

SAG 11: Preparing for the WFIRST Microlensing Survey

Jennifer Yee
(CfA)

What is **Unique** About WFIRST/AFTA?

- Systematic planet census at “snowline distances”
- Free-floating planets to Earth-mass and below
- **Accurate planet masses for representative sample (i.e., subject to mild, well-understood selection)**
- Accurate distances from here to Galactic Center (for **representative sample**): “**Galactic distribution of planets**”

AFTA Report - Uncertainties

- The **magnitude distribution of source stars** in the fields of interest has not been measured
- The microlensing **event rates** for some of the fields of interest have not been measured
- the **relative frequency of planets** in the Galactic **bulge** versus **disk**

Charter

Although the launch of the WFIRST mission is still many years off, it is nevertheless vitally important to consider **what activities must be carried out in the near future** in order to **retire any scientific risks** associated with, and **maximize the returns** from, the WFIRST microlensing survey. In particular, there may be **projects that require a long time baseline and/or might affect the final mission design**, and thus must be undertaken soon. This SAG will bring together members of the microlensing community to identify scientific programs that will benefit the WFIRST microlensing mission. **Of particular interest are mission-critical observational programs that must be completed before the launch of WFIRST.**

Charter

"What scientific programs can be undertaken now to ensure the success of the WFIRST mission and maximize its scientific return?"

Charter

1. Identify both **mission critical** and **mission enhancing** programs,
2. Identify **immediate science** to come out of each program, as well as the program's **direct impact on the WFIRST** mission,
3. For each proposed program, **quantify the improved scientific return** for the WFIRST mission,
4. Emphasize programs that can be executed using existing (NASA) resources.

AFTA Report – Suggested Work

1. “Measurements of the **source luminosity function** to faint magnitudes **with HST** should be performed in the potential target fields”
2. “A **near-IR microlensing survey of the potential WFIRST fields** ... both to measure the microlensing event rate in these fields and to estimate the relative bulge and disk contributions to the planet detection rates.”

