Subaru + HST SN searches

Andy Howell
University of Toronto

Thanks to:
Tony Spadafora (LBL)
Nao Suzuki (LBL)
Adam Riess (JHU/StSci)

S82E5937 1997:02:19 07:06:57

IfA Deep Survey

Subaru Suprime-Cam + CFHT12k

- Area: 2.5 □°

🕑 Cadence: 7-21d for 5 months

↓ 5σ limit: RIZ~25-26, over 9-17 visits

Barris & Tonry 2004
Survey 2001-2002

23 SNe, 15 at z>0.7

SCP Subaru

Spring 2002 (SDF+)

- Area: 1.2 □° (7 SuprimeCam)
- Cadence: 2 visits
- 5σ limit: i'(AB)=26.5

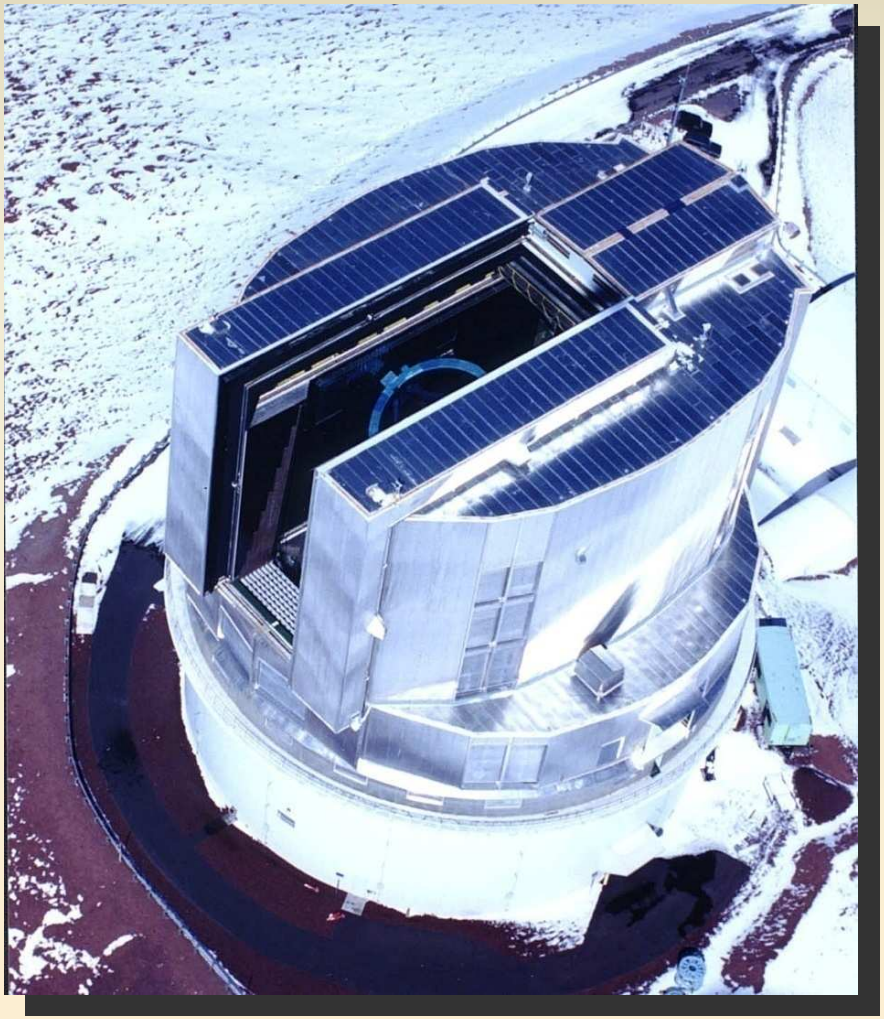
Supernova Cosmology Project

Fall 2002

- Area: 0.92 □° (5 SuprimeCam)
- Cadence: 2 ref, 7 search (3-14d)
- 5σ limit: i'(AB)=26.5

