



LO

the optoelectronics research group in General Motors' physics department, where he advanced the technology and application of tunable diode lasers, including the analysis of vehicle exhaust gases. In fundamental studies of lead-salt diode lasers, Lo demonstrated that laser lifetime and stability are limited by the development of excessive resistance at the electrical contacts. To prevent this, he devised a multilayer ohmic contact consisting of different metal films. This configuration extended the laser operating lifetime to more than 1000 hours and increased shelf life to an estimated 25 years. Lo also invented an ingot-nucleation crystal-growth technique and a cadmium-diffusion process—methods that resulted in lasers with output powers of over 5 mW. In addition, he devised a laser structure with a graded carrier concentration that permitted higher operating temperatures with wider frequency-tuning ranges. Most recently, he and his colleagues used molecular-beam epitaxy to grow laser structures that set new records for operating temperatures: 174 K continuous and 270 K pulsed.

The lasers developed by Lo's group are acknowledged to be the best in the world. They have been used by the National Aeronautics and Space Administration in experiments designed to sense atmospheric concentrations of gases. General Motors has used them to measure specific gases in automotive exhaust, including carbon monoxide, methane and sulfuric acid. The uniquely fast response of a diode-laser spectrometer provided the first characterization of time-dependent emissions from a computer-controlled engine. The lasers have also been used to measure oxygen in silicon wafers, to track the evolution of vapor from a fuel spray and to detect molecules adsorbed on surfaces.

Lo performed his many activities with generosity, perseverance, spirit and a personal commitment to high

quality. He gave much to his colleagues and to his profession.

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Marianus Czerny

Marianus Czerny, professor emeritus of experimental physics at the Johann Wolfgang von Goethe Universität in Frankfurt am Main, West Germany, died in Munich on 10 September 1985, shortly before his 90th birthday.

His working life belonged to the university and its Physics Institute, to which he still felt closely connected in his later days. It is hardly possible to gain a full appreciation of the breadth of his scientific activities from a short description. His investigations in 1925–27 of the far-infrared rotational spectra of the hydrogen-halogen gases, which gave the first experimental proof of the dependence of rotational quantum numbers (as predicted by quantum mechanics), were extremely difficult in those days. Still of special interest today are his infrared *Reststrahlen* measurements of the alkali halogenide crystals, which he performed in Berlin with his pupils R. Bowling Barnes and C. H. Cartwright. They found sidebands in *Reststrahlen* reflex bands that gave the first evidence for what are now called multiphonon effects. He continued these investigations later in Frankfurt, demonstrating the existence of a sharp cutoff of higher multiphonon processes in high-frequency spectral tails that can be explained by quantum theory.

Czerny's dedication to the instrumental side of experimental physics was manifested in his development of a special kind of infrared photography, called evaporography, as well as in his work with A. F. Turner and V. Plettig in 1930 on astigmatism in spectrometers. The latter resulted in the well-known "Czerny-Turner" optical arrangement. Along the same lines, his work on fast bolometers was the necessary first step in the development of the chopped-signal method of infrared photometry. The breadth of his scientific interests is illustrated by his 1949 publication in which he demonstrated that the eye's red-sensitivity limit decreases in the same manner as the body's own heat-radiation spectrum, and by a more philosophical publication of 1979 about the goals of our scientific-technical community.

Czerny took great pride in teaching young students, and even 15 years after attaining emeritus status he appeared daily at the institute, exactly on time for the practical seminar, giving advice, answering questions and fre-



CZERNY

quently repairing the most delicate instruments with amazing agility.

Czerny was truly a pioneer, a scientist of the old school: meticulous, responsible, of heartfelt simplicity and great tolerance, and extremely economical with the funds entrusted to him. He carried out his work during a difficult period of German history; the war damages to the university and the laborious years of rebuilding severely limited the development of his abilities. But in spite of all the adversities, he was always able to create for his students and collaborators the academic atmosphere that is the prerequisite for thriving, creative scientific work.

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Jesse O. Betterton Jr

Jesse O. Betterton Jr, known for his work as a physical metallurgist, died at his home in Evergreen, Colorado, on 20 January 1986. He was 65 years old.

Betterton joined the war effort at the Dow Chemical Company in Midland, Michigan, in 1942, soon after receiving his BS from Lehigh. In 1947 he left Dow to pursue a doctoral degree with Sir William Hume-Rothery at Oxford University, England. He returned to the US after completing his PhD in 1950 and joined the staff of Oak Ridge National Laboratory. He was a group leader in the Oak Ridge metals and ceramics division until 1968, when he became associate professor of physics at the University of New Orleans. His work there on the ultrapurification of metals such as zirconium resulted in the purest single titanium crystal ever obtained. Betterton retired from the university in 1981. □