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One Dimensional Conductors
or TCNQ

Near Infrared Optical Properties of (TSeF)(TCNQ).
B. WELBER and E. M. ENGLER, IBM Research (Yorktown) and
P. M. GRANT, IBM Research (San Jose).-- We have measured the normal incidence room temperature reflectivity of (TSeF)(TCNQ) from 0.6 - 1.6 eV. A Drude analysis of the data yields values of $\hbar\omega_p$ = 1.68 eV and $\tau = 3.5 \times 10^{-15}$ sec as compared to 1.38 eV and 2.3×10^{-15} sec found previously for (TTF)(TCNQ).[1] The higher figure for the plasma energy of (TSeF)(TCNQ) is consistent with the higher dc conductivity of this material and an expected greater band dispersion arising from cation-cation overlap. The longer Drude lifetime found for (TSeF)(TCNQ) supports a recent interpretation of the thermopower of $(TTF_{1-x}TSeF_x)(TCNQ)$ alloys based on lifetime differences between cation-anion chains.[2]

[1] P. M. Grant, R. L. Greene, G. C. Wrighton, and G. Castro, Phys. Rev. Letters 31, 1311 (1973).

[2] P. M. Chaiken, J. F. Kwak, R. L. Greene, S. Etemad and E. Engler, to be published.

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GH 18 Stimulated Backscattering in a Linear Inhomogeneous Medium. D. J. KAUP, Dept. of Physics, Clarkson College of Tech., Potsdam, N.Y.--Previous work[1] on homogeneous undamped stimulated backscattering is extended to the case of a linear inhomogeneous, undamped three-wave interaction. Even with a linear inhomogeneity present, the inverse scattering solution is still valid, with the reflection coefficient still given by

$$R = (\pi E_o)^{-1} \int_{-\infty}^{\infty} d\lambda \ell n[1+\Gamma(\lambda)],$$

where E_o is the incident energy and Γ is again a function only of the initial pulse profiles. However, now it is not practical to obtain closed form solutions for Γ, even for square initial pulses, so numerical methods must be used. Still, determining R by the above integral is faster than computer simulations, and we shall compare values for the homogeneous and inhomogeneous cases, pointing our the different possible effects of the inhomogeneity.

[1] D.J. Kaup, A. Reiman and A. Bers, Bull. Am. Phys. Soc. Vol. 20, p. 1291, 1975.

GH 19 Achievement of Megampere Discharge Currents with Nine Kilojoules of Energy. C. B. ZAROWIN, IBM T. J. Watson Research Center. -- We report achievement of megampere currents in a low pressure gas discharge with the expenditure of only nine kilojoules of capacitively stored energy. The coupling to the discharge is electrodeless, employing an unusual coaxial multiturn step-down transformer. For a given peak current, significantly less stored energy is required than for conventional inductive coupling, because the gas discharge is more tightly coupled to the primary of this device. A description of the device and an outline of its properties will be given in addition to some preliminary results obtained with its first realization.

WEDNESDAY MORNING, 4 FEBRUARY 1976
MORGAN SUITE AT 9:00 A.M.
D.C. Tsui, presiding

ORGANICS, SEMICONDUCTORS, RADIATION DAMAGE

GI 1 Demonstration of Charge Transfer in One-Dimensional Organic Metals.* G. CIOBANU, University of Bucharest and Institute of Physics, Bucharest, Romania and S. K. MUN, TAESUL LEE and T. P. DAS, SUNY Albany--From a study of the energy-levels of neutral and charged TCNQ and TTF molecules in the TCNQ-TTF system and their counterparts in the systems TCNQ-TSeF, TCNQ-DSeDTF (cis and trans), obtained by the self-consistent charge extended Hückel procedure and including the effect of Coulomb interactions with charges on the atoms in neighboring molecules, it is demonstrated that substantial charge transfer, ranging from 72% for TCNQ-TTF to 40% for TCNQ-DSeDTF (cis), are needed to explain in each case the common Fermi levels for the two chains, the latter ranging from -9.0 to -10.6 eV. The occurrence of substantial charge transfer in TCNQ-TTF agrees with conclusions from uv- and X-ray photoemission experiments.[1,2]

*Supported by National Science Foundation and Romanian Council of Science and Technology.
[1]W.D. Grobman, R.A. Pollak, D.E. Eastman, E.T. Maas Jr. and B.A. Scott, Phys. Rev. Lett. 32, 534 (1974).
[2]B.H. Schectman, S.F. Lin and W.E. Spicer, Phys. Rev. Lett. 34, 667 (1975).

GI 2 Near Infrared Optical Properties of (TSeF)(TCNQ). B. WELBER and E. M. ENGLER, IBM Research (Yorktown) and P. M. GRANT, IBM Research (San Jose).-- We have measured the normal incidence room temperature reflectivity of (TSeF)(TCNQ) from 0.6 - 1.6 eV. A Drude analysis of the data yields values of $\hbar\omega_p$ = 1.68 eV and τ = 3.5 x 10^{-15} sec as compared to 1.38 eV and 2.3 x 10^{-15} sec found previously for (TTF)(TCNQ).[1] The higher figure for the plasma energy of (TSeF)(TCNQ) is consistent with the higher dc conductivity of this material and an expected greater band dispersion arising from cation-cation overlap. The longer Drude lifetime found for (TSeF)(TCNQ) supports a recent interpretation of the thermopower of $(TTF_{1-x}TSeF_x)(TCNQ)$ alloys based on lifetime differences between cation-anion chains.[2]

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[2]P. M. Chaiken, J. F. Kwak, R. L. Greene, S. Etemad and E. Engler, to be published.

GI 3 EPR of Triplet Excitons in Crystalline Tetracene.† M. CHOPP,* L. YARMUS, J. ROSENTHAL, and C.E. SWENBERG,** New York University.--We present an analysis of the magnetic resonance spectrum of triplet excitons in single-crystal tetracene. This is a summary report of an investigation initiated earlier.[1] The main feature of the spectrum that has to be explained is the observation of high degrees of spin polarization that exhibit both anisotropy and a dependence upon excitation intensity. The analysis is based on solutions to a set of non-linear rate equations for the steady-state spin populations. The central roles of both singlet exciton fission in providing selective population and exciton hopping in mediating spin relaxation will be discussed.

†Partially supported by N.S.F. and E.R.D.A.

*Present address: NYC Health and Hospitals Corporation.

**Present address: National Institute of Mental Health.

[1]L. Yarmus, J. Rosenthal, and M. Chopp, Chem. Phys. Letters 16 477 (1972).

GI 4 Singlet Exciton Fission in Tetracene Crystals: A Test of the Pair-State Model.* J. ROSENTHAL, C.E. SWENBERG,** and L. YARMUS, New York University.-- We examine the problem of applying the pair-state model of exciton-exciton annihilation in high magnetic fields to the case of singlet exciton fission in crystalline tetracene. Attempts to fit the angular field dependence of prompt fluorescence and the spin polarization of magnetic resonance spectra in the interval close to pair-state crossings are both shown to be unsuccessful. These results are taken to suggest a defect in the model, at least for fission. Some speculations toward a resolution are offered.

*Partially supported by N.S.F. and E.R.D.A.

**Present address: National Institute of Mental Health.

GI 5 Observation of Higher Subband in n-type (100) Si Inversion Layers. D. C. TSUI, Bell Labs., Murray Hill, NJ--Population of higher