National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

ExoPlanet Exploration Program

Report on KISS workshop

Innovative Approaches to Exoplanet Spectra

Wes Traub
with Yuk Yung, Steve Unwin, & Mark Swain

Exoplanet Science Measurements from Solar System Probes
KITP, UCSB Campus, Santa Barbara
18-19 May 2010

Sponsored by Keck Institute for Space Studies (KISS)
Kavli Institute for Theoretical Physics (KITP)

Purpose

- Our purpose is to generate new ideas for exoplanet science observations, using near-term platforms.
- Platforms include aircraft, balloons, rockets, & the ISS.
- We will start with a Short Course on exoplanets.
- We will then look at each platform, and list all the crazy ideas you can think of.
- Priorities: 1. near-term, 2. science, & 3. cost.
- We will then meet in sub-groups to refine those ideas.
- We will end up with a few ideas per platform.
- These ideas can be pursued by us and others.
- We will generate a brief report summarizing the mtg.
- We will put all talks on-line.

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Schedule

- Tues.: Short Course, Near-term Science, Aircraft
- Wed.: Balloons, Suborbital NASA & Commercial Rockets
- Thur.: Rockets to orbit, ISS, Initial breakout groups
- Fri.: Breakout groups, Reports, Findings.

- Session Chairs: Initiate & guide your session discussion.
- Speakers: Keep it short, save some charts for backup.
- Breaks, lunches, & dinners are for continued discussion.
- Amanuensis: Roger Carlson

Related events

- Bridging the Gap to Space, 26-28 Oct., Boulder, Eliot Young
- X-prize competitions, several, 2 Nov.
- Space Elevator Competition, 9 Nov., Edwards CA, NASA
- JPL Next-Gen Suborbital S/C Payload Workshop, 13 Nov., JPL, J.Kwok (JPL) & M.Isakowitz (CSF)
- Student payloads for balloons, 18 Dec. deadline, NASA
- Next-Gen Suborbital Res. Conf., 18-20 Feb, Boulder, Alan Stern
- **Theory & Obsservation of Exoplanets, Jan-May, KITP, A. Burrows, K. Menou, & D. Stevenson**
- KISS follow-up funding is possible

48 Participants

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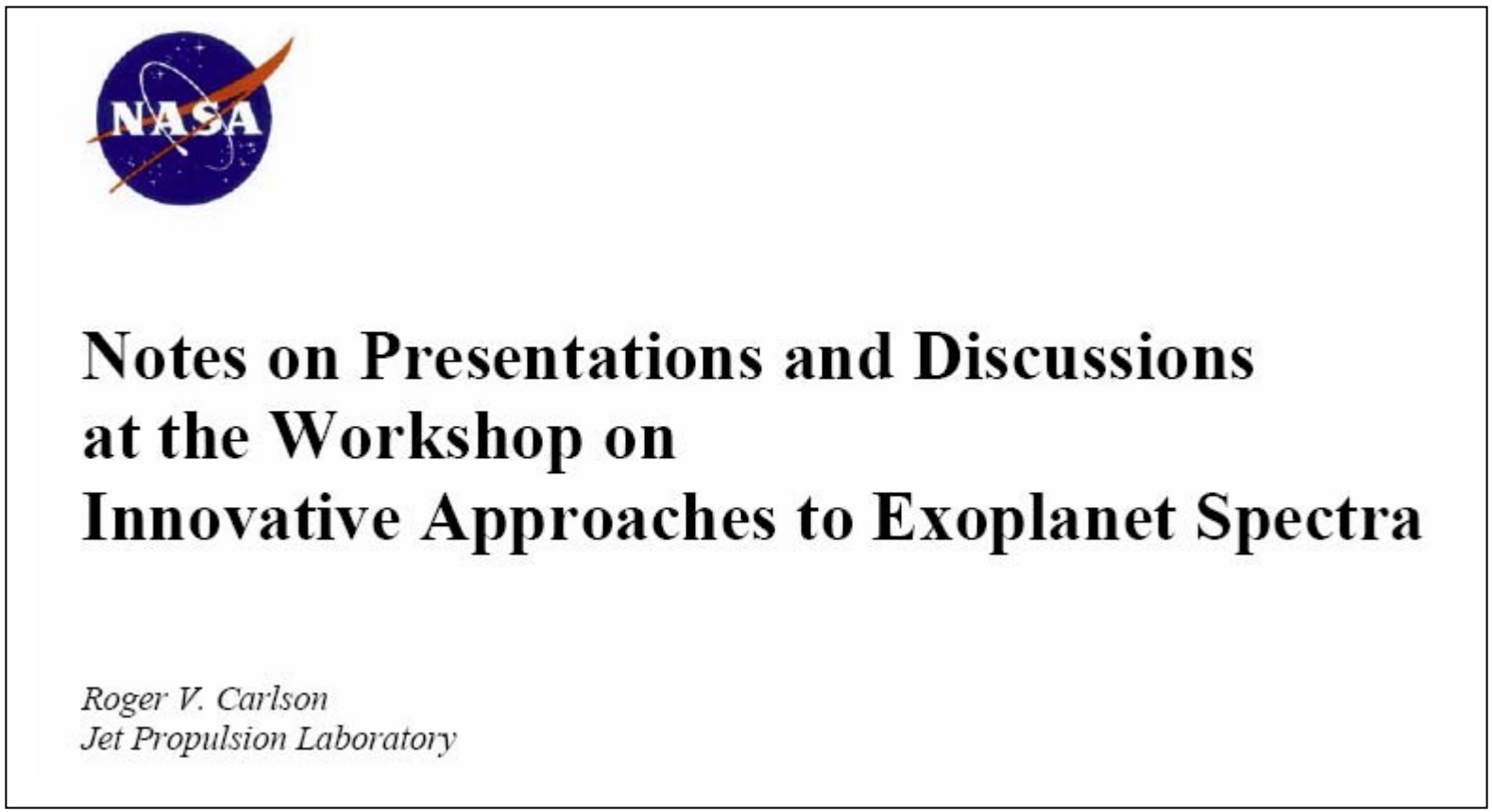
First	Last	Institution	Discipline
Konstantine	Batygin	Caltech	atmospheres
Chas	Beichman	Caltech_NEXScI	Proto-planet disks
Dan	Belden	USAF	DoD rockets
Rus	Belikov	Ames	Coronagraphs
Beth	Biller	U. Hawaii	observations
Jeff	Booth	JPL	balloons
Eric	Cady	Princeton	imaging exoplanets
Kerri	Cahoy	Ames	direct imaging & characterization
Roger	Carlson	JPL	technical writer
Joe	Carroll	Tether Appl.	Small spacecraft
Supriya	Chakrabarti	BU	Rockets
Pin	Chen	JPL	Atmospheric chemistry
Arvid	Croonquist	JPL	ISS
Carl	Grillmair	Caltech	Transits
Joe	Harrington	UCF	Exoplanet observations
Brian	Hicks	BU	imaging exoplanets
John	Johnson	Caltech, IFA	Exoplanet observations
Jeremy	Kasdin	Princeton	Coronagraphs, engineering
Nancy	Kiang	GISS/JPL	Photosynthesis
John	Krist	JPL	Coronagraphs, optics
Shri	Kulkarni	Caltech	Astrophysics
Mike	Line	Caltech	atmospheres
Tom	Mace	Dryden	Aircraft platforms
Bruce	Macintosh	LLNL	Exoplanet coronagraphy
Mark	Marley	Ames	Giant planet theory
Taro	Matsuo	JPL/NAOJ	coronagraphs
Beverley	McKeon	Caltech	Turbulence
Bertrand	Mennesson	JPL	Interferometry
David	Miller	MIT	Cubesats
Barth	Netterfield	U.Toronto	Balloon pointing, astrophys.
Lewis	Roberts	JPL	Atmospheric seeing
Rocco	Samuele	NGAS/JPL	Laboratory instrumentation
Dmitry	Savransky	Princeton	direct detection of exoplanets
Gene	Serabyn	JPL	Coronagraphs, interferometers
Michael	Shao	JPL	Interferometers, coronagraphs
Steven	Smith	SWRI	Stationary airships
Remi	Soummer	STScI	Coronagraphs
Karl	Stapelfeldt	JPL	Proto-planet disks
Mark	Swain	JPL	Exoplanet spectroscopy
Motohide	Tamura	NAOJ	Space telescopes
Wes	Traub	JPL	Exoplanet science, instruments
John	Trauger	JPL	Coronagraphs
Mitch	Troy	JPL	Coronagraphs, ground
Stephen	Unwin	JPL	Interferometers
Gautam	Vasisht	JPL	Observation, instrumentation
Erick	Young	SOFIA	SOFIA
Eliot	Young	SWRI	small payloads
Yuk	Yung	Caltech	Planetary atmospheres

