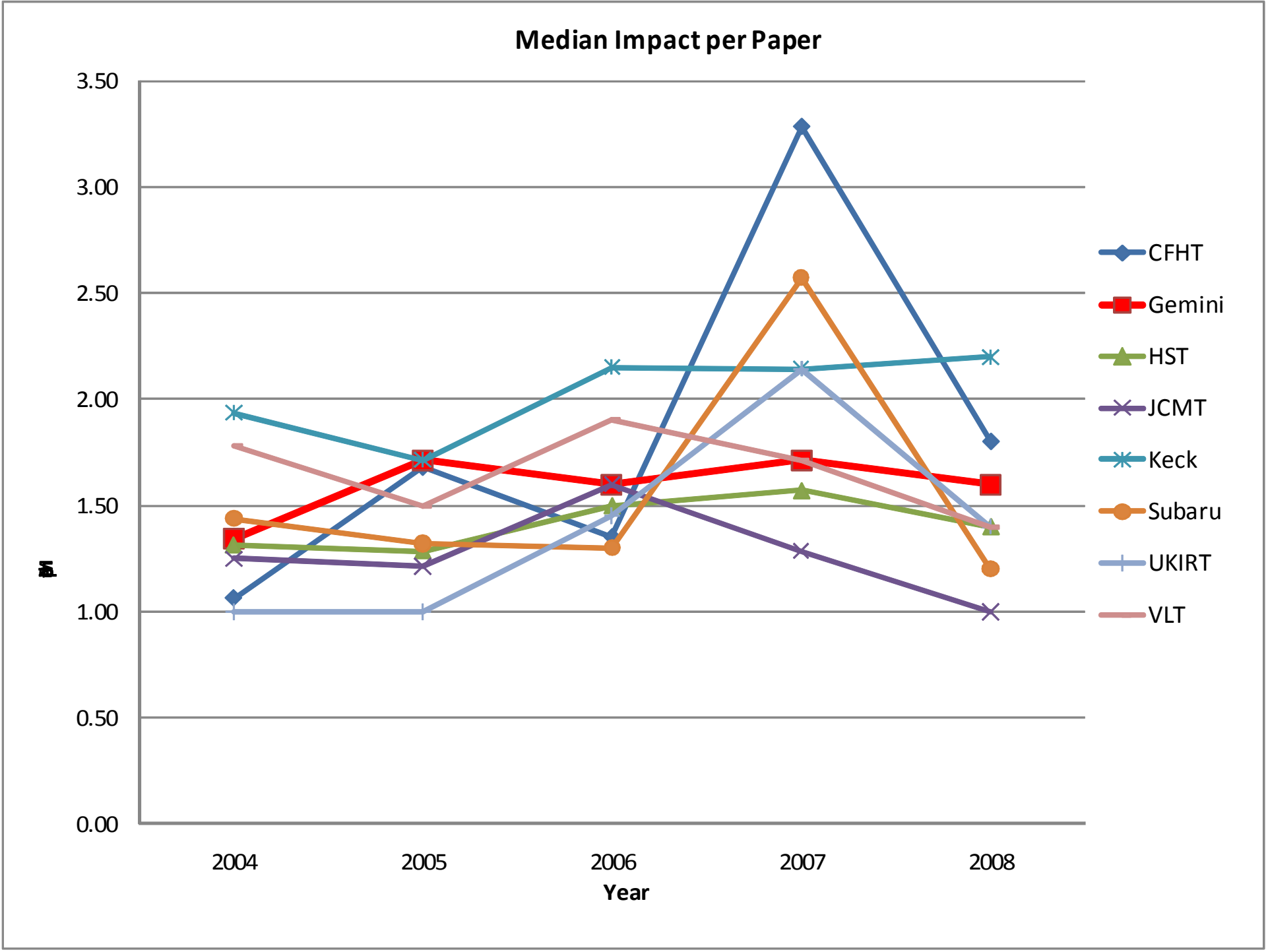
Move to queue is similar to moving to automobile from horse and buggy. The H&B model had reached a limit in effectiveness and a new model is needed to improve productivity/effectiveness. The queue will continue to evolve, as does the automobile, as understanding of the processes and technology improve.

Gemini in Comparison


# of Papers per Telescope
180
160
140
120
100
80
60
40
20
0
2005
2005
2006
2007
2008
Year
CFHT
Gemini
HST
JCMT
Keck
Subaru
UKIRT
VLT


Papers/Telescope versus Age
Keck
Subaru
Gemini
VLT
CFHT
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
Age

