Exoplanet Measurements from Solar System Probes

Background and Motivation

David Bennett

1993 : 1st Microlensing Events

- Could mean that Milky Way's dark halo was made of brown dwarf or old white dwarfs
- But we don't know if the lens objects are in the Milky Way halo, disk, or Large Magellanic Cloud
- A 30cm telescope in a heliocentric orbit would answer this question
  - Dark Object Microlens Explorer (1995 Midex proposal)
    - PI: Alcock
    - Lost to WMAP
  - But the 30cm telescopes are launched into heliocentric orbit regularly by NASA's Solar System Exploration Division

Late 1990's

- Attempted Cassini Cruise Phase Observations of Microlensing events
- Convinced Cassini/ISS PI Carolyn Porco to attempt test observations
  - But after reaction wheel anomaly, test observations and many other cruise phase ISS observations are canceled.

2003-2004

- Worked with Mike A'Hearn on Deep Impact Extended Mission after HQ allows "new science" extended mission proposal: Deep Impact Microlens Explorer (DIME)
- Support from JPL
- Extended mission proposed prior to launch due to
- But, at the last minute, DI launch pushed back from 2004 to 2005 - and JPL proposal team recalled for prime mission work
- Proposed with pseudo-budget estimated by GSFC
  - Rejected due to dubious budget
  - Strong science review - told to re-propose in 2005
- 2005 AO canceled

2005-2010

- Deep Impact completes prime mission: Nov. 2005
- EPOCh and DIXI proposals submitted to Discovery 2006 competition
- Selected in combined EPOXI mission in July, 2007
- EPOCH exoplanet mission ran from Jan.-Aug., 2008
- Comet Boethin goes AWOL - so Nov. 2010 flyby of Comet 103P/Hartley instead of Dec., 2008 flyby of Boethin
- Microlensing Deep Impact opportunity missed due to proposal schedule - not science
  - Science case faded a bit
- EPOCh used only 8 months out of 5 yr extended mission

Exoplanet **P**rogram **A**nalysis **G**roup

- Formed in 2010 as lowest level of NASA advisory structure
  - Does “analysis” instead of “advice”
  - Reports to the Astrophysics Subcommittee of the NASA Advisory Council
- Based on success of PAGs in Solar System Division
- 5 Science Analysis Groups Selected:
  1. Debris Disks and Exozodiacal Dust
  2. Potential for Exoplanet Science Measurements from Solar System Probes
  3. Planetary Architecture and Dynamical Stability
  4. Planetary Measurements Needed for Exoplanet Characterization
  5. State of External Occulter Concepts and Technology

Goals for ExoPAG SAG 2:

- Determine the Exoplanet science that is possible with solar system missions
- Are there (low risk) instruments that can be added to missions in development?
  - e.g. GRB detectors for timing localization
- Look at practical implementation issues
  - Late and extended mission observations don't risk prime science
  - Sources of funding
- Parallel efforts
  - Mario Perez (HQ) - astrophysics w/ solar system missions
  - Cosmology at 5 AU