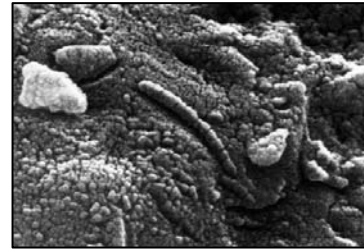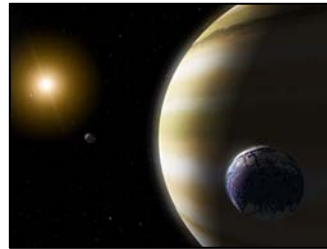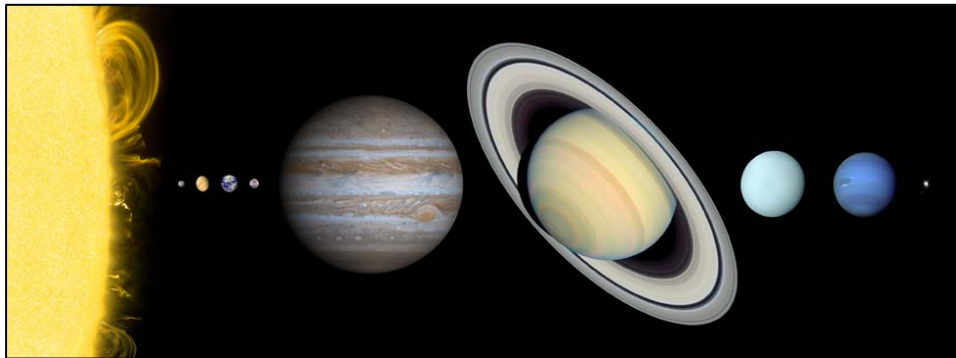# Looking for Little Green Men
