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Pressure Dependence of the Drude Edge in Crystalline $(SN)_x$. P. M. GRANT and B. WELBER, IBM Research Laboratories--We have measured the pressure dependence of the Drude edges in crystalline $(SN)_x$ using polarized reflectance techniques. For E||b we observe a weak red shift with increasing pressure similar to that found earlier for decreasing temperature[1] suggesting that the latter is primarily a volume effect. The implications of our results concerning the pressure dependence[2] of the superconducting transition temperature in $(SN)_x$ will be discussed.

[1]P. M. Grant, et al., Bull. Am. Phys. Soc. 21, 254 (1976).
[2]W. D. Gill, et al., Phys. Rev. Letters, 35, 1732 (1975).

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ture down to about 0.2 K when both the real and imaginary components of the susceptibility, χ' and χ'' respectively, change markedly. The temperature, T', at which this change occurs is lowered on increasing a D.C. magnetic field applied to the sample. Below T', both χ' and χ'' increase continously down to the lowest temperatures recorded (~45 mk). Samples synthesized both at the University of British Columbia and IBM, San Jose, show similar behaviour.

[1]R.L. Greene, G.B. Street and L.J. Suter, Phys. Rev. Lett. 34, 577 (1975).

EJ 4 Electronic Structure Investigations of $(SN)_x$ and Its Precursor S_2N_2 Using the Extended Tight Binding (ETB) Method. I. P. BATRA and S. CIRACI*, IBM Research Laboratory, San Jose, CA.--We present detailed electronic structure, total density of states and orbital density of states for polymeric sulphur nitride, $(SN)_x$, and its precursor disulphur dinitride, S_2N_2, using the ETB method. Our calculation predicts that S_2N_2 is an indirect gap (Eg ~1.5 eV) semiconductor. By a comparative study of S_2N_2 and $(SN)_x$ we have been able to show that in going from S_2N_2 to $(SN)_x$, S-3p and N-2p hybridization increases leading to a charge delocalization and hence enhanced conductivity for $(SN)_x$. We have also been able to provide a complete interpretation of the X-ray and UPS photoelectron spectra of $(SN)_x$. The intensities of various peaks are in good accord with those expected from our calculated symmetries of initial state wave functions (ignoring final state effects). Similar data are provided for S_2N_2.

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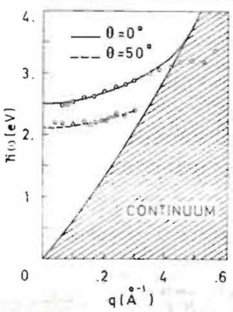
EJ 5 Electrical Resistance of Single Crystal and Epitaxially-Grown Films of $(SN)_x$. R. J. SOULEN and D. B. UTTON, NBS* -- The dc electrical resistance of a single crystal and three epitaxially-grown thin films of $(SN)_x$ was measured from 0.030 K to 8.9 K in an ambient magnetic field of less than 10^{-7} T. The single crystal sample had a residual resistivity ratio of 16 and exhibited a drop to immeasurably small resistance over the temperature region from 0.05 K to 0.27 K. Such behavior is similar to what was originally observed by Greene, Street, and Suter.[1] By contrast, the resistance of the films increased dramatically as the temperature was lowered. Above 0.25 K the data for the three films were fitted very well by an equation representing transport of electrons by tunneling between metallic particles of $(SN)_x$. A change in the temperature dependence of resistance below 0.25 K suggests, but not conclusively, that individual particles of $(SN)_x$ become superconducting below this temperature.
*Supported in part by ONR Contract N00014-76-F-001
[1]R. L. Greene, G. B. Street, and L. J. Suter, Phys. Rev. Lett., 35, 577 (1975).

