Editorial

JQE's Invited Papers Policy

As stated in my Editorial in the July 1977 issue, JQE has instituted a policy of publishing Invited Papers. This issue contains the first Invited Papers to be published under this new policy. The purpose of this Editorial is to explain the purpose of this policy and the nature of the Invited Papers.

First, let me point out that JQE has no desire to compete with the Invited Papers policy of the PROCEEDINGS OF THE IEEE. Our intent is to honor researchers who have conducted a large amount of exceptional research in a given field, but it is not the primary intent that JQE's Invited Papers be tutorial in nature. The requirement is that JQE's Invited Papers have archival value (i.e., a large portion of the Invited Papers must contain previously unpublished material). The goal will be to invite researchers who, for whatever reasons, have not gotten around to publishing their work as full papers. This happens more often these days because of the popularity of letter journals. It is the intent that JQE's Invited Papers will review the author's own research results rather than reviewing the entire field with a long list of references. Thus, one may regard JQE's Invited Papers as being comparable in intent in the quantum electronics field to the articles published in the *Review of Modern Physics*.

In addition to the goal of honoring outstanding research in the quantum electronics field, the Invited Papers are also selected to serve the readership of JQE in another manner. As per the referenced Editorial in the July 1977 issue, JQE has decided to broaden its scope of interest. As a help in accomplishing this task, Invited Papers can serve as examples of the subject areas the Journal is interested in addressing. The Invited Papers can serve as an example of our commitment to that area of research. (Special Issues can also aid us in achieving this task; we have three Special Issues in the active stage at the present time.)

As a reminder, JQE is now committed to the following areas of research in the quantum electronics field: the physics and engineering aspects of phenomena, devices, and systems affecting the generation, amplification, modulation, detection, and propagation; as well as the practical and scientific applications of coherent electromagnetic radiation having submillimeter and shorter wavelengths. One journal which has successfully incorporated all of these diversified topics, and therefore can serve as an example, is the *Soviet Journal of Quantum Electronics.*

Other portions of JQE's Invited Papers policy are: the Invited Papers will be reviewed by two reviewers. Due to the invited nature of such manuscripts, we have a compelling (i.e., but not completely binding) obligation to publish these Invited Papers. This rule has been installed in order to provide additional safeguard against unfortunate oversights which can occasionally occur and it is meant to be an aid in maintaining high standards. Another rule is that page charges by the authors of Invited Papers be honored in the same manner as for regular contributed papers.

The Associate Editors and I always welcome your comments and constructive criticism concerning matters pertaining to JQE for our function is to serve the rapid and efficient transfer of scientific information between researchers in the quantum electronics field.

ANTHONY J. DEMARIA
Editor, J-QE (1977–1980)

Quantum Electronics Letters

New CW Far-Infrared Laser Lines from CO_2 Laser-Pumped CD_3OH

EDWARD J. DANIELEWICZ AND CARL OTTO WEISS

Abstract—**Twenty-one new CW far-infrared laser lines have been observed from the CD_3OH molecule pumped by a CO_2 laser. The wavelengths of these new lines fall in the short wavelength range from 34.5 to 287 μm.**

SEVENTY CW far-infrared (FIR) laser lines have been previously reported for the CO_2 laser-pumped CD_3OH molecule [1]. Thus it is one of the molecules with the most FIR laser lines and yet it is one of the least studied FIR laser molecules.

The intense C–O stretch vibrational mode absorption band of CD_3OH, centered at 985.5 cm^{-1}, overlaps the P and R branches of the 10.4 μm emission band of the CO_2 laser [2]. Recent assignments of the FIR laser lines in the C–O stretch mode of the optically pumped CH_3OH laser have revealed the importance of K-changing transitions for producing high power FIR laser lines with short wavelengths such as the well known 118.8 μm line [3], [4]. Also transitions where the internal rotational quantum number n changes by one can produce laser lines with wavelengths as short as about 40 μm [4], [5]. Since it is so similar to normal methanol, we expected similar behavior from the deuterated variety. On the contrary, no wavelengths shorter than $\lambda \simeq 200$ μm have been previously reported for CD_3OH [1]. We therefore reexamined some of the known pump lines which overlap the C–O stretch absorption band of CD_3OH, and we report in this letter the discovery of 21 new short-wavelength CW FIR laser lines.

The experimental setup consisted of a CW CO_2 laser pumping a FIR Fabry–Perot resonator of the conventional Chang design [6]. The CO_2 laser could be tuned with a 150 lines/mm original-ruled grating and provided up to 10 W average power on single transitions in the 10.4 μm CO_2 laser band. The linearly polarized CO_2 pump beam was chopped to allow for synchronous detection of the resulting FIR signal and focused with f/100 optics into the resonator. The FIR laser cavity had internal gold coated mirrors of 10 cm diameter and were separated by 80 cm. Input of the pump beam and output of the FIR radiation were via a 3 mm diameter coupling hole in the flat mirror. The other mirror was concave with a radius of curvature of 2 m. It was mounted on a motor-driven micrometer stage to facilitate cavity-length tuning. The FIR output radiation is deflected by a metal mirror through a polyethylene window-lens which focuses the output into the Golay cell detector. The detector signal was input into a "lock-in" amplifier and then recorded on the Y channel of a chart recorder. A potentiometer turned by the cavity length scanning-motor provided a signal proportional to the cavity length which was then fed into the x channel of the recorder. Direct wavelength measurements were possible from the cavity length scans recorded in this way.

The CD_3OH gas (minimum 99 percent deuterated) was supplied by Sharp and Dohme and continuously flowed through the laser. Coincidences between pump lines and absorption lines were monitored using a capacitance microphone mounted directly in the FIR cavity chamber. When dealing with the deuterated forms of methanol, there is the danger of contamination of the gas by water vapor, since exchange of OH groups with OD groups occurs very rapidly. Thus for example with the CD_3OD and CH_3OD forms of deuterated methanol, the actual isotopic purity of the gas is rapidly altered by exchange with residual water vapor in the laser. This danger is absent for CD_3OH and this is an advantage of CD_3OH over the other deuterated forms.

The experimental results are summarized in Table I. The lines indicated with a dagger coincide, within experimental errors, with those previously reported in [1]. They have been included in Table I for comparison with the new lines. The wavelength measurements for the new lines were performed directly from cavity-length scans after averaging over several scans and calibrating with precisely known wavelengths of CH_3OH. The wavelength measurements are estimated to be accurate to within ±0.5 percent. The polarization of the FIR lines relative to the CO_2 pump laser was measured using a wire grid polarizer. The listed pressures were measured using a Pirani gauge calibrated for air and correspond to the optimum

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E. J. Danielewicz is with the Max-Planck-Institut für Festkörperforschung, Stuttgart, Germany.
C. O. Weiss is with the Physikalisch-Technische, Bundesanstalt, Braunschweig, Germany.

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