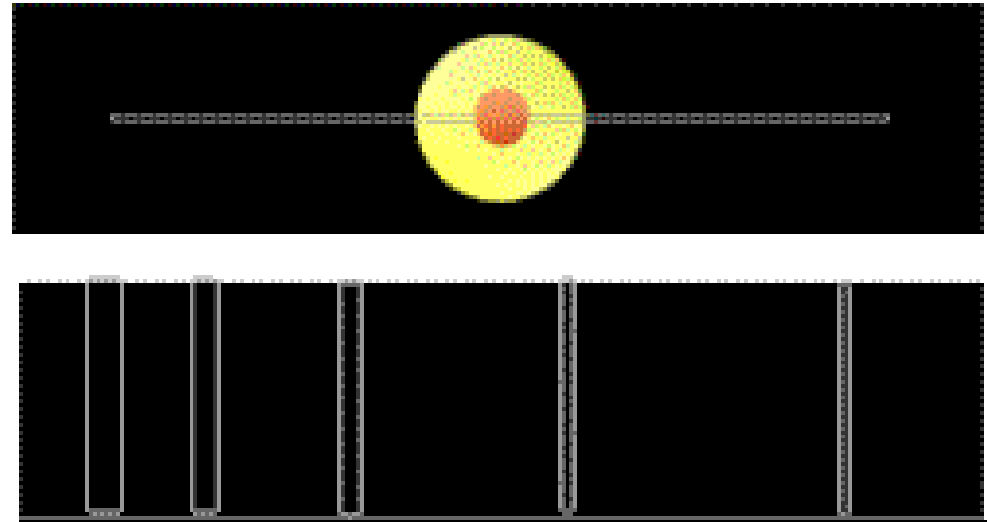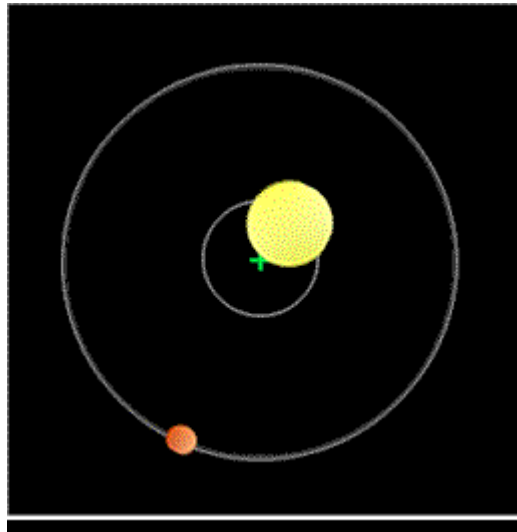
Filip Jagodzinski
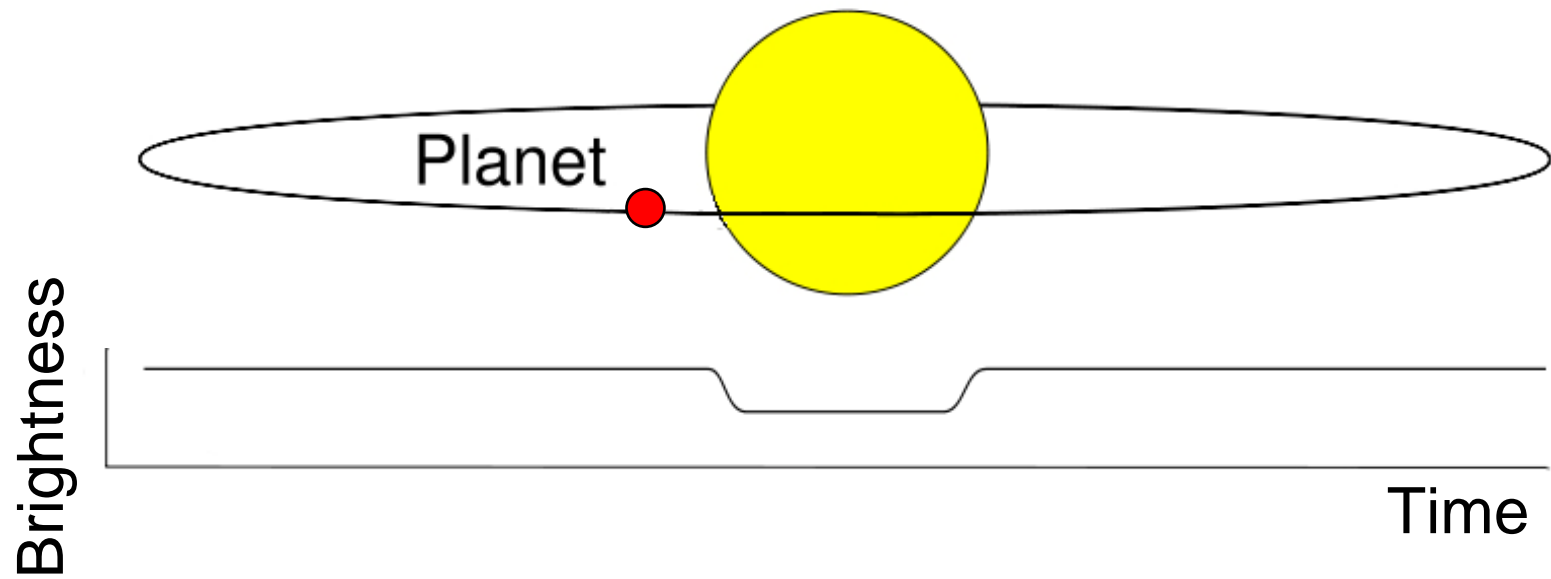01 October 2007