EJ 6 Metallic Conductivity in $(SN)_x$ Films.* W. D. GILL, W. BEYER†, and G. B. STREET, IBM Research Laboratory, San Jose, CA--The dc conductivity of $(SN)_x$ films is found to be a sensitive function of substrate temperature T_s. We have investigated the temperature dependence of the dc conductivity and the absolute thermoelectric power of films for $-20°C<T_s<60°C$. At lower values of T_s the conductivity is low ($\sigma_{RT} \approx 10^{-2}\ \Omega^{-1}\mathrm{cm}^{-1}$) with semiconductor temperature dependence and the thermopower is large and positive. As T_s is increased the conductivity of the films increases several orders of magnitude ($\sigma_{RT} \approx 10^{+2}\ \Omega^{-1}\mathrm{cm}^{-1}$ for $T_s = 50°C$) and the temperature dependence of σ becomes slightly metallic-like. The thermopower decreases with increasing T_s finally becoming negative for $T_s>40°C$ and with the same temperature dependence as measured in good quality $(SN)_x$ crystals. These results are compatible with a model based on the observed heterogeneous structure of the films.
*Research supported in part by ONR.
†Present Address: Fachbereich Physik der Universität Marburg, F.R. Germany

EJ 7 Pressure Dependence of the Drude Edge in Crystalline $(SN)_x$. P. M. GRANT and B. WELBER, IBM Research Laboratories--We have measured the pressure dependence of the Drude edges in crystalline $(SN)_x$ using polarized reflectance techniques. For E∥b we observe a weak red shift with increasing pressure similar to that found earlier for decreasing temperature[1] suggesting that the latter is primarily a volume effect. The implications of our results concerning the pressure dependence[2] of the superconducting transition temperature in $(SN)_x$ will be discussed.

[1]P. M. Grant, et al., Bull. Am. Phys. Soc. 21, 254 (1976).
[2]W. D. Gill, et al., Phys. Rev. Letters, 35, 1732 (1975).

EJ 8
Plasmon excitations in $(SN)_x$.[+] F. BROSENS, J.T. DEVREESE, L.F. LEMMENS [++], University of Antwerpen (RUCA-UIA), J. RUVALDS, University of Virginia.



---The anomalous anisotropy and dispersion of plasmons in $(SN)_x$, as measured by Chen et al., [1], are explained within a model of an electron gas with an anisotropic effective mass. The R.P.A. (full line: θ=0°; dashed line : θ=50°) yields good agreement with the electron loss data (open circles) for the plasmon dispersion.