Website, notes, & presentations

http://www.kiss.caltech.edu/workshops/exoplanet2009/index.html



Notes on Presentations and Discussions at the Workshop on Innovative Approaches to Exoplanet Spectra

Roger V. Carlson
Jet Propulsion Laboratory

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Innovative Approaches…Exoplanets (1 of 4)

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- **Short-course talks**
  - Chas Beichman — debris disks
  - Lynne Hillenbrand — zodi
  - John Johnson — system architectures
  - Jeremy Kasdin — system evolution
  - Nancy Kiang — photosynthesis signatures
  - Yuk Yung — atmospheres
  - Carl Grillmair — combined light
  - Mike Shao — astrometry & microlensing
  - John Trauger — direct detection
- **Science goals**
  - Joe Harrington — Spitzer
  - Mark Marley — giant planet spectra
  - Karl Stapelfeldt — architectures
  - Wes Traub — super Earths

Innovative Approaches…Exoplanets (2 of 4)

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- **Aircraft platforms**
  - Tom Mace — airborne Earth sensing
  - Erick Young — SOFIA
- **Balloon platforms**
  - Jeff Booth — pointing
  - Pin Chen — seeing
  - Barth Netterfield — balloons
  - Steve Smith — lighter-than-air vehicles
  - Gautam Vasisht — combined light
  - Eliot Young — low-cost access
- **Suborbital rockets**
  - Supriya Chakrabarti — PICTURE
  - Mike Shao — coronagraph on a rocket

Innovative Approaches…Exoplanets (3 of 4)

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- **Commercial & military rockets**
  - Matthew Isakowitz science opportunities
  - Dan Belden USAF rocket access
  - Joe Carroll options & issues
  - Joe Harrington combined light from orbit
  - Taro Matsuo Japanese platform on ISS
  - Remi Soummer coronagraphy from orbit
  - Gautam Vasisht transits from orbit
  - Eliot Young commercial satellites
- **ISS**
  - Mike Clayton WB-57
  - Arvid Croonquist ISS specifications
  - John Krist coronagraphy from the ISS
  - David Miller ISS and microsatellites
  - Rocco Samuele transits from the ISS

Innovative Approaches…Exoplanets (4 of 4)

- **Bottom line for exoplanet observations**
  - SOFIA may be useful, but other aircraft are not
  - balloons have good promise, overnight & ULDB (1 proposal)
  - sub-orbital rockets may be useful (1 existing exp.)
  - military rockets can lift large guest payloads on F-ring (0 proposals)
  - commercial rockets may be useful, but not clear yet (0 proposals)
  - ISS is a good platform, worth pursuing (xx? proposals)