Searching for Extrasolar Planets with Gravitational Microlensing Subo Dong The Ohio State University

# How Microlensing Works

- When a foreground (lens) star passes very close to the line of sight toward a background (source) star, light beams from the source are bent by the gravity of the lens. As if seen through a magnifying glass, the source star gets brighter.
- With right alignment, a planet orbiting around the lens star acts like a smaller magnifying glass that causes additional brief variation of the source light. Planets are found by capturing such "blips", which last for a few hours to a couple of days.



### Microlensing: A New Window to Extrasolar Worlds

The first microlensing planet was found in 2003. As a new technique, microlensing has just started to offer unique insights into many key questions on extrasolar planets.

#### How common is our Solar System?

Microlensing is most sensitive to extrasolar planetary systems with similar architecture to our own, which are largely inaccessible to other techniques at present.

#### Are there other Earths out there?

The technique is exceptionally sensitive to very low-mass planets -- Earth-mass planets are already within the reach of ongoing projects.

#### What is the Galactic planet demography?

Microlensing probes distant planets all the way toward the Galactic center. In principle, we can even find planets in the Andromeda Galaxy with microlensing.



Credit: Jim McCormick

OGLE-2006-BLG-109Lb,c: Our discovery of the first Solar System analog

- The discovery potential of microlensing is curbed by the complicated and timeconsuming analysis that is required to interpret the observations.
- I have developed a new set of efficient analysis algorithms, which has played a central role in our discoveries of ~10 extrasolar planets.
- As a Sagan fellow, I will further develop the analysis technique in order to meet with the challenge of analyzing the rapidly-increasing quantity of observational data expected in the near future.
- In the next few years, we expect to discover a couple dozen more new planets and planetary systems. These results will provide clues on how typical Solar System analogs are in the Galaxy. An exciting prospect is the potential to discover the first Earth-mass exoplanet.



MicroFUN (Microlensing Follow-Up Network) employs a global network of telescopes to search for planets with microlensing.

## Galactic Demography of Exoplanets

- In ~5 years, a powerful next-generation microlensing telescope network will be built. It is expected to find many hundreds of planets including a couple dozen Earths.
- I propose to develop the crucial numerical techniques required for the automated analysis of these discoveries.
- Complementary with NASA's Kepler mission, the findings will offer us a complete picture of the demography of exoplanets and reveal to us the frequency of extrasolar Earths.