SCP Subaru yield

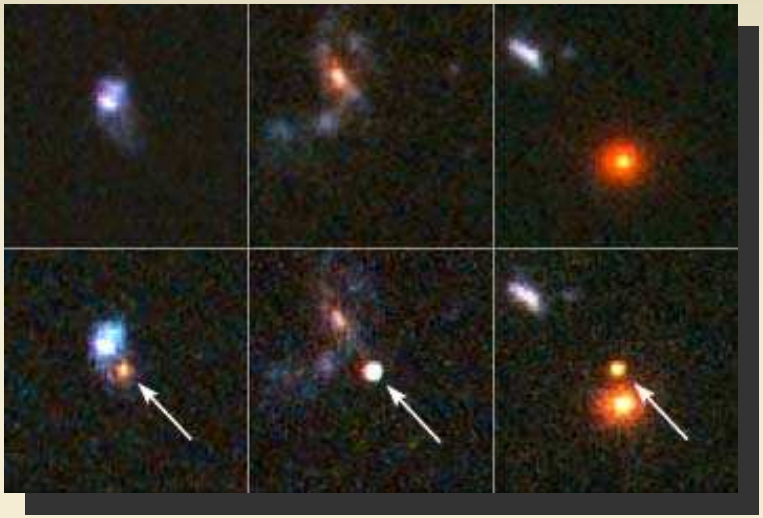
- 30 SNe reported in IAUC, followed spectroscopically (13 with some evidence for Ia)
- Detected SNe Ia to z=1.26
- Colors for z>1 Sne require ~8hr 8m IR observations per data point



Subaru Deep Field Search

- See Maoz KITP talk for details/collaborators
- 2 nights on Subaru/Suprime-Cam
- Re-imaged SDF
- Limit: r', i'~27, z'~26
- 40 SNe/epoch up to z=1.5
- First done 2 years ago, new run in Feb. 2007
- Run scheduled for May 2007
- One epoch each time: Cadence:0. Can only do probabilistic rates.

Typical ACS Search



See:
Riess et al. 2004, 2006
Strolger et al. 2004

- **Area:** 0.05 □° (15 ACS)

🕑 **Cadence:** 45d (5 epochs)

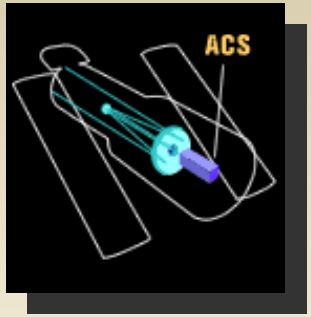
⭳ **5σ limit:** F850LP(Vega)=~26

Additional I observations.

~5 z > 1 SNe Ia per run, up to z=1.5

Follow-up with ACS, NICMOS

ACS Searches



Higher-z

Cycle 11 (2002/3)

- ■: 0.05 □° (15 ACS)
- ◷: 45d (5 epochs)
- ⭳: Z(Vega)=~26

Higher-z

Cycle 13 (2004/5)

- ■: 0.05 □° (15 ACS)
- ◷: 45d (5 epochs)
- ⭳: Z(Vega)=~26

Higher-z / SCP

Cycle 12 (2003/4)

