Photographic observation of close binaries with large magnitude differences

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Problems:

1. Size of diffraction image
2. Ross effect (shrinking of high exposed star images in the photographic emulsion)
3. Halo by diffusion of light in the photographic emulsion
4. Scintillation

Methods of improving the observation conditions are as following:

1. Deformation of diffraction image with quadratic or other formed masks
2. Diffraction gratings render possible a better measurement but don't avoid Ross effect and halo of diffusion.
   The halo of diffusion can reach much more of diameter than the original image.

A special cameraapparatus was invented which contains a rotating ring with a radial slit that reduces the brightness of brighter component. The ring is located in the focal plane of the telescope so that a separation of very small distances is possible.

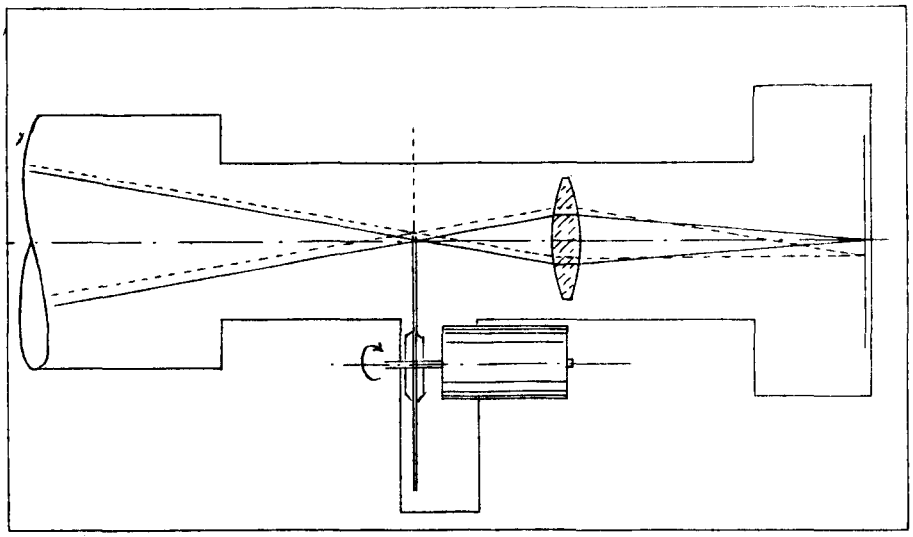

Fig. 1 The rotating ring in the focal plane of the telescope reduces the light from the brighter star only (full line);
the light from the fainter component comes undisturbed to the film (dashed line).

https://doi.org/10.1017/S0252921100009829 Published online by Cambridge University Press

The reducing of brighter component avoids Ross effect and halo of diffusion.

With a slit of 0.2 or 0.1 mm a factor of reducing of 1 : 1000 or more can be achieved. The ring is rotating very precisely, the accuracy in radial deviation is 2 microns, the frequency is about 800 rpm.

Except for the small ring the largest part of the field of view remains free for astrometric measurement of reference stars.

With the 12 inch-refractor of the Wilhelm-Foerster-Sternwarte at Berlin usuable photographs of Sirius A and B were taken, although the observatory is located in the city and the horicontal distance of Sirius at Berlin is 20^{o}. The magnitude difference between Sirius A and B is 10.