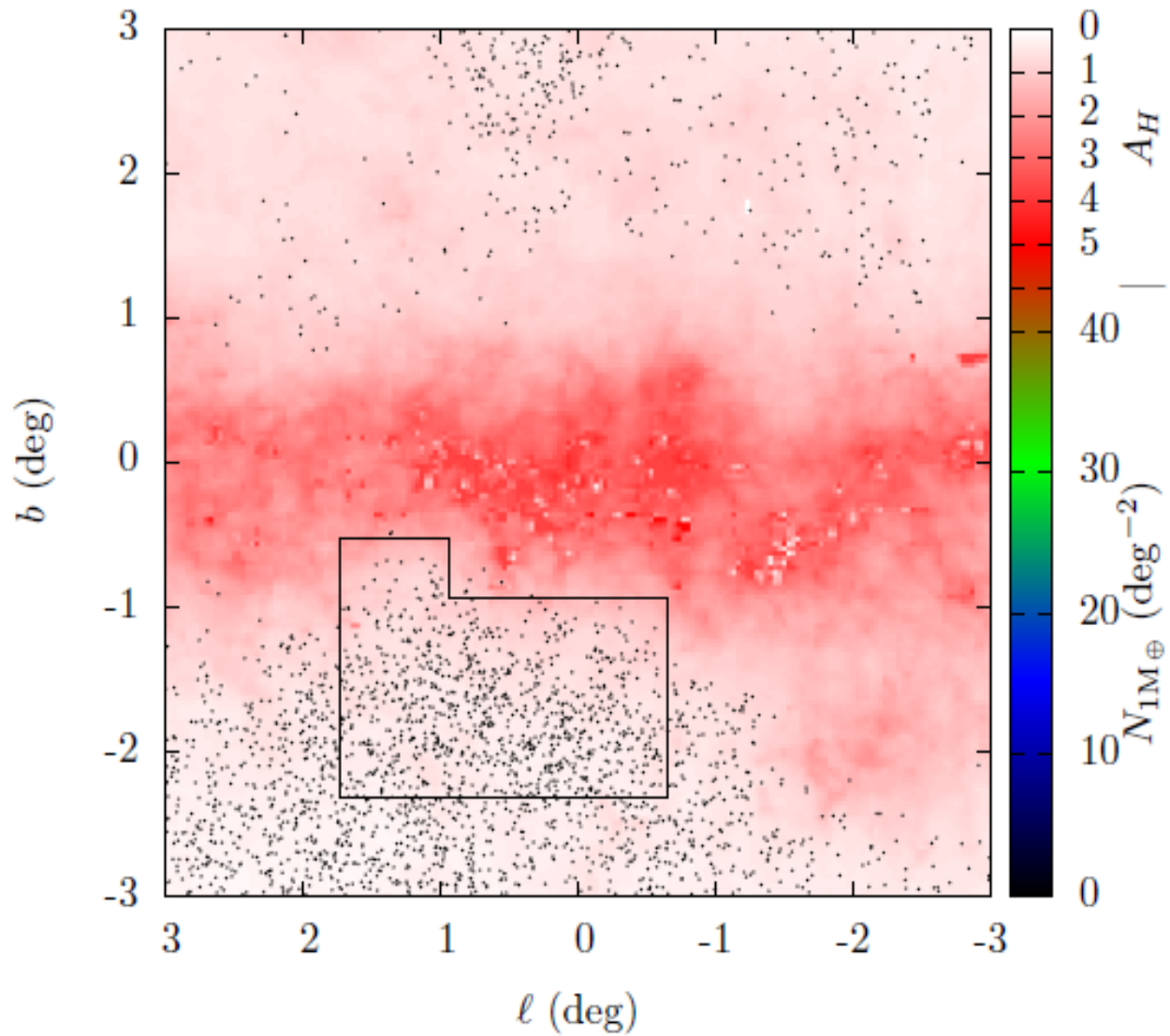
Potential Topics

- *HST* survey: I-band, H-band (other bands?)
- *Spitzer* and/or *Kepler* μ lens parallaxes
- *HST* followup of μ lens planets
- Ground-based H-band survey (w/ VVV?)
- M31 μ lens survey

HST Survey: Immediate Science

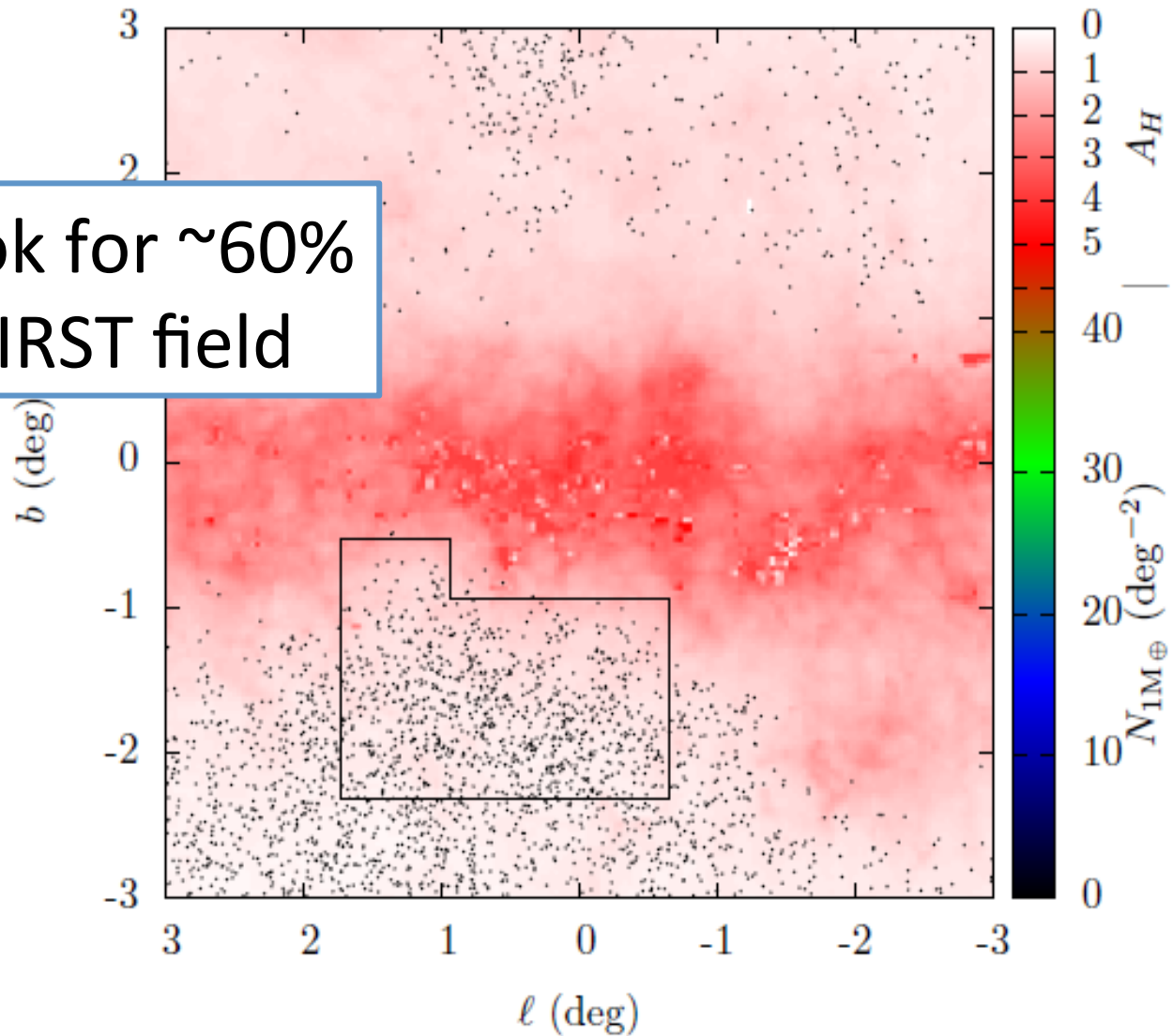
- Mass Estimates/Upper Limits of All Historic μ lens events in this area
 - Characterization of the Lens Population
 - Vetting of BH parallax candidates
- Mass Estimates of known μ lens planets

