NASA’s Kepler Mission Announces a Planet Bonanza, 715 New Worlds
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NASA’s Kepler Mission:
Searching for planets around other stars
Detecting Planets
Exoplanet Missions

Hubble
Spitzer
Kepler
JWST
TESS
WFIRST-AFTA
New Worlds Telescope

Ground-based Observatories

2001 Decadal Survey
2010 Decadal Survey

Astronomy and Astrophysics in the New Millennium
New Worlds, New Horizons in Astronomy and Astrophysics
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Planet Candidates
As of November 4, 2013

Total = 3,601
Common False Positives
Opening the Planet Verification Bottleneck
Multiplicity

- Of Kepler’s 150,000 stars, only a couple thousand stars have a transit-like pattern.
- If patterns appeared randomly, only a few stars would have more than one pattern.
- But … hundreds of stars have multiple transit-like patterns.

Multiplicity is not random!
What are the Multis?
Planets occur in systems like our solar system.
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A similar configuration of stars would be unstable.
Discoveries: Then and Now
Summary

- 715 newly verified planets orbiting 305 stars
- Increases total known planets to nearly 1,700
- Multiplicity is a powerful technique for wholesale planet verification
- Results are based on the first two years of observations
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Sizes of Verified Planets
As of February 26, 2014

Number of Planets

- Earth-size (< 1.25 R⊕)
- Super Earth-size (1.25 - 2 R⊕)
- Neptune-size (2 - 6 R⊕)
- Jupiter-size & larger (> 6 R⊕)

Yesterday:
- Earth-size
- Super Earth-size
- Neptune-size
- Jupiter-size & larger
Sizes of Verified Planets
As of February 26, 2014

Number of Planets

- **Today**
- **Yesterday**

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- **Super Earth-size** (1.25 - 2 R⃣)
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- **Changes**
  - Earth-size: +400 %
  - Super Earth-size: +600 %
  - Neptune-size: +200 %
  - Jupiter-size & larger: +2 %
Multiple Planet Population

Size Relative to Earth (radius)

Orbital Period (days)

February 2014

Jupiter
Neptune
Earth
Small, Flat, and Circular

Multiple planet systems are similar to our inner solar system
Summary

• Kepler introduces 715 new planets – all in multiple planet systems
  • 94% are smaller than Neptune
  • Four new habitable zone planets

• Multi-planet systems are highly valuable
  • Good for demographic studies
  • Tell us about planets and planet formation

• The new systems have small planets with flat and circular orbits like our inner Solar System
  • Reminds us of home, placing ourselves into context!

• Multiplicity is a powerful technique for wholesale planet verification

• Hundreds more planets are expected from Kepler’s 4-years of data
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Kepler’s Ongoing Legacy:
Understanding planet formation and evolution
and our place in the Galaxy
For more information, please visit:

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