Free Floting Planet ~How to detect?~

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Introduction

What is the Free floating planets?

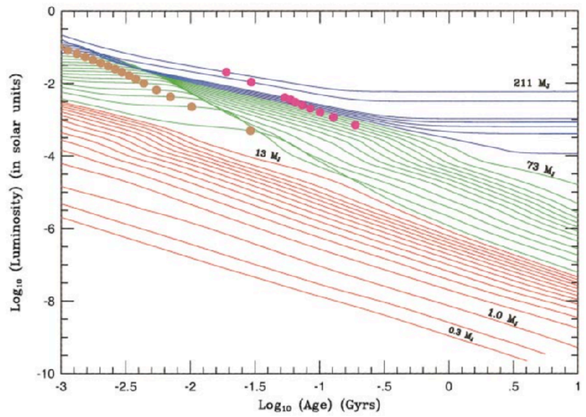
Free floating planets are planets that are not bounded by any host stars. It is difficult for us to detect them, but we sometimes can detect by imaging or microlensing. It is said that free floating planets are made in star system, and gravitationally scattered to the outer of the system. So it is important to know about free floating planet in order to understand plenet formation.

Planets or Brown dwarfs?

"Brown dwarfs" have intermadiate mass between stars and planets. The mass is about 13Msun ~ 73Msun. In the brown dwarfs, hydrogen does not burn stably, and deutrium burns temporarily. Some people distinct planets and brown dwarfs by the formation process, but in my poster, I will distinct them by the mass.

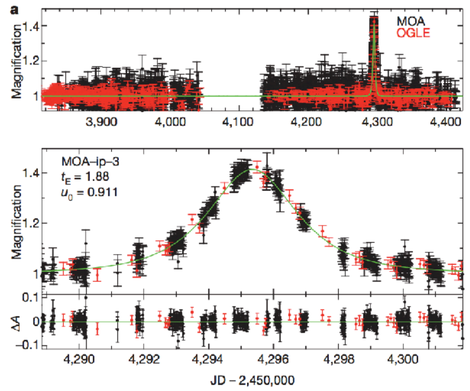
How to detect?

So, what how can we detect these free floating planets? The answer is, imaging or Microlensing.



(Burrows et al. 2011)

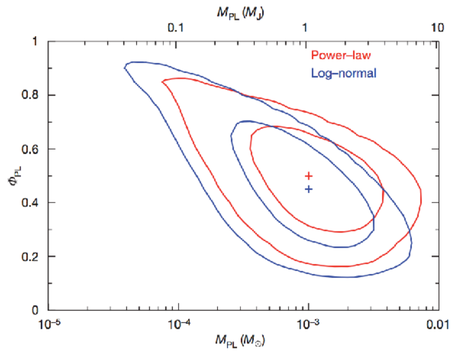
Microlensing



(Sumi et al. 2011)

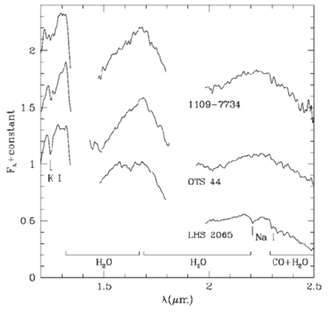
Sumi et al. 2011said consider that how many short-single lens events are free-floating. They calculated the distribution of mass, and they concluded that the number of the free-floating planets is twice as many as M-dwarfs.

Free floaring planets are see as single lens events, so we cannot know the lens-masses. And microlensing is good at detecting the distant planets from the earth, but is not good at detecting the further information such as orbital period or atmosphere. We can only stastical analysis via microlensing.



(Sumi et al. 2011)

Imaging



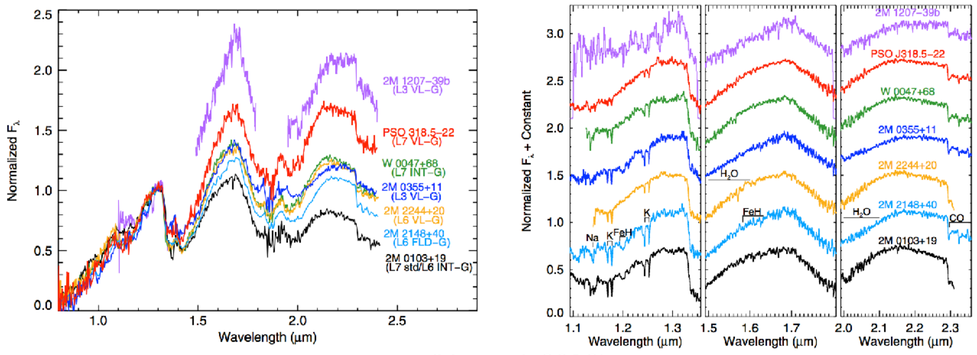
(Luhman et al. 2005)

Planetaly mass brown dwarfs

The left picture is from Luhman et al 2005. They detected the planetary mass object, Cha 1109-7734. First, they finded it using HST photometric observation. Next, they confirmed using Gemini Near-Infrared Spectrograph (GNIRS), because they have to except the false positive probability. According to the triangular shape of spectra in H-band, this object has low surface-gravity, because the absorption of water is expanded by the fast rotationg.

PSO318.5-22

Liu et al. 2013 said that they detected the planetary mass free floating object, PSO318.5-22.
They saids the spectrograph shows that the low surface gravity, and the mass is estimated 6.5Mjup. The color is similar to the known planets, for example, HR8799's planets.



(Liu et al. 2013)

Summary

- Free floating planets are defined as unbound planets by their hosts.
- The formation process is not known well, so it is important to detect those plansts.
- We can detect free floating planets via imaging and microlensing.
- Through imaging, spectroscopy is important because we have to except falce positive probability.
- Through microlensing, we can only stastical discussion, and it is said that the number of free floating planets is twice as many as M-dwarfs.

Refelences

[1] Adam Burrows et al. 2001, Reviews of modern physics, Vol 73
[2] Luhman et al. 2005, ApJL, 635:L93–L96
[3] Liu et al. 2013, ApJL, 777:L20
[4] Sumi et al. 2011, Nature, vol 473, p349