I-band HST Survey

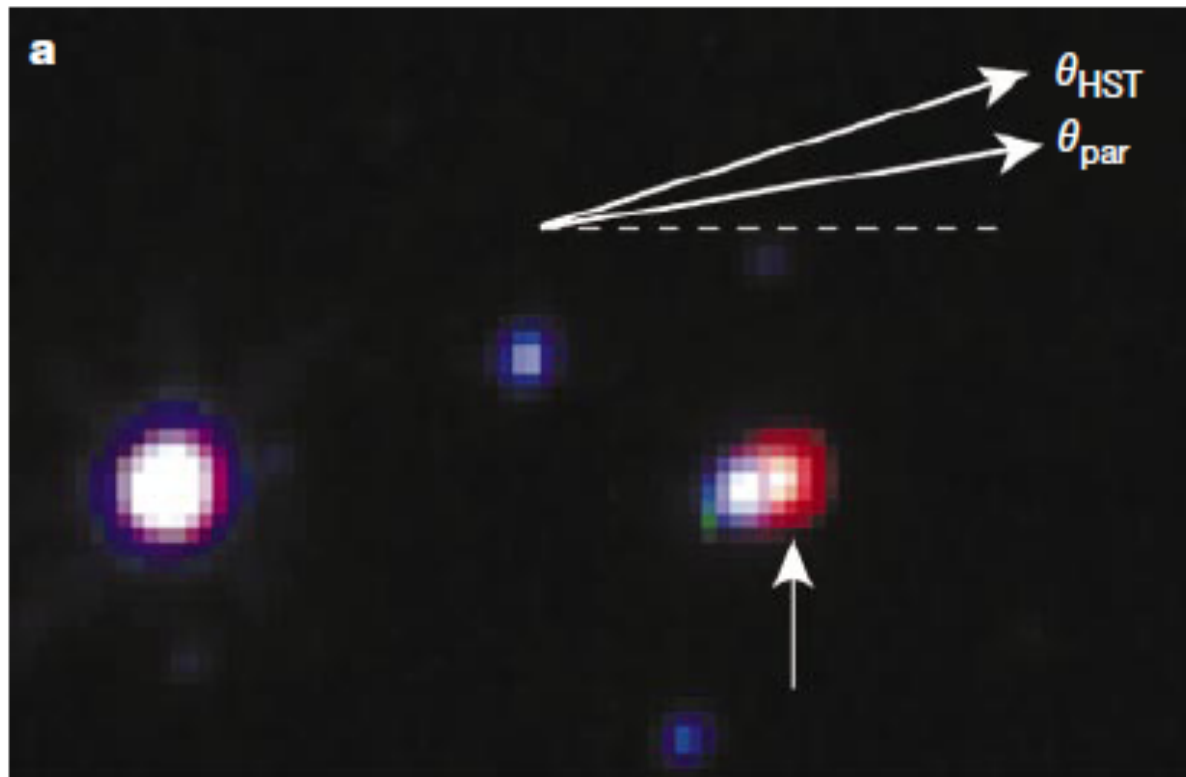


I-band HST Survey

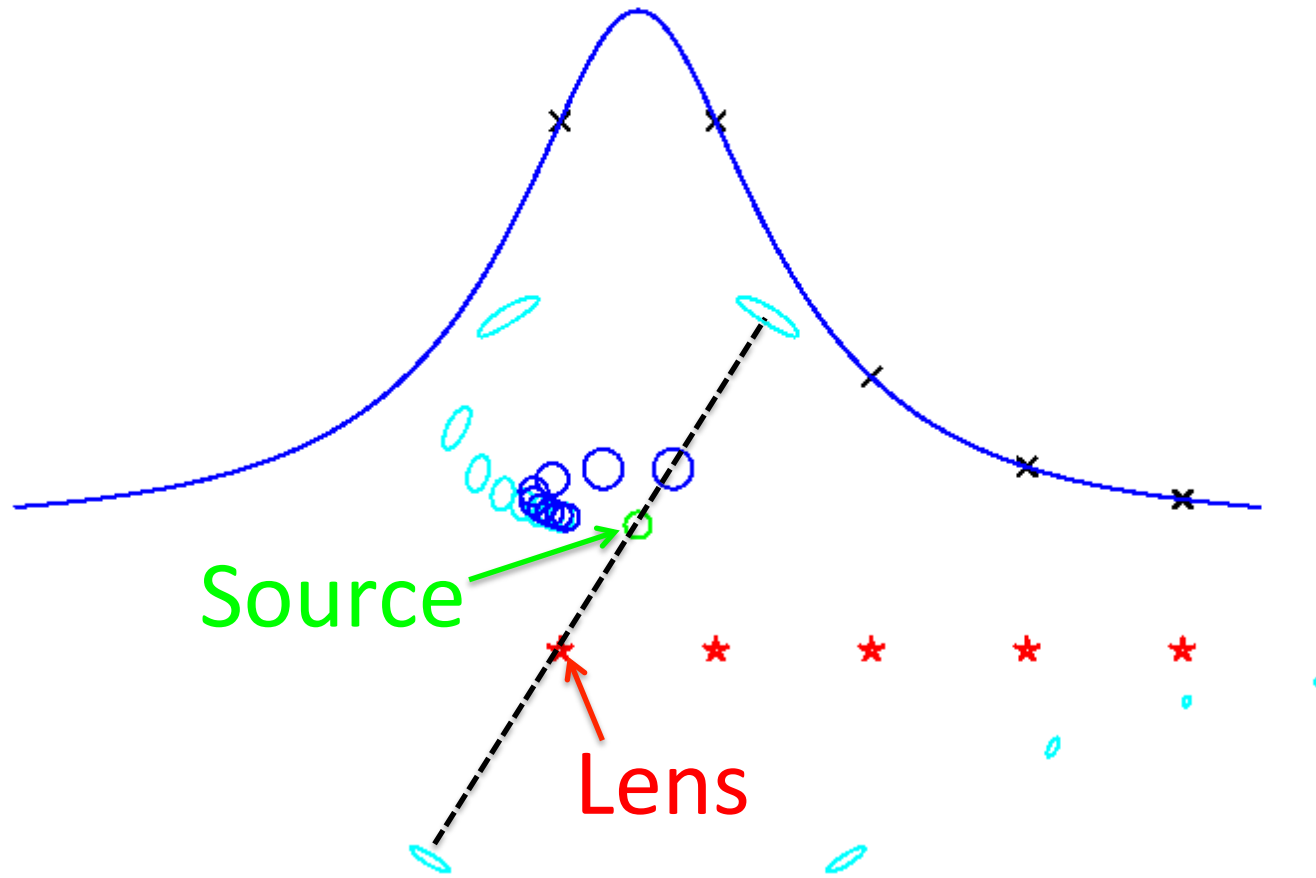
I-band ok for ~60%
of WFIRST field



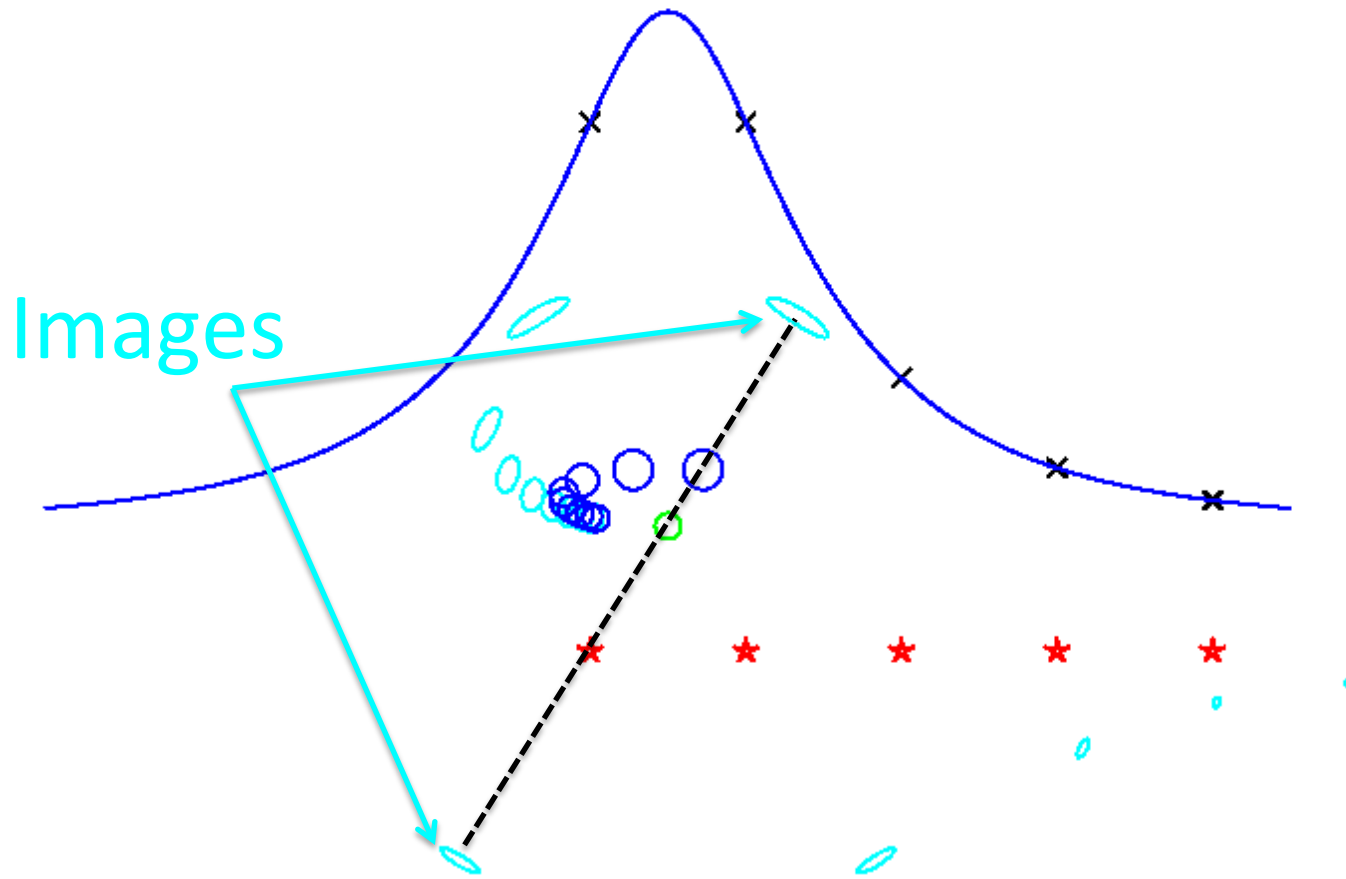
HST Survey: Proper Motions



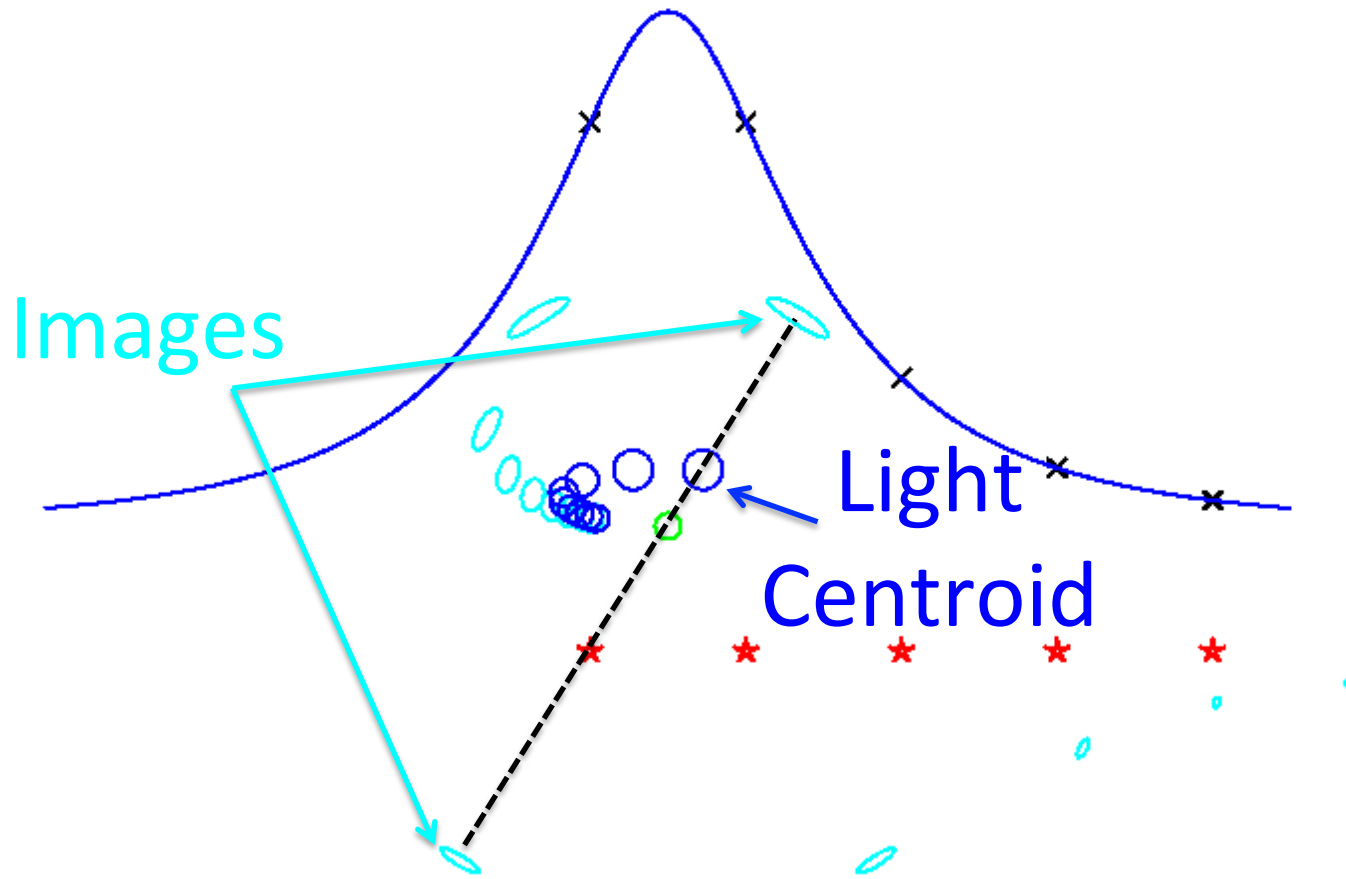
