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**Laser Studies of Molecular
Energy Transfer in Gases**

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Laser Studies of Molecular Energy Transfer in Gases

The work accomplished under this one year contract has been described in articles published and submitted for publication in technical journals. Appropriate preprints of these articles have been submitted and reprints have been or will be sent as available. A list of these publications is attached. Some of the work supported by the contract is now being continued under grant DA-ARO-D-31-124-72-G164 from the Army Research Office-Durham. Publications resulting from this work will be reported under that grant.

The research work of Dr. Hao-Lin Chen, Dr. F. Wodarczyk, Mr. P.F. Zittel, Mr. R.V. Steele, Dr. L. Hall, Mr. S.R. Leone, Mr. J. Finzi, and Mr. J.M. Scott drew support from this contract.

Summary

Laser studies of vibrational energy transfer were carried out for systems of importance in understanding the kinetics and performance of chemical and molecular lasers. Our studies of the vibrational relaxation of the upper laser level of CO_2 were completed. Work on energy transfer in hydrogen chloride is approaching completion. Important progress has been made in understanding the general problem of the partitioning of transferred vibrational energy among rotational and translational degrees of freedom. Rate measurements in mixtures of three and four gases have considerably increased the number of systems which may be studied with fixed frequency lasers. The work on $\text{N}_2\text{-CO}$,

paper 4, is an example. Work with a tunable infrared laser has just begun to be productive and will be fully reported at a later date.

C Bradley Moore

Publications

1. Temperature Dependence of Nearly Resonant Vibration-Vibration Energy Transfer in CO₂ Mixtures, by J.C. Stephenson and C.B. Moore, J. Chem. Phys. 56, 1295 (1972).
 2. Vibrational Relaxation of Laser-Excited CO₂-Polyatomic Mixtures, by J.C. Stephenson, R.E. Wood, and C.B. Moore, J. Chem. Phys. 56, 4813 (1972).
 3. V-V Energy Transfer in CO₂-Hydrogen Halide Mixtures, by J.C. Stephenson, J. Pinzi, and C.B. Moore, J. Chem. Phys. 56, 5214 (1972).
 4. Vibration-to-Vibration Energy Transfer in N₂-CO, by P.F. Zittel and C.B. Moore, Appl. Phys. Letters, 1 Aug. 1972.
- Two review articles received indirect support from the contract.

5. Lasers in Chemistry, by C.B. Moore, Ann. Rev. Phys. Chem. 22, 387 (1971).
6. Vibration-Vibration Energy Transfer, by C.B. Moore, Adv. Chem. Phys. (1972).