Life is ...

200 to 400 Billion Stars
100,000 light years in diameter
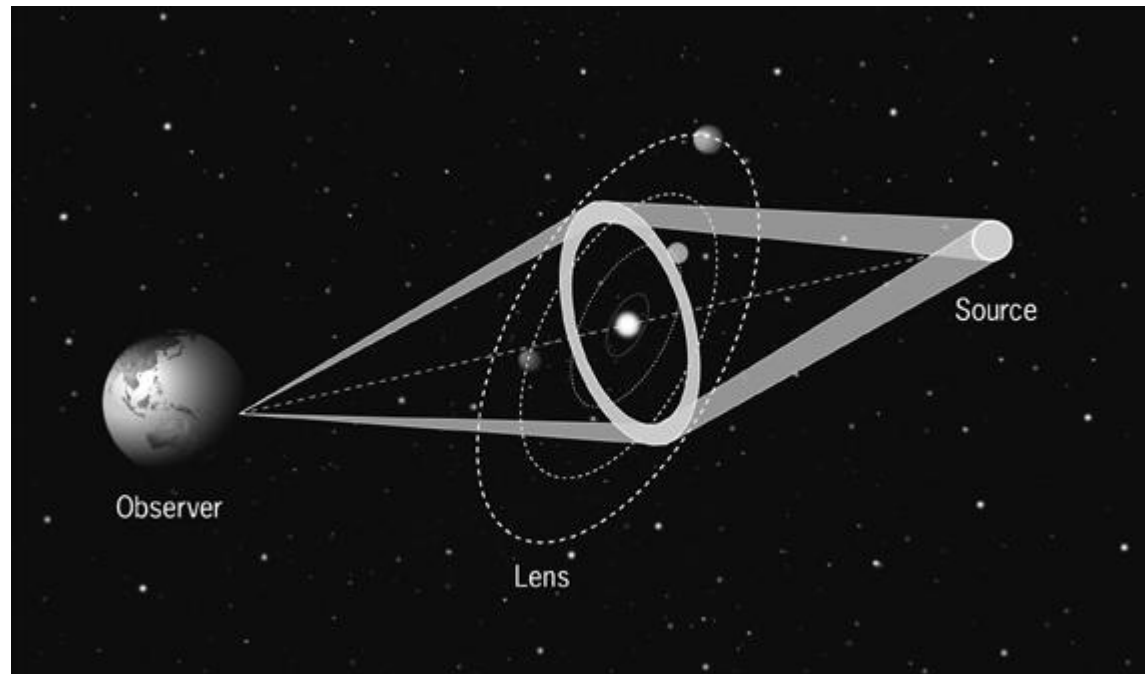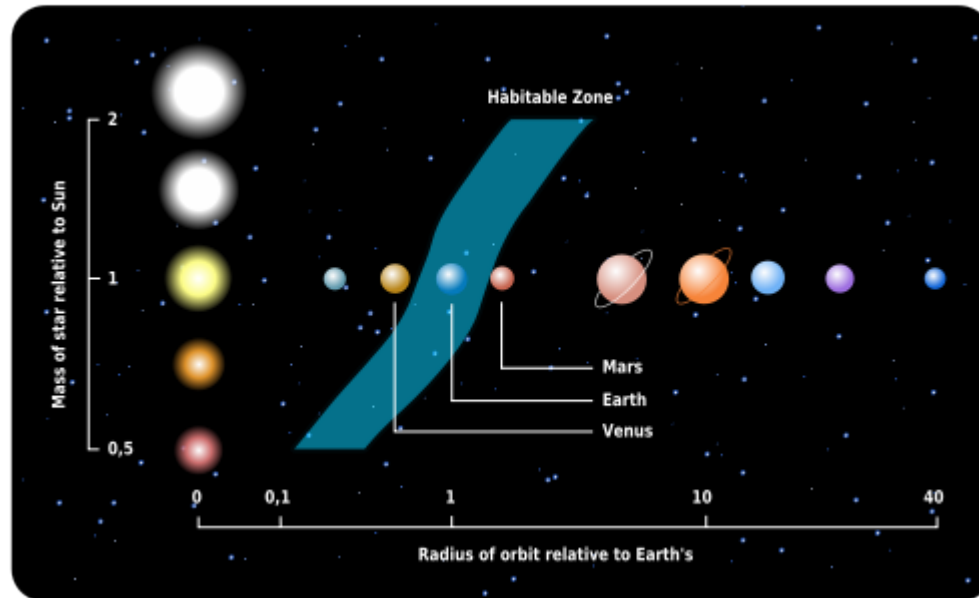~ 30k parsecs

