8-1 *INVITED*: INTEGRATED OPTICS - PRESENT AND FUTURE

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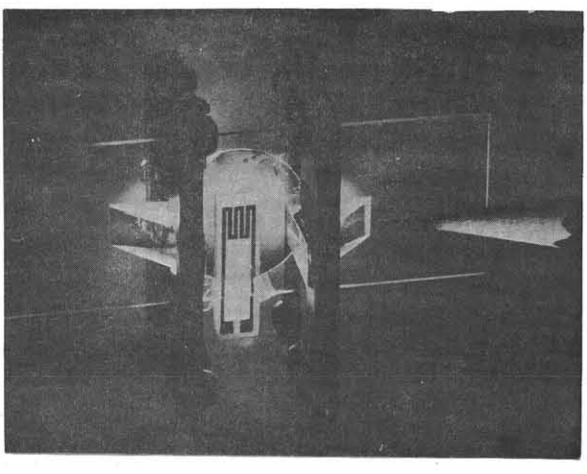
Integrated optics involves research and development of optical circuits which contain thin-film optical passive and active devices. These circuits can be standardized, catalogued and packaged as the building blocks of an optical system. We expect that in the final analysis, both reliability and economy can result through miniaturization and batch fabrication. Since the inception of these concepts four years ago, there have been two different approaches toward the development of integrated optics. The first approach involves the formation of three-dimensional miniature waveguides on a substrate. The waveguide has a width of typically 1 micron or less. As the fabrication processes involve repeated masking, ion-milling and diffusion or epitaxy, each process must be precisely positioned and that proves to be costly because of the small dimensions involved. In the second approach, slab waveguides are used, and the light wave propagates freely in the two-dimensional plane of the film. To avoid diffraction, the light beam should have a width on the order of 50 μm. Since the width of the slab waveguide is much larger than that of the light beam, no careful alignment is required between various processes of the fabrication. At the present stage of the development, we believe the second approach to be more practical, which will be considered exclusively below.

To develop integrated optics based on two-dimensional optics, thin-film prisms, lenses, lasers and modulators have been constructed. These devices will be reviewed briefly. The discussion also includes a novel method of light



guiding interconnections (Fig. 1), new wave phenomena in composite waveguides, and our recent studies of the magneto-optical switch (Fig. 2). Looking into the future, we expect integrated optics to grow rapidly. However, there are still "miles to go" before a practical circuit can be realized.