Astrometric microlensing



Astrometric microlensing



Astrometric microlensing

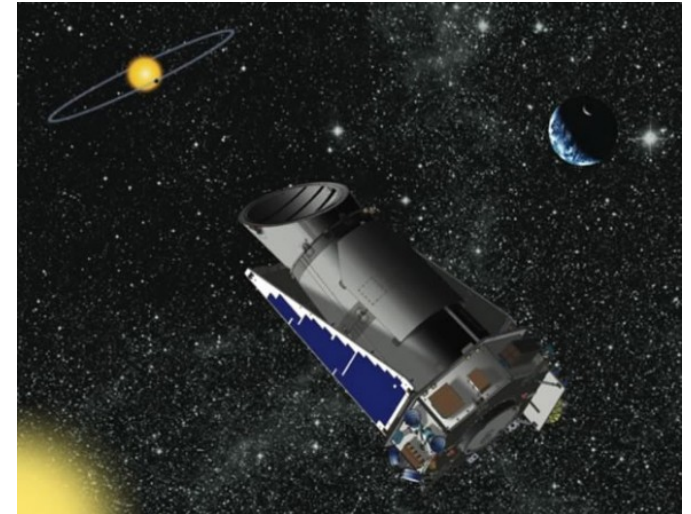
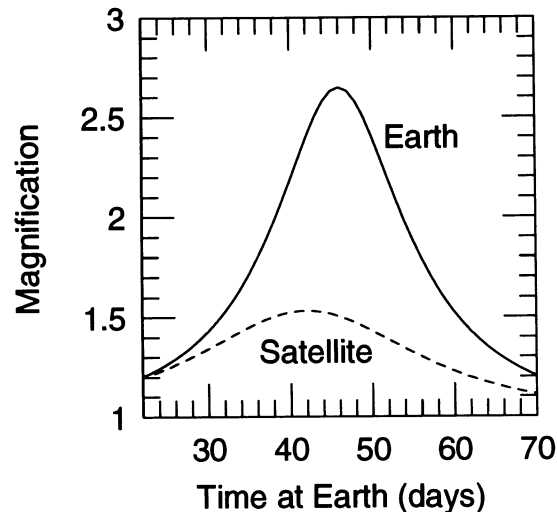
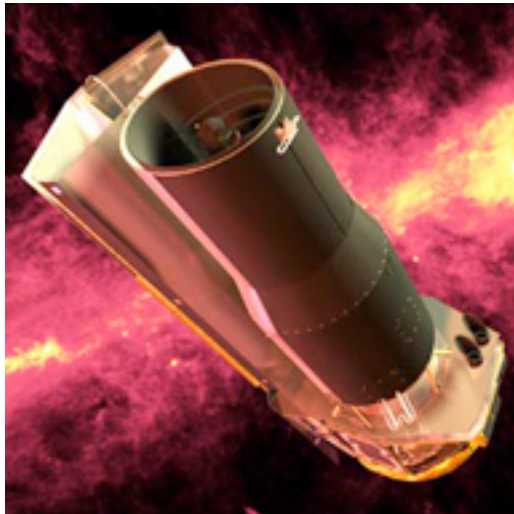


HST Survey: Benefit To *WFIRST*

- Proper Motions
 - Vetting of *WFIRST* astrometric mass measurements