Detecting Planets – The Doppler Shift

Detecting Planets – Planetary Transit
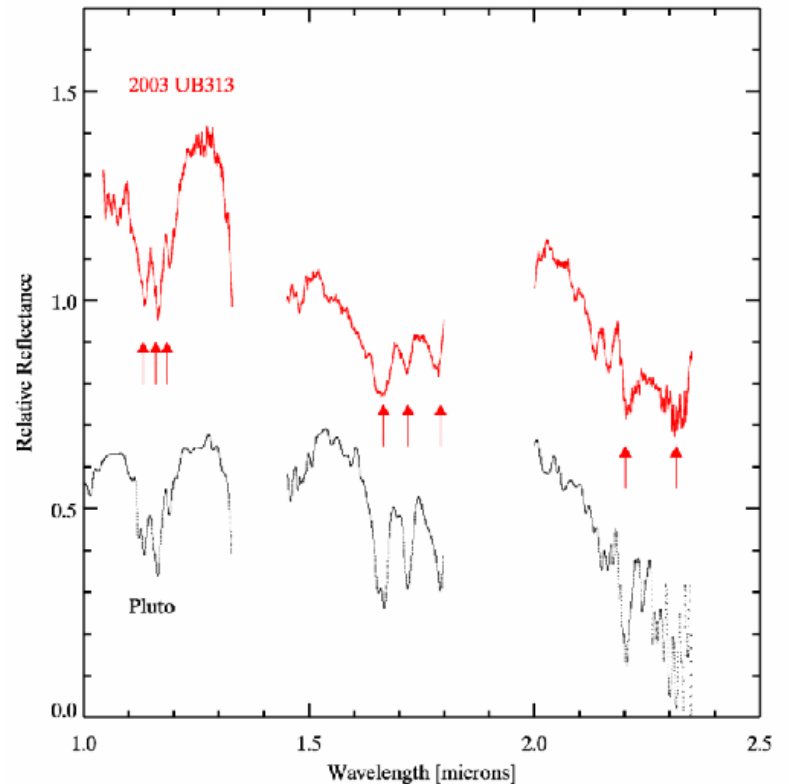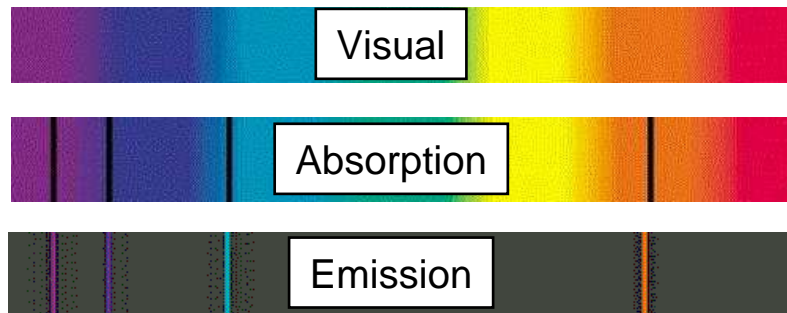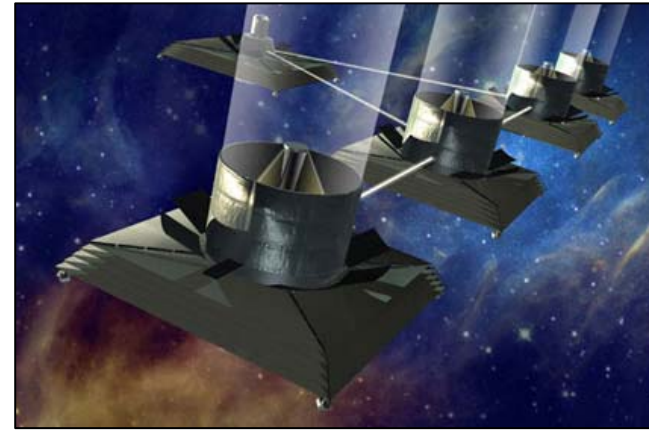
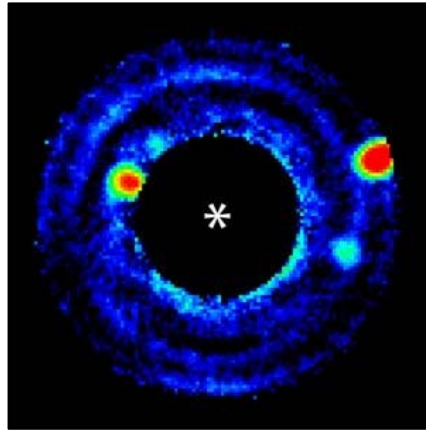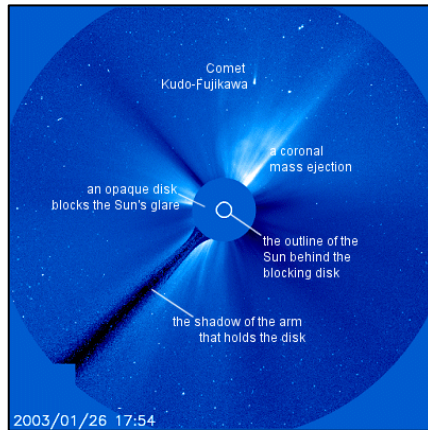# Detecting Planets – Microlensing

