

Chapter 4: Additional material

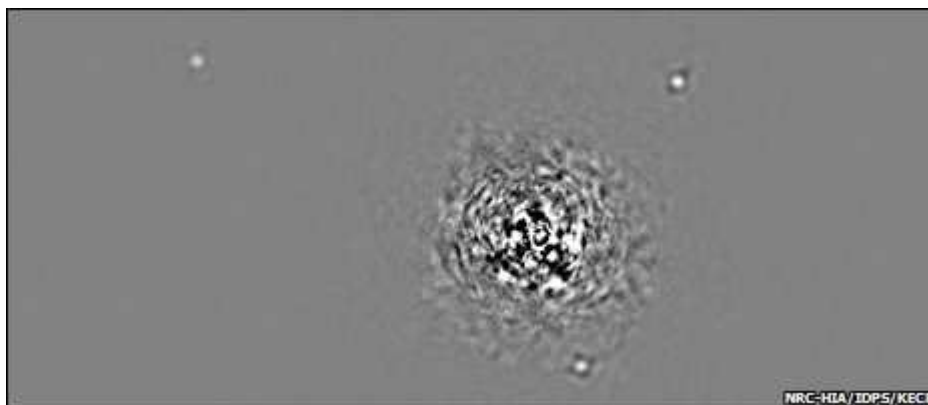
1) The visual detection of planets orbiting normal stars.

In the text the possibility of detecting planets by direct imaging was not discussed as this was not widely regarded a feasible due to the fact that the light reflected from the planet would be lost in the glare of the light from the star.

In the infrared, stars are less bright than in the visible and the brightness difference is reduced, so making detection easier. In fact, a planetary sized body had been detected in orbit around a brown dwarf. This had been achieved using one of the 8m telescopes of the VLT in Chile (5.11.4) with the use of adaptive optics (5.10.2) to correct for atmospheric turbulence. This is very effective in the infrared and so allows telescopes to achieve higher resolutions and thus allow planets at small angular distances from their star to be seen.

Planets observed in the infrared

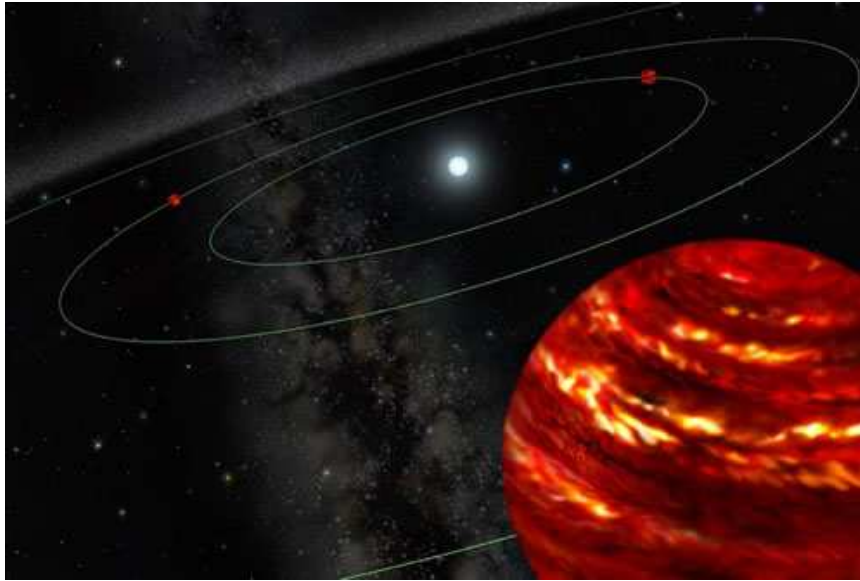
In November 2008, a team of astronomers using the 10m Keck and 8m Gemini-North telescopes (5.11.1 and 5.11.2) announced the discovery of three planets orbiting the, 129 light year distant, star HR 8799. Again, the observations were made in the infrared and, in addition, an occulting device was used to remove much of the light from the star.



An infrared image showing three planets in orbit around the star HR8799.

HR8799 is quite close to the position in the sky of 51 Pegasus, the first sun-like star to have a planet discovered in orbit around it. (4.1.2). The

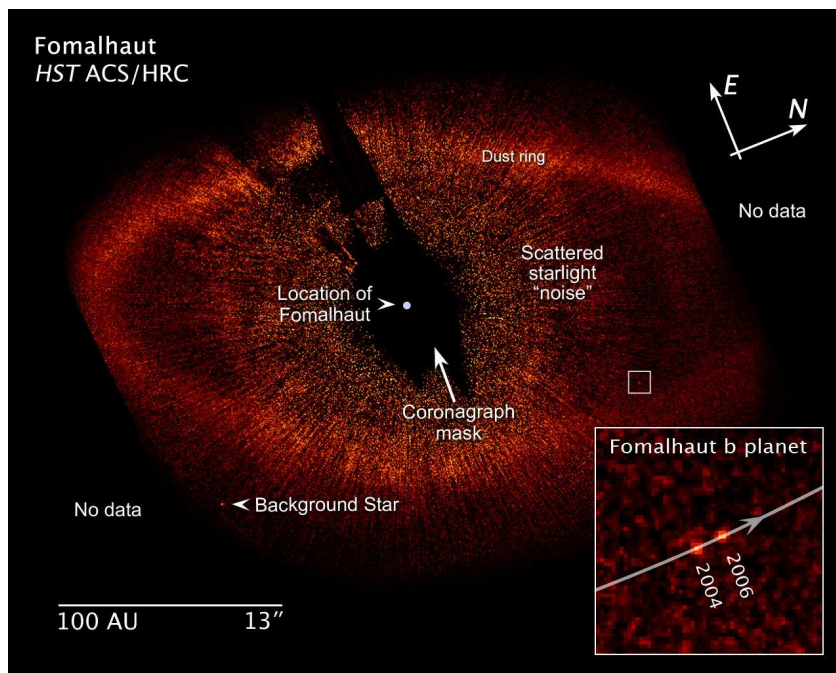
three planets are several times the mass of Jupiter and even the closest has an orbital radius equal to the Sun-Neptune distance of ~30 AU.



Artist's impression of the HR 8799 triple planet system

A planet discovered in visible light by the Hubble Space Telescope

In a discovery first, the detection of a planet in visible light was also announced in November 2008. The discovery was based on two observations, in 2004 and 2006, of the star Fomalhaut that lies at a distance of 25 light years from our Sun.



A composite of two images of the Fomalhaut star system.

Again, an occulting disk was used to largely eliminate the light from the star. Beyond the scattered "starlight noise" is seen a prominent dust ring. To the lower right of the star's position a faint object was imaged which was seen to move in the two years between the observations. This is the planet Formalhaut b which is ~ 3 Jupiter masses and orbits Formalhaut at a distance of ~10.7 billion miles or 73 AU. It is thus the first planet ever to have been imaged in visible light.

Will this method detect many planets?

All four planets are several times the mass of Jupiter (and hence relatively bright) and lie at great distance from their star. Both stars are not that far distant so the angular separation of the planets from their stars enabled them to be distinguished from the remnant starlight. It does not seem likely that planets of the size and distance from their star of our Earth could be detected by this method, but observations, either from Earth or space, might well be able to detect a significant number of planets in the future.