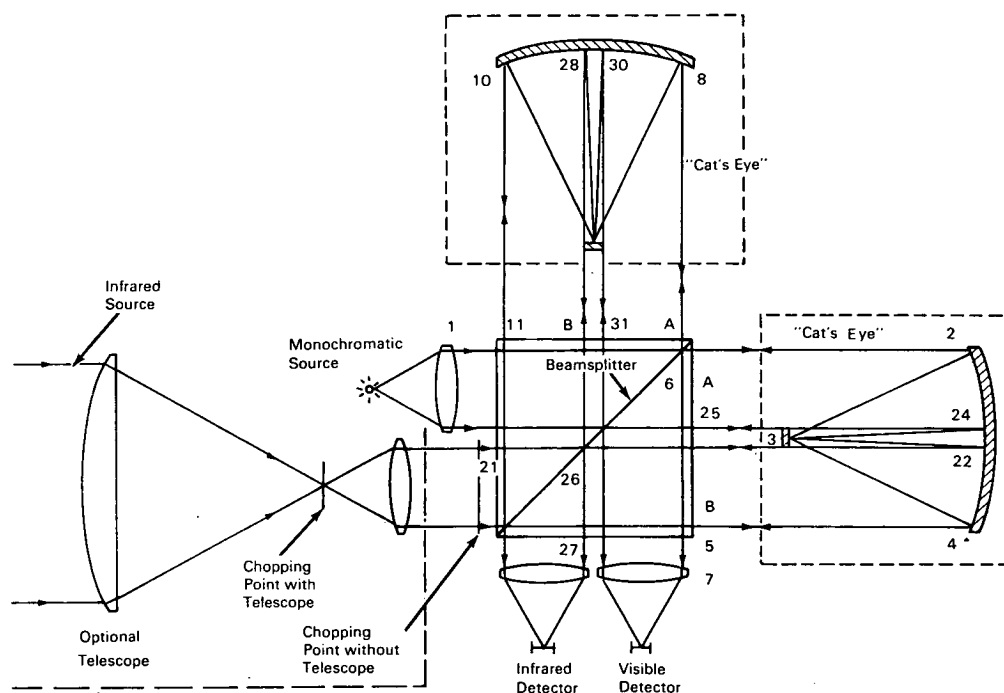


NASA TECH BRIEF



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Unique Construction Makes Interferometer Insensitive to Mechanical Stresses



The problem: To provide an interferometer that will produce useful interference patterns in the presence of random mechanical stresses. In present instruments, such mechanical perturbations are intolerable.

The solution: A Michelson-type interferometer in which each plane mirror is replaced by a "cat's eye" (a parabolic mirror with a small plane mirror at its focus). The parabolic mirror and plane mirror are precisely and rigidly mounted with respect to each other, making the instrument insensitive to mechanical movement. A cubical beamsplitter with dichroic surfaces permits operation in either infrared or visible light.

How it's done: Each "cat's eye" reflector is rigidly mounted in a cylindrical housing to prevent relative motion of the mirrors. An optical path difference change is effected by translating one "cat's eye" along its axis of symmetry. Lateral and angular deviations from this path have no effect, provided reasonable amounts of the two wavefronts interfere.

A monochromatic source and collimator are used for the visible light. The infrared light is chopped or interrupted before it enters the beamsplitter, making it easier to detect. Separate detectors are used for the visible light and for the infrared light. The portions

(continued overleaf)

of the beamsplitter indicated by A have dichroic surfaces that transmit the visible and reflect the infrared, while the portions indicated by B transmit the infrared and reflect the visible.

The monochromatic visible light starts at point 1 and is split at point 6. The transmitted portion travels the following path: 1, 2, 3, 4, 5, 4, 3, 2, 6, 7 (detector). The reflected portion travels the following path: 1, 6, 8, 9, 10, 11, 10, 9, 8, 7 (detector). The infrared ray travels the following paths: transmitted—21, 22, 3, 24, 25, 24, 3, 22, 26, 27 (detector); reflected—21, 26, 28, 9, 30, 31, 30, 9, 28, 27 (detector). For the monochromatic light, the detector observes a sinusoidal variation in intensity as the "cat's eye" moves axially. The distance moved between successive intensity peaks is a function of the light source wavelength. For a non-monochromatic light source, constituent frequencies

can be derived from the intensity variations using a Fourier transformation analysis.

Notes:

1. This invention should be of interest to both users and manufacturers of interferometers.
2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California, 91103
Reference: B65-10295

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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