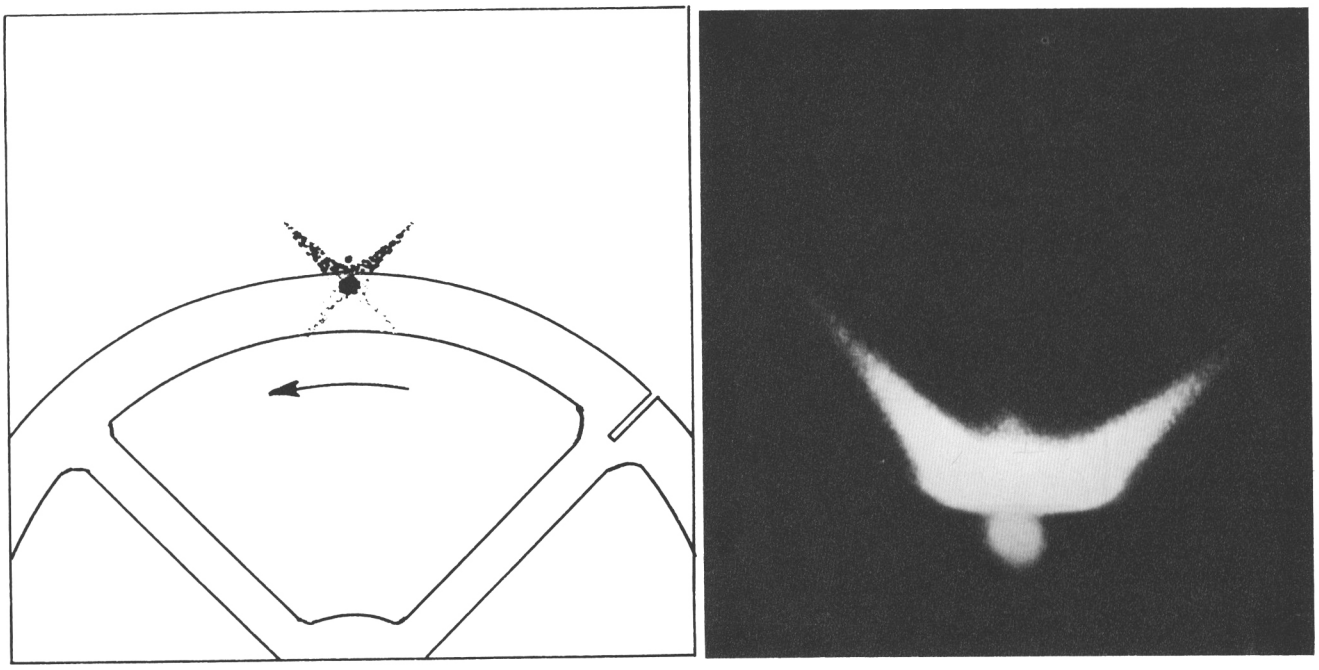

Fig. 2 and 3 The diffraction image from Sirius A, shaped by a quadratic mask is partly visible. The central image of Sirius A is very reduced behind the rotating ring. The image of Sirius B is above outside the ring. On original film the images of both components are clearly separated.

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The cameraapparatus was also tested in connection with an Image-Intensifier-Television-Camera mounted on the 75 cm-reflector at Berlin.

For putting to the test satellites of Saturn were observed by reducing the image of the planet.

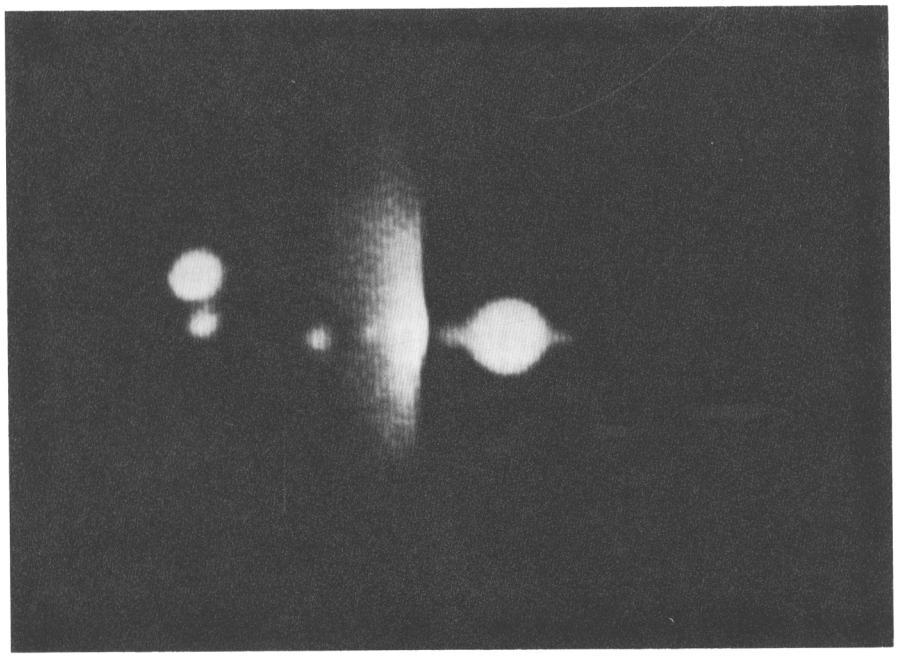

Fig. 4 Saturn with satellites Titan, Rhea, Dione and Enceladus (May 6, 1981)

Other application of a similar apparatus could be imaginable and useful for detection of extrasolar planets with a space telescope.

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