



The Future of XO Planets

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ABSTRACT

The XO Project in its original form discovered five transiting gas giant planets, XO-1b, XO-2b, ... XO-5b. XO continues now in an expanded, globally networked mode of operation with longitudinally dispersed sites and fully autonomous robotic observatories in individual enclosures. XO's objectives are both scientific and cultural. Scientifically, XO seeks the longer-period, cooler gas-giant planets of the brighter stars to which the first-generation transit surveys were relatively insensitive. Culturally, XO seeks to assist in preparing a larger, international community to participate in the discovery and characterization of transiting gas giants, with an eye toward ~2017 when space-based all-sky transit survey(s) will inundate the community with them by the thousands, orbiting stars bright enough to enable suitable characterization of representative subsets.

ASTROPHYSICAL GOALS

XO Planet Survey:

- More XO planets, transiting gas giants orbiting bright stars ($V < 12$ mag).
- More \rightarrow determine variety and diversity of exoplanets
- Longer periods (weeks, not days) \rightarrow population different from that with 3-day orbits.

XO Planet Characterization:

- Best exoplanetary characterization of the best exoplanets with HST, JWST, etc.
- Better photometry & spectroscopy in verification phase.
- More RVs \rightarrow better eccentricities, M_{planet} & R_{planet}
- Long-term photometric monitoring (amateurs/decades).

XO Survey Unit e pluribus unum



Specifications:

- Three XO units at present time...more as interest and funding permit (see "Join us" box).
- Each XO unit is \$50k, autonomous, and self-contained.
- Fully operational with roof closed.
- Two wires, electricity and internet, supplied by host site. (Off-grid solar with sneaker-net, optional).
- One enclosure (ScopeCraft).
- One weather station (Boltwood II).
- One German equatorial mount (S. B. Paramount ME)
- Two 200-mm f/1.8 lenses (Canon).
- Two 1k x 1k 24-um Kodak CCDs (Apogee).
- Bandpass = 400-700 nm.
- One PC (Ubuntu linux + RTS2 + IDL Virtual Machine).
- One weather station (Boltwood II).
- One ethernet switch, one computer-controlled power bus, one watchdog circuit for reboots.

Locations:

- Three XO units at present time...more as interest and funding permit (see "Join us" box).
- Unit 1 (pictured) Vermillion Cliffs Observatory (Utah USA).
- Units 2&3 planned for deployment at Observatorio del Teide (Canary Islands, Spain)

Schedule:

- Monitor each 500 sq degree sweep for 2 months by three XO units (12 lens-month equivalent times 500 sq degrees).
- On 2-month cycle, analyze data, generate candidates, activate follow up teams.
- Starting Fall 2011. Continuing through 2014 or beyond as interest and resources permit.

XO COMMUNITY INVOLVEMENT

The vision:

- XO planet discovery is a multi-step process that requires a large number of persons and a diversity of resources. The ground-based surveys' aggregate discovery rate is limited by follow up, primarily human talent.
- By 2017, if an all-sky space-based survey supersedes the sum of gas-giant discoveries to date by an order of magnitude, then we should have prepared a larger community of teams to follow up the new discoveries in time to define the most interesting ones for JWST.
- Being prepared requires more participants than currently existing teams.
- XO planet candidate follow up to be organized around areas of sky allocated to teams on a semi-annual basis.

More participants. Perhaps you?

- Maybe you will contribute one of these?
 - Additional longitude/latitude coverage.
 - Culling photometry or spectroscopy.
 - RVs \rightarrow better eccentricities, M_{planet} & R_{planet}
 - Long-term photometric monitoring (decades).
 - Software/algorithm development.
 - Data analysis.
 - Management of a team.
 - Publications.

XO Team

Incomplete list of past and present participants in the XO Project, both discovery and characterization.

Berggren, E.	Fuota, C. N.	Kaustrom, H.	Taylor, B.
Berta, Z.	Fuota, J.	Konze, V.	Tinetti, G.
Bisping, R.	Garcia-Melendo, E.	Korner, R.	Valenti, J. A.
Brown, L. R.	Gary, R. L.	Lang, D.	Vannunier, T.
Brown, T. M.	Gilliland, R. L.	Machalek, P.	Vasht, G.
Burke, C. J.	Greene, T.	Mallin, F.	
Burrows, A.	Gregorio, J.	Mari, G.	
Bye, B. A.	Griffith, C. A.	McCullough, P. R.	
Charbonneau, D.	Hessley, J. N.	Montañés Rodríguez, P.	
Christensen-Dalsgaard, J.	Hébrard, G.	Nolan, E. P.	
Crouzet, N.	Hors, J. L.	Noyes, R.	
Deming, D. L.	Howell, P. J.	Nutzman, P.	
Dewar, P.	Howell, S.	Plavick, A.	
Desert, J.-M.	Janes, K.	Prato, L.	
Dodd, C.	Janes, K. A.	Sky, J. E.	
Fleming, M.	Johns-Krull, C. M.	Summers, F. J.	
Fleming, S. W.	Kjeldsen, H.	Swain, M. R.	

JOIN US!

The continuation of the XO Project is an opportunity for many individuals, teams, and institutions to participate in the discovery and characterization of transiting gas-giant XO planets. You are welcome to join. Contact the XO community organizer, Peter McCullough, to contribute your talents and resources.

Acknowledgments

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