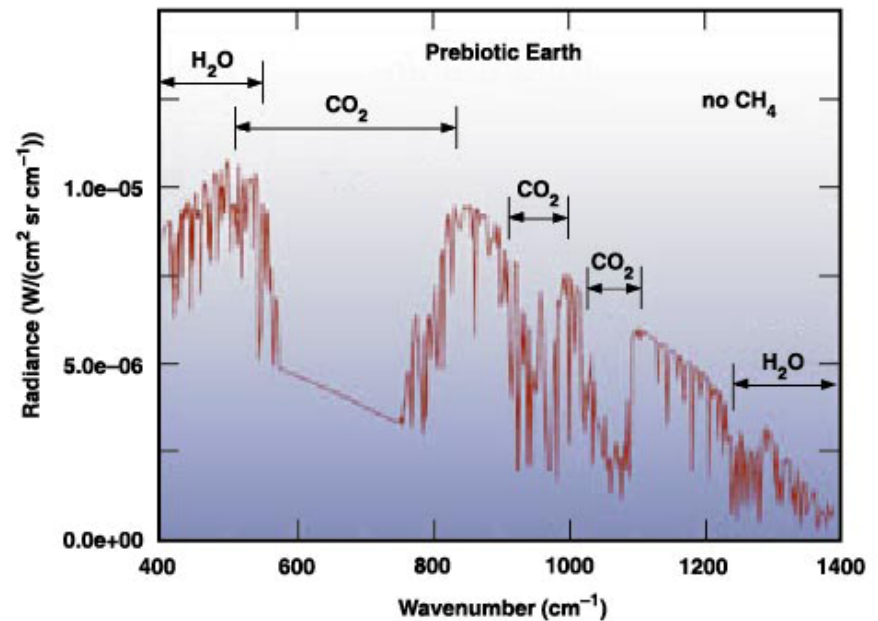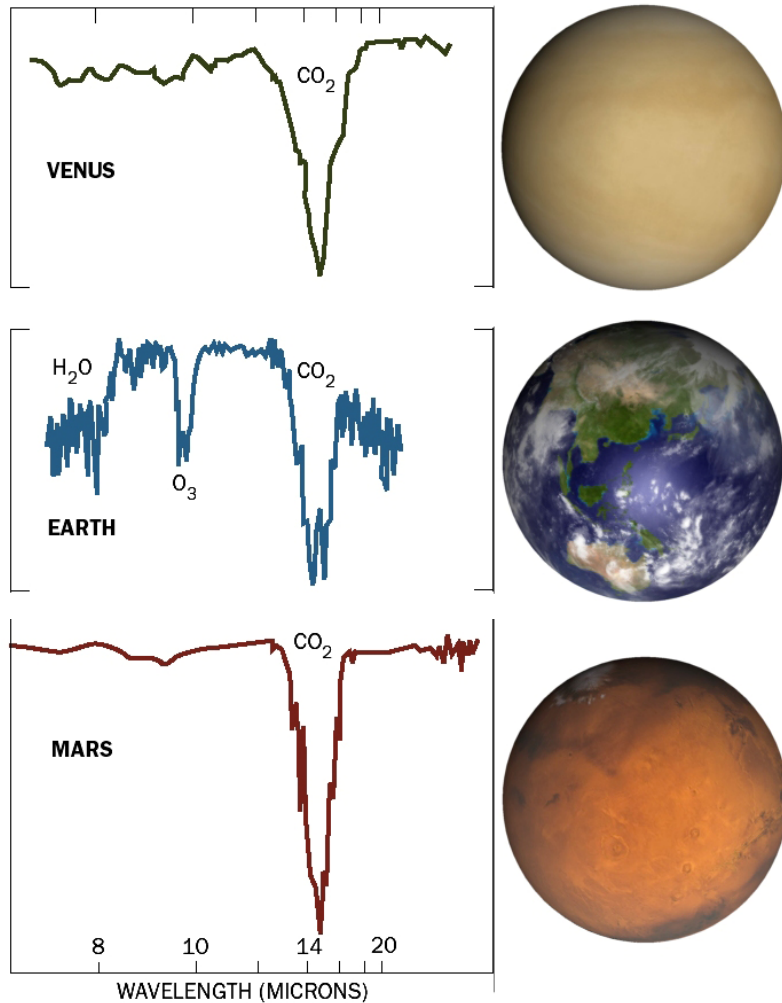# Habitable Zones

