Bull. Astr. Soc. India (1996) **24,** 3–4

How bright are extra-solar planets?

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Received 6 June 1995; accepted 7 June 1995

Interest in the detection of other planetary systems has been mounting over the past decade, ever since the IRAS mission showed that many nearby main-sequence stars have substantial amounts of dust around them. Follow-up observations from the ground have found that the circumstellar dust often forms a disc around the central star. The most notable example is the disc of β Pictoris, revealed through coronagraph images, which suggests the possibility of a planetary system. However, direct evidence of extra-solar planets has not been found, with the exception of the planets orbiting the millisecond pulsar PSR B1257 + 12, which were found using timing observations (A. Wolszczan, *Science*, vol. 264, 22 April 1994).

Last year, J.R.P. Angel of Steward Observatory described in *Nature* (vol. 368, 17 March 1994) how one can use adaptive optics to take pictures of extra-solar planets with the next generation of large ground-based telescopes. So far, ground-based telescopes have proved inadequate because of blurring caused by the Earth's atmosphere. The new system of adaptive optics put forward by Angel senses and corrects atmospheric distortion before the light from a star is brought to focus. With the largest telescopes under construction, adaptive optics should allow Jupiter-sized planets around nearby stars to be imaged. It is generally held by astronomers that a Jupiter-like giant planet must be a typical member of other planetary systems.

Now, Adam Burrows of the University of Arizona and collaborators have calculated the expected intensity of light from extra-solar giant planets (EGPs). In the 25 May 1995 issue of *Nature*, Burrows *et al.* report the predicted optical and infrared fluxes of EGPs which range from 0.3 to 15 Jovian masses and are between 10 million and 5 billion years old.

Detailed computer calculations showed that a young EGP is much brighter than the current Jupiter. For example, a 10 million year-old EGP that is twice the mass of Jupiter is 2000 times as bright. At the age of the Pleiades cluster, which might possibly contain planetary systems around some of the individual stars, such as EGP would be roughly 200 times as

bright as present-day Jupiter; at the age of the Hyades cluster, it would be roughly 18 times as bright. The Pleiades is thought to be 70 million years old, while the Hyades is around 600 million years in age.

From their analysis, Burrows and collaborators conclude that the detection of EGPs requires telescopes with both high sensitivity and high angular resolution. These characteristics of the new generation of telescopes such as the Large Binocular Telescope (LBT), the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) and the Space Infrared Telescope Facility (SIRTF) make them ideal tools for the search. Not only will they be capable of detecting EGPs which have a broad range in masses and separations from the central star, these telescopes should also be very good at discovering brown dwarfs.

The importance of the Burrows *et al.* work lies in that it focusses on the crucial question of the brightness of extra-solar planets as a function of their age and mass. This will aid in the development of search strategies. It seems likely that the next generation of telescopes will either find Jupiter-like planets around nearby stars, or show conclusively that they are rare.