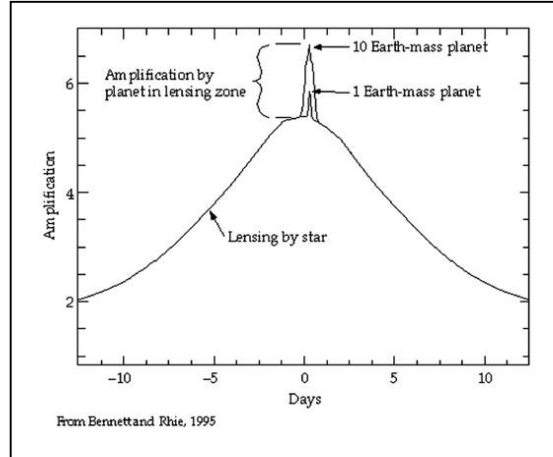
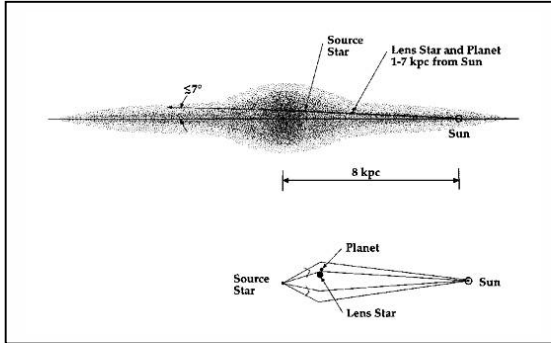
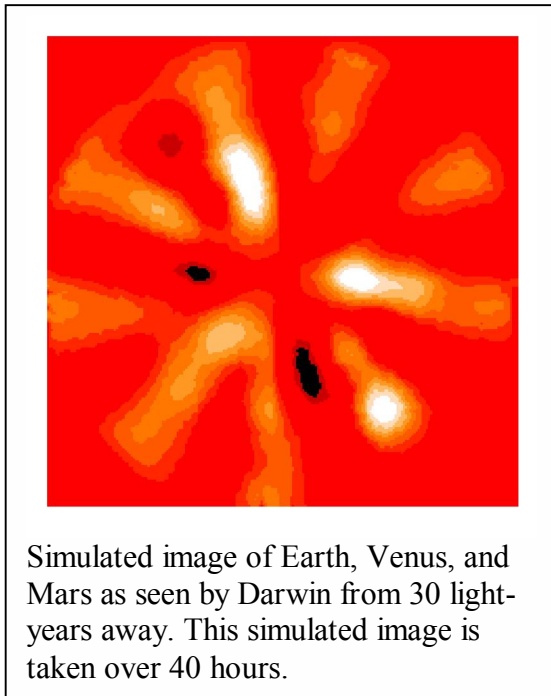


## Other (More Direct) Methods for the Detection of Planets

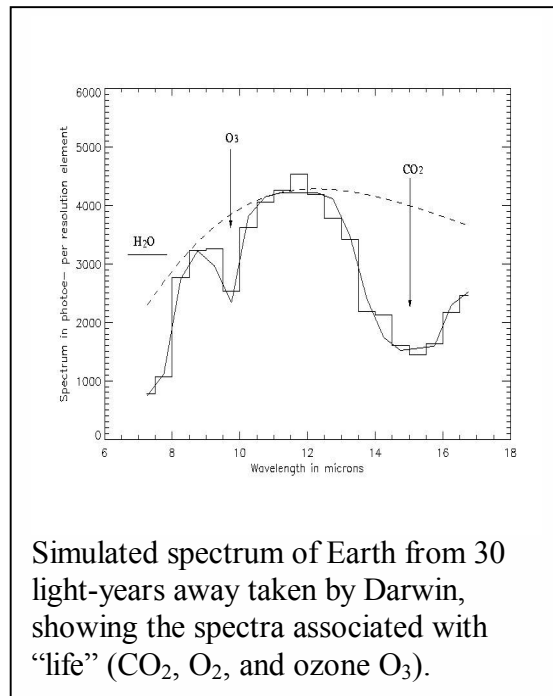
**Gravitational Microlensing** – Einstein showed almost 90 years ago that gravity is a manifestation of curved spacetime. Therefore masses can act as lenses (i.e., devices that bend light). Microlensing is light bent by much smaller masses – stars in this case, but they could also be planets. One can detect even Earth-sized planets out to huge distances (8000 parsecs, the distance of the sun to the galactic center). Over 100 candidate microlensing events have been observed to date from OGLE (Udalski, A. et al., 1994, *Acta Astron*, **44**, 165) and MACHO (Alcock et al., 1995, *Ap. J.*, **445**, 133.).



**DIRECT MEASUREMENT** – As spacecraft go into space, they can observe planets directly around other solar systems, as well as measuring the spectral signatures of “life” (i.e. oxygen, carbon dioxide, etc.). Darwin is one proposed spacecraft to do this, using a *nulling interferometer* to cancel out the light from the parent star.



Simulated image of Earth, Venus, and Mars as seen by Darwin from 30 light-years away. This simulated image is taken over 40 hours.



Simulated spectrum of Earth from 30 light-years away taken by Darwin, showing the spectra associated with “life” (CO<sub>2</sub>, O<sub>2</sub>, and ozone O<sub>3</sub>).