Infrared Spectroscopy

Emission and absorption lines are the fingerprints of atoms and molecules.

Future/Current Methods

Biosignatures – Terrestrial Planet Finder

Current (and Future) Methods

- Employ Doppler Shift, Planetary Transitivity, & Microlensing to detect suspect star systems

Detection & Analysis

- Detect extrasolar planets

Analysis

252 Planets	M[sini] (M jup)	Period (days)	s-M Axis (AU)	Ecc.	Incl. (deg)	Ang. Dist. (arcsec)	st. Dist. (pc)	Spec. Type	st. Mass (M sun)	st. Metal.	st. Alpha	st. Delta
14 Her b	4.64	1773.4	2.77	0.369	-	0.153039	18.1	K0 V	0.9	0.43	16 10 23	+43 49 18
16 Cyg B b	1.68	799.5	1.68	0.689	-	0.078463	21.41	G2.5 V	1.01	0.08	19 41 51	+50 31 03
2M1207 b	5	-	46	-	-	0.779661	59	M8	0.025	-	12 07 33	-39 32 54
4 Uma b	7.1	269.3	0.87	0.432	-	0.013945	62.39	K III	1.234	-0.25	08 40 13	+64 19 41
47 Uma b	2.6	1083.2	2.11	0.049	-	0.151068	13.97	G0 V	1.03	0	10 59 29	+40 25 46
47 Uma c	1.34	2594	7.73	0	-	0.553319	13.97	G0 V	1.03	0	10 59 29	+40 25 46
51 Peg b	0.468	4.23077	0.052	0	-	0.003537	14.7	G2 IV	1.11	0.2	22 57 27	+20 46 07
55 Cnc b	0.784	14.67	0.115	0.0197	-	0.00858	13.4	G8 V	1.03	0.29	08 52 37	+28 20 02
55 Cnc c	0.217	43.93	0.24	0.44	-	0.018	13.4	G8 V	1.03	0.29	08 52 37	+28 20 02

- Gather Biosignature data for suspect star systems

Detection

- Detect extrasolar "habitable" planet

Analysis

How Many Earths?