 - Characterization of BHs and Neutron Stars
 - Identification of BDs (isolated and in BD-BD binaries)
 - Stellar distribution (mass and distance)
- CMDs → Mass/Luminosity Functions
 - Field Selection

Spitzer and *Kepler* Parallaxes

- Measurements of Mass and Distances for 4 μ lens events/year
- Galactic Distribution of Planets
- Potential pathfinder for future mission



Ground-based H-band Survey

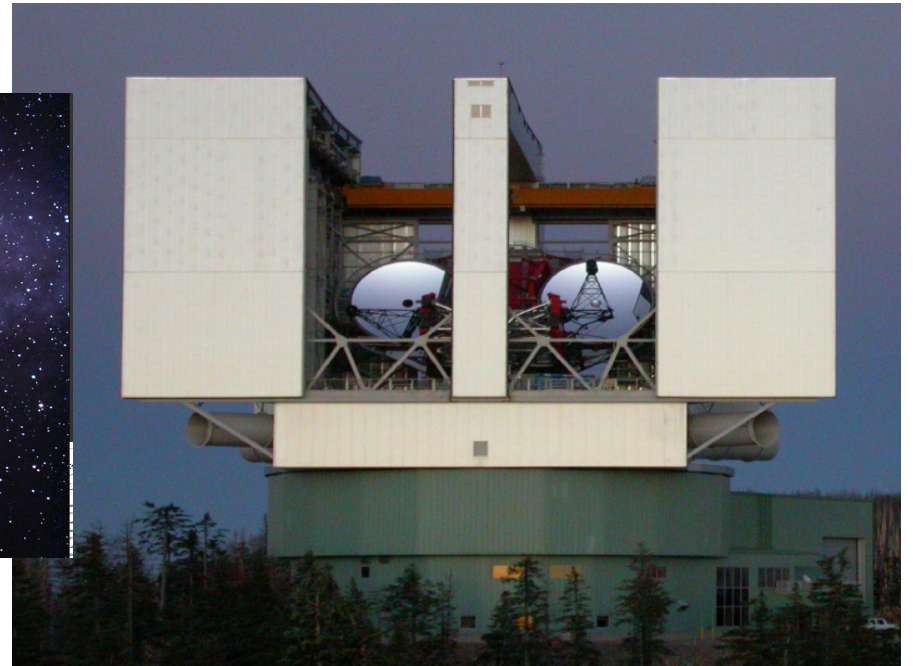
- Microlensing event rate
- Galactic distribution of Giant Planets
- Synergy with Optical Surveys