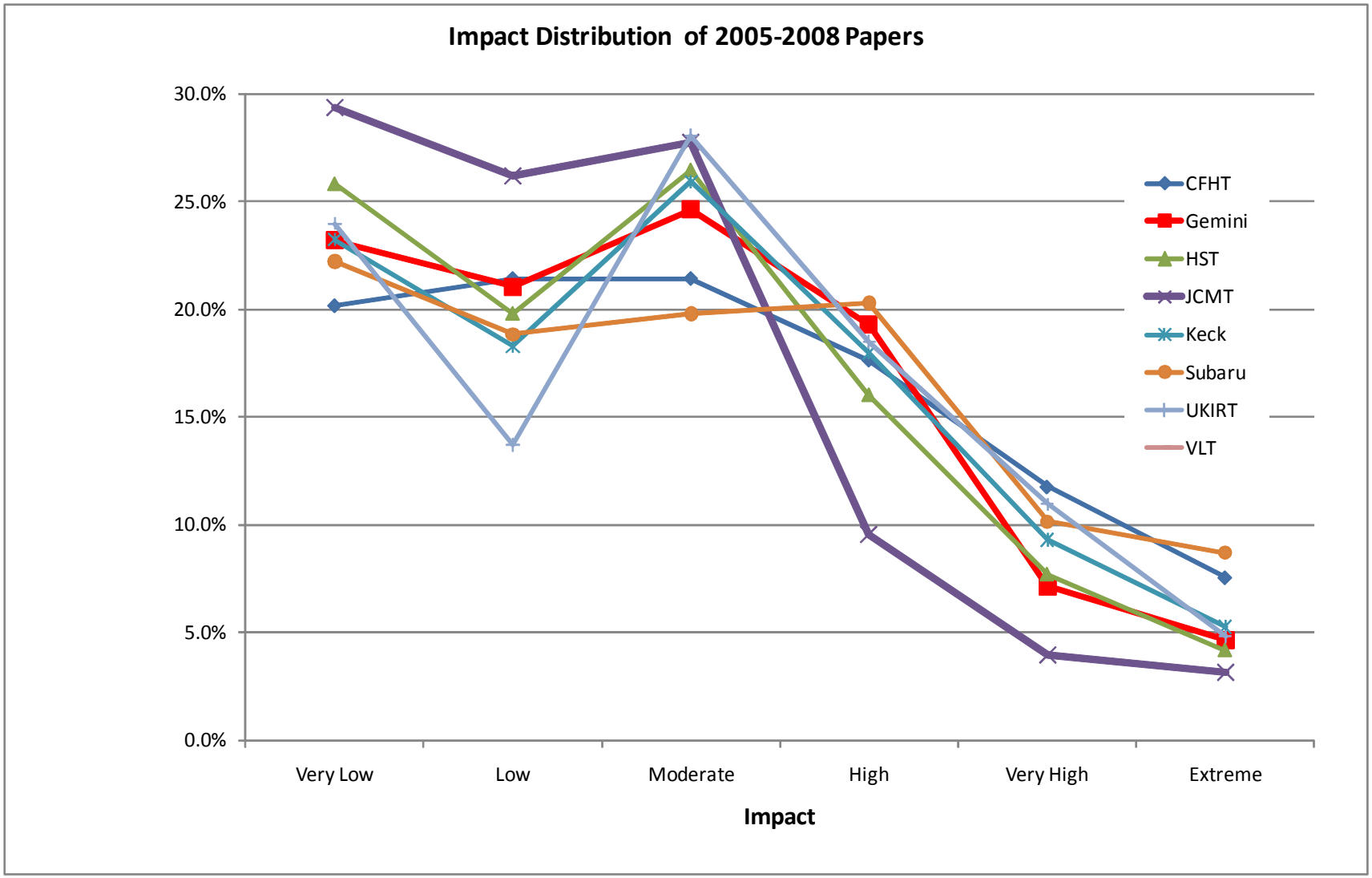
Impact


Median Impact per Paper
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2004
2005
2006
2007
2008
Year
CFHT
Gemini
HST
JCMT
Keck
Subaru
UKIRT
VLT

Impact Distribution Function (IDF)

IDF

Name	Impact Range
Very Low	0 - 1
Low	1 - 2
Moderate	2 - 4
High	4 - 7
Very High	7 - 11
Extreme	> 11


Impact Distribution of 2005-2008 Papers
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Very Low
Low
Moderate
High
Very High
Extreme
Impact
CFHT
Gemini
HST
JCMT
Keck
Subaru
UKIRT
VLT

Partnership Productivity and Impact

More Gemini Specifics

Breakdown by Program Type (and telescope)

Program Type	# of Papers	Average Impact
SRB1	153	5.60
SRB2	89	3.46
SRB3	41	2.21
SRB4	11	1.39
Classical	41	3.06
Commissioning	5	0.87
Discretionary	55	1.62
Demo Science	5	0.82
Payback	2	1.42
Science Verification	12	0.93
All Papers*	438	3.62

Telescope	# of Papers	Average Impact
GN	200	4.20
GS	135	4.12

Comments on Previous Slide

Breakdown by Partner

Country	# of Papers	% of Papers	Average Impact	Approximate Share of Time
AR	3	0%	1.07	2%
AU	61	8%	7.31	5%
BR	28	4%	5.58	2%
CA	128	18%	4.41	13%
CL	17	2%	3.89	5%
GS	56	8%	2.29	9%
UH	39	5%	2.47	5%
UK	130	18%	2.98	21%
US	258	36%	3.47	39%

Comments on Previous Slide

Conclusions

Conclusions