"In space there are numberless earths circling around other suns, which may bear upon them creatures similar or even superior to those upon our human Earth."

-Giordano Bruno

Milky Way: 100,000 light years wide
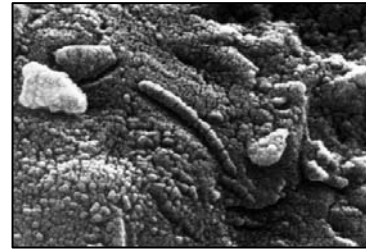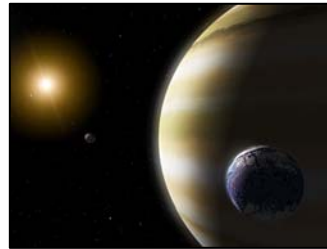Galaxy: 150,000,000,000 light years wide

Too Much Data

Extra Solar Planet Search

Terrestrial Planet Search
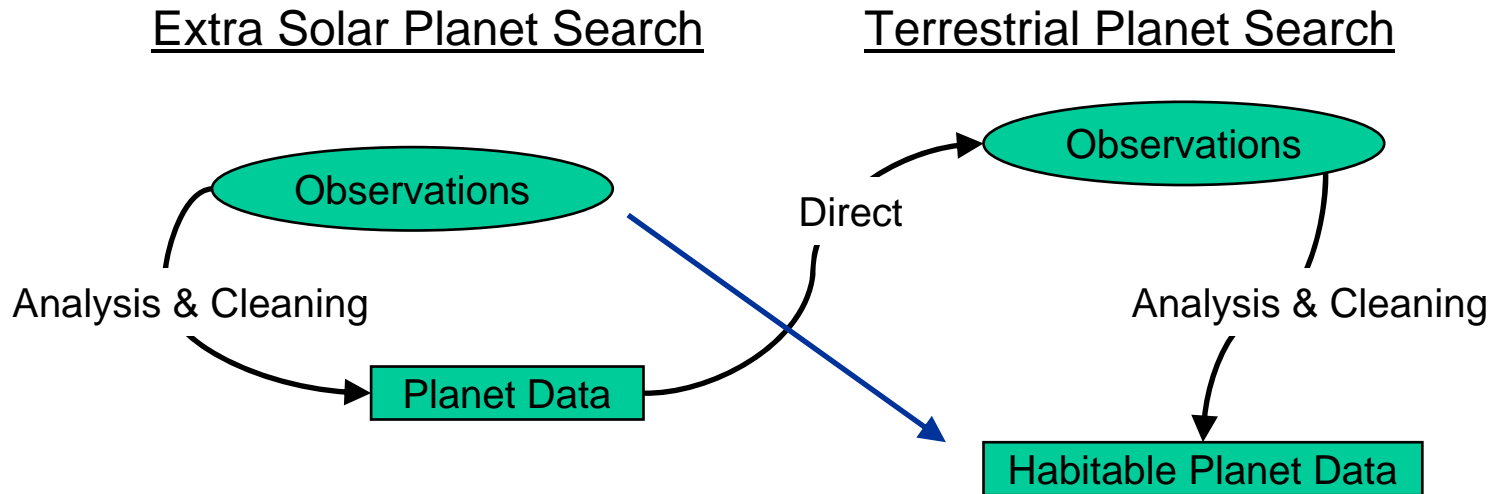
Machine Learning
- Support Vector Machines
- Unsupervised Learning
- Boosting
- Klustering

Difficulties
- No learning set / no comparison
- Is pre-analysis possible?
- Is pre-analysis necessary?

Looking for Little Green Men

Filip Jagodzinski
01 October 2007