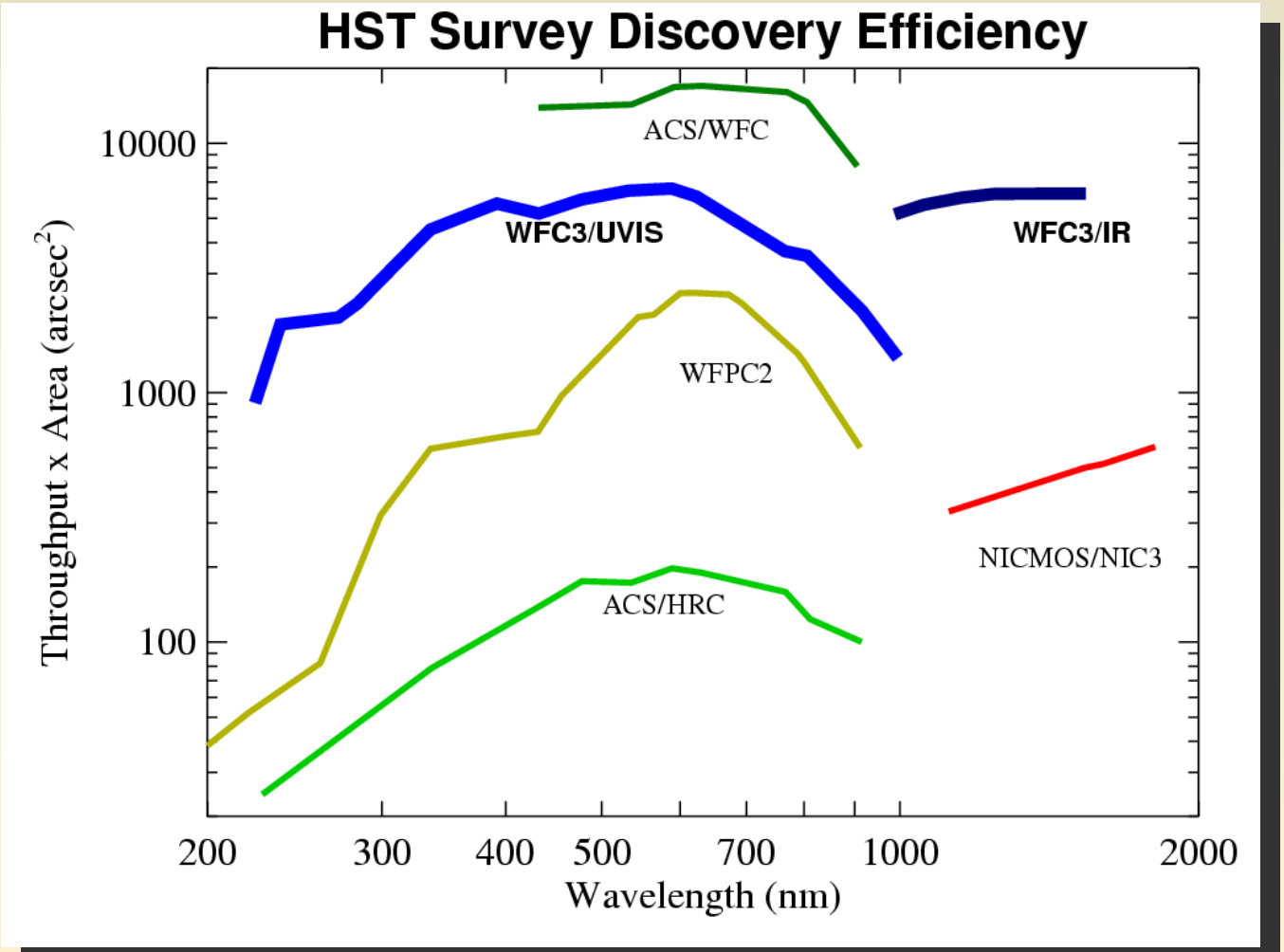
- ■: 0.05 □° (15 ACS)
- ◷: 45d (4 epochs)
- ⭳: Z(Vega)=~26

SCP Cluster

Cycle 14 (2005/6)

- ■: 0.08 □° (25 ACS)
- ◷: 23d, 8 visits/field
- ⭳: z'(Vega)=25.5

Future HST



- WFC3 worse than ACS for SNe
  - Lower optical throughput
  - Smaller area
- z>2 SNe Ia?
  - Not for cosmology
  - Could test systematics (Riess & Livio 2006)

Instruments

Source: Miyazaki

Instrument	A(m^2)	Ω(□°)	AΩ	Year
SDSS	3.83	6.0	23	1998
Megacam	9.59	1.0	9.59	2003
Suprime-Cam	51.65	0.256	13.17	1999
Pan-STARRS 1			13	2009
DEC			37	
Hyper-Suprime			162 (91)	2012
LSST			329	

Conclusions

- Unless ACS is revived, the era of searching with HST at $1<z<1.5$ is over
- Supernovae at $z\sim1.2$ can be found with Subaru, but ground-based IR follow-up and spectroscopy is heroic
- See Melbourne et al. (astro-ph/0703381) for SN at $z=1.3$ using Keck AO
- Might be able to get $z>1$ rates with Subaru if photometric typing can be made to work