

AST SPECIAL TOPICS: EXOPLANETS
MISC. LECTURE NOTES: SPRING 2015

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WEEK 2, DAY A: EXOPLANET CENSUS

A statistical smorgasbord based on

http://exoplanetarchive.ipac.caltech.edu/docs/counts_detail.html

(1) Overview

- Total exoplanet count as of Feb. 3 2015 is 1810; of these, 1205 are transiting exoplanets
- To date the vast majority of planets have been detected/discovered via the transit technique (1183), w/ the vast majority of these detections credited to the Kepler mission (1021)
- Kepler claims 4175 “candidates”; 3186 of these are unconfirmed; note that the difference between these two numbers is NOT 1021 — why not?
- radial velocity detections rank second (529)
- imaging (35) and microlensing (28) are in a near-tie for (a distant) third place
- all other techniques combined have yielded ~ 35 detections

(2) Census of fundamental exoplanet properties and how (and how well) we know these properties

- Confirmed Planets with measured/estimated masses: 535
- Confirmed Planets with measured/estimated $m \sin i$: 483
- Confirmed Planets with measured/estimated radii: 1213
- Clicking into each of the above (starting with mass), and examining the resulting table, one might well ask things like:
 - Why do any planets discovered by the transit technique (Kepler-XXX) have masses associated with them? (HINT: reorder table by period)
 - Why do (almost?) ALL planets discovered by the transit technique have mass values, and not $m \sin i$ values?

- Are exoplanet orbital periods, masses, etc. always “well determined”?
 - How many significant figures are used in these listings, and what determines the choice of number of sig figs? (Can one trust ALL the sig figs listed in these tables?)
 - Clicking into “imaging”, and examining the resulting table, one might well ask things like:
 - Since we can measure a for all of these exoplanets, why do so many entries lack P ?
 - Should we be suspicious of the masses listed for exoplanets discovered via imaging?
- (3) All of which raises the question: how can we trust ANY of the information in the NASA Exoplanet archive?
- See http://exoplanetarchive.ipac.caltech.edu/docs/contribute_data.html
 - “All data or values must come from a peer-reviewed and accepted publication. All contributions must include the reference information, including journal name, page and volume or astro-ph number.”
 - Click on the “?” icon next to the “host name” and gets a more complete summary of data for the exoplanet and its host star, including the publication claiming its discovery and the reference(s) for the planet’s parameters/properties.
 - Good targets to try this on (one each from the RV, transit, and imaging methods):
 - 4 UMa (RV...first object in the entire exoplanet catalog [why]?)
 - CoRoT-1 b (transit w/ RV followup)
 - CFBDSIR J145etc (imaging)
 - Click into the reference listed of each of the above. Each paper’s abstract immediately offers an overview of the specifics of the technique used, and how the results for the exoplanet were obtained.
 - However, in my short perusal of a couple of these entries, I couldn’t find multiple-field entries with multiple references. Are there any examples of, e.g., an exoplanet with mass and radius determinations from different sources?