(clearly not as deep
as *WFIRST*)



M31-LBT μ lens Planet Survey

- Planet frequency/type by galactic environment
- Pathfinder for *WFIRST* M31 μ lens survey

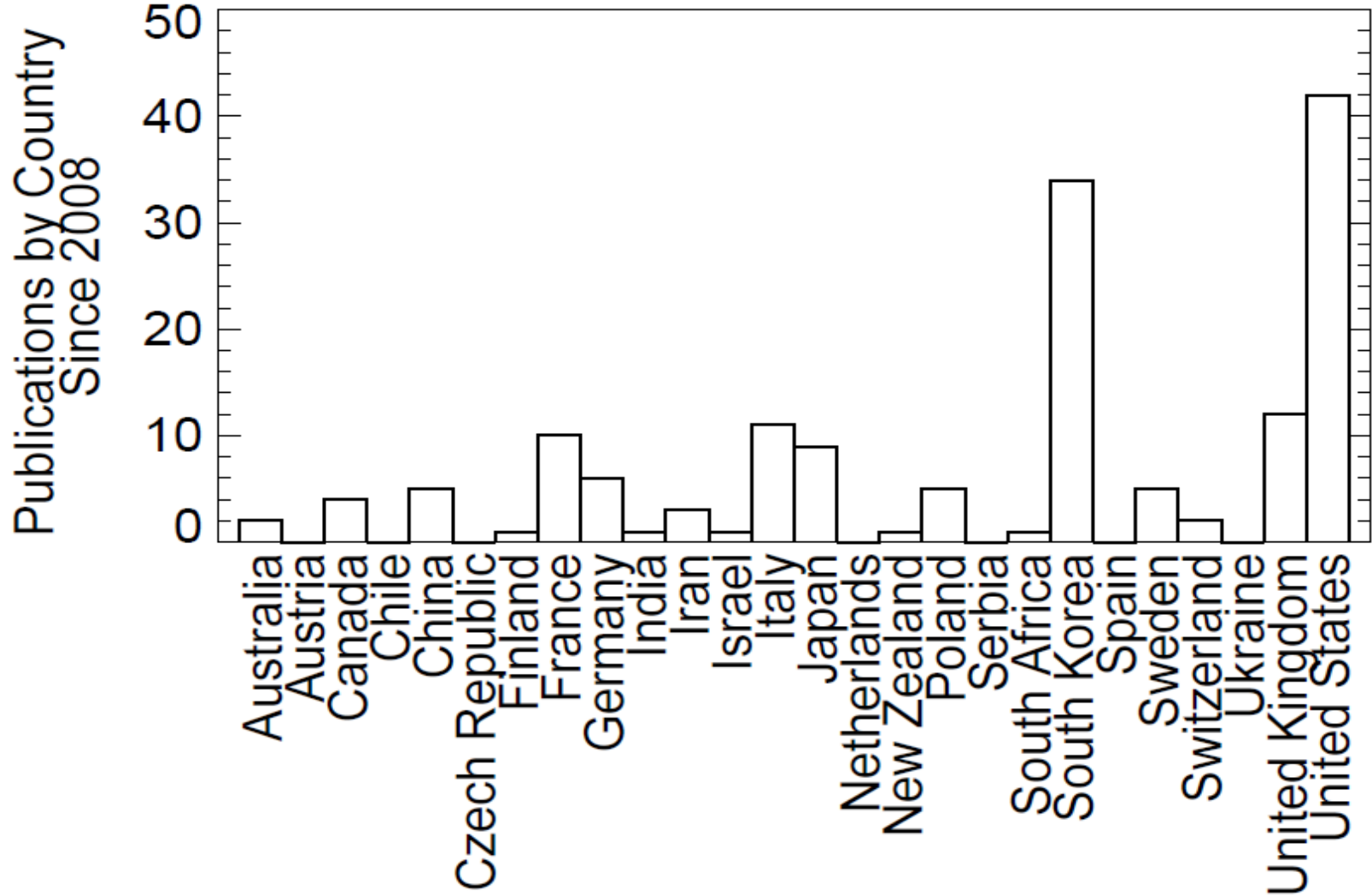


Potential Topics

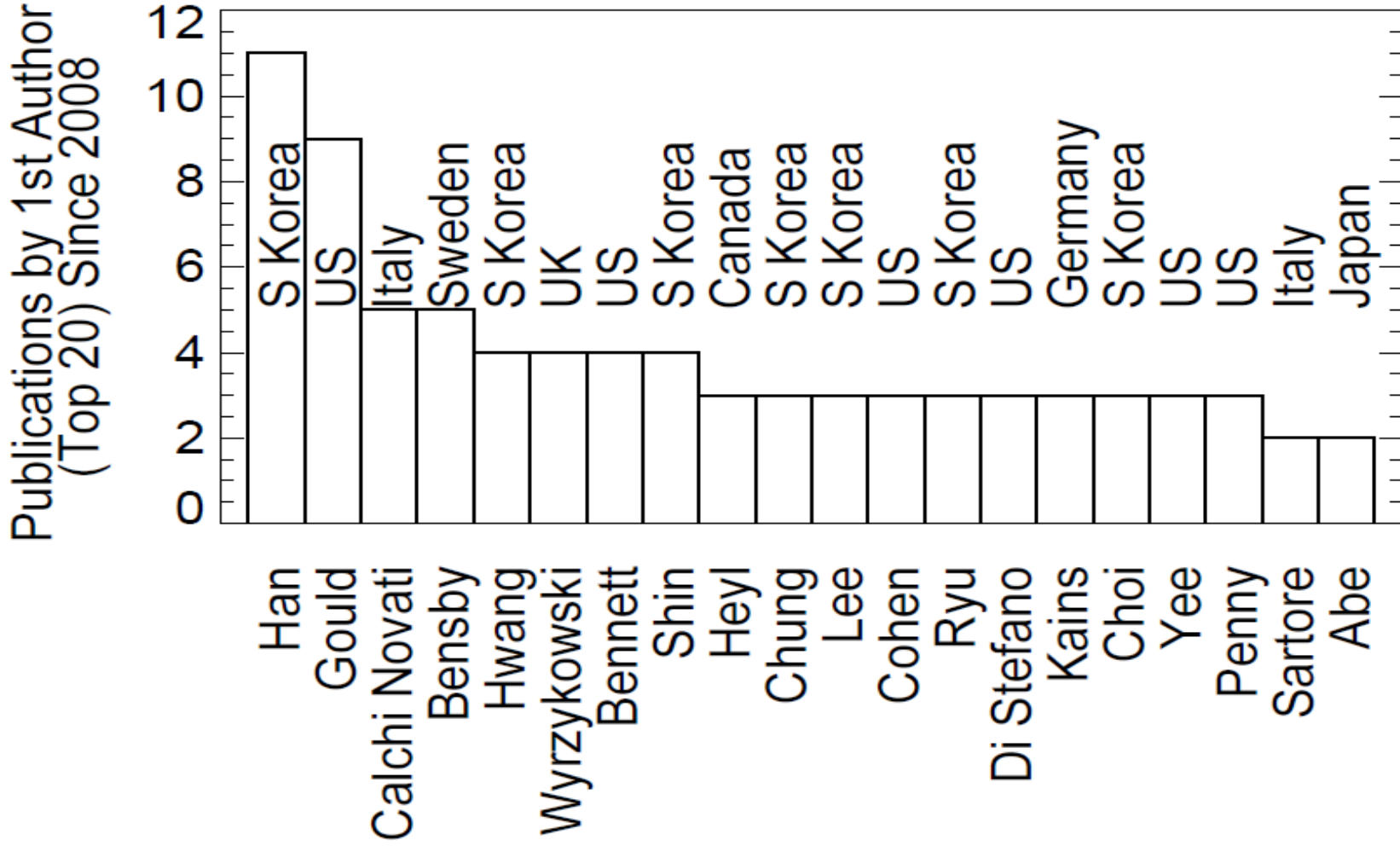
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All of them would build human potential for
WFIRST

μ lens papers by country of 1st author



μ lens papers by 1st author



SAG 11 Timeline

- Dec 15th - Announcement of the SAG
- Jan 4-5th - Overview of the SAG at ExoPAG 9
- Jan 22, 2014 - First meeting of the SAG
- Feb 2014 - Second meeting of the SAG
- April 2014 - Draft report of the SAG/telecon
- May 2014 - Final SAG report
- Summer 2014 - SAG report at ExoPAG 10?

SAG 11 members

Jean-Philippe
Beaulieu

David Bennett

Geoff Bryden

Arnaud Cassan

Sun-Ju Chung

Scott Gaudi

Neil Gehrels

Andy Gould

Matthew T. Penny

Nicholas Rattenbury

Ryu Yoon-Hyun

Rachel Street

Takahiro Sumi

Jennifer C. Yee

Contact:

jyee@cfa.harvard.edu