This Week's Citation Classic

Gordon E I. A review of acoustooptical deflection and modulation devices.
Proc. IEEE 54:1391-401, 1966.
[Bell Telephone Laboratories, Inc., Murray Hill, NJ]

The basic operating principles and design rules of a then new class of acoustooptic deflection and modulation devices were described in terms of very simple physical models and supported by theory. This paper was one of a group of 12 closely related papers. [The *SCI*® indicates that this paper has been cited in over 140 publications since 1966.]

Eugene I. Gordon
14 Braidburn Way
Convent Station, NJ 07961

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"During 1962, I became interested in high-speed modulation of light for communication purposes and began to do some experiments. One day the late Jack Morton, vice president of the device development area at Bell Labs, called me into his office and encouraged me very strongly to work on light deflection, which he considered to be more important than modulation. He was interested in optical memory for which random scanning of a laser beam would be quite desirable. I explored analytically the usual static electrooptic techniques and decided these were unpromising. Moreover, another group at Bell Labs was working on this.

"It occurred to me that using an ultrasonic wave in an optically transparent medium would provide a means of deflecting a light beam incident on the acoustic column at the Bragg angle. The angle of deflection would be varied by varying the frequency of the acoustic wave. While high-speed deflection into many resolvable spots was possible, the necessary acoustic bandwidth was not available from state-of-the-art electrical to ultrasonic transducers. I concluded that the technique was not yet technologically interesting. I therefore turned to the study of microwave propagation in electrooptic material as a means of achieving a similar effect. This had the potential for large bandwidth and hence many resolvable spots. Just as the experiments, while successfully demonstrating the effect,[1] were proving to be difficult because of the limitations of the materials (KTN), a group at Bell Labs developed some new, very broadband acoustic transducers. I therefore returned to the initial idea of acoustooptic deflection. This led to a series of 12 papers, mostly coauthored with Martin G. Cohen,[2] the last of which appeared in 1967.[3] One of these[4] introduced the idea of a universal figure of merit for materials used in these devices and has proved to be of considerable value. The field of interest also allowed me to actively renew a long-term friendship with Robert Adler of Zenith who had been developing similar ideas quite independently for use in television displays based on scanned laser beams.

"I believe the reason that this paper has been cited so often is that the field is one of importance and continuing interest. The paper itself is a description of the principles needed to build these devices in terms of fairly simple physical models, yet provides an elegant, but easily understood, theoretical and analytical support. In other words, the paper is well written, quite readable, complete, and early.

"Interestingly, I discovered during a recent trip to China sponsored by IEEE that the paper is well known and well read there also."

1. **Cohen M G & Gordon E I.** Electro-optic [$KTa_xNb_{1-x}O_3$(KTN)] gratings for light beam modulation and deflection. *Appl. Phys. Lett.* 5:181-2, 1964.
2. ----------. Acoustic beam probing using optical techniques. *Bell Syst. Tech. J.* 44:693, 1965. [The *SCI* indicates that this paper has been cited in over 130 publications since 1965.]
3. ----------. Focusing of microwave acoustic beams. *J. Appl. Phys.* 38:2340-4, 1967.
4. **Gordon E I.** Figure of merit for acousto-optical deflection and modulation devices. *IEEE J. Quantum Electron.* QE-2:104-5, 1966.