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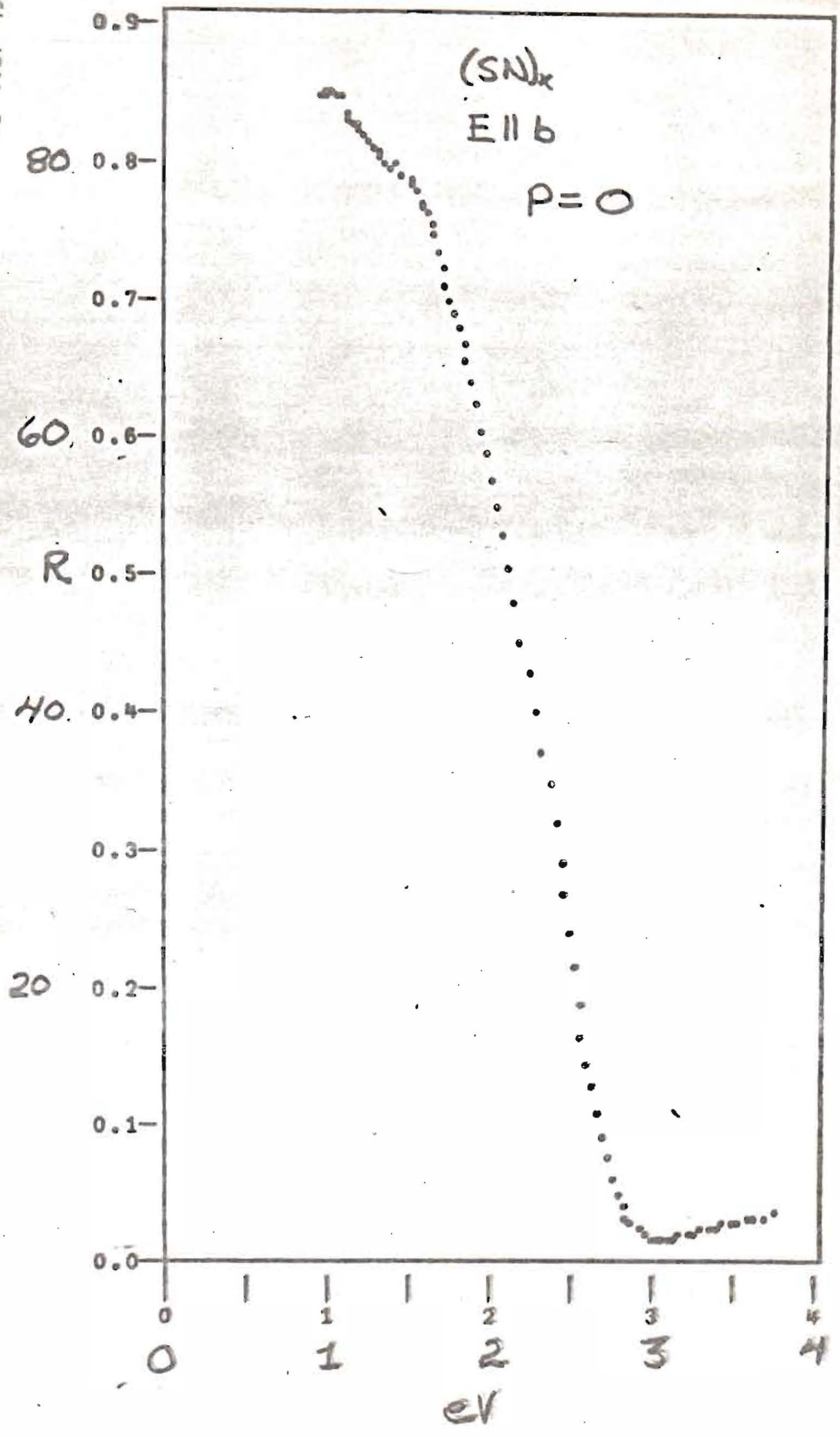
[1] C.H. Chen, J. Silcox, A.F. Garito, A.J. Heeger, A.G. McDiarmid, Phys. Rev. Letters 36, 525 (1976).
+ Supported by the Project E.S.I.S.
++ Aangesteld navorser van het N.F.W.O.

EJ 9 Optical Properties of Linear Chain Mercury Compounds. D. L. PEEBLES, C. K. CHIANG, M. J. COHEN, A. J. HEEGER, N. MIRO, and A. G. MacDIARMID, U. of Pennsylvania, Phila., PA -- Polarized reflectance studies from single crystal faces of the quasi-1 D compounds $Hg_{2.86}AsF_6$ and $Hg_{2.86}AsF_6 \cdot AsF_3$ are presented. The results indicate metallic behavior for electronic excitations along the chains (in the $\vec{a}$-$\vec{b}$ plane) with free electron Drude theory giving a satisfactory initial description of the data. The plasma frequency is found to be $\hbar\omega_p = 4.8$ eV, and combined with the electron density yields a free electron optical mass. The implied optical conductivity in the a-b plane at room temperature is $\sigma_{opt} = (4\pi)^{-1}\omega_p^2\tau \simeq 10^4(\Omega\text{-cm})^{-1}$ in good agreement with the measured dc value. Normal incidence studies of reflectance from crystal faces at an angle with the a-b plane are analyzed to provide a complete description of the complex dielectric tensor in the spectral range from 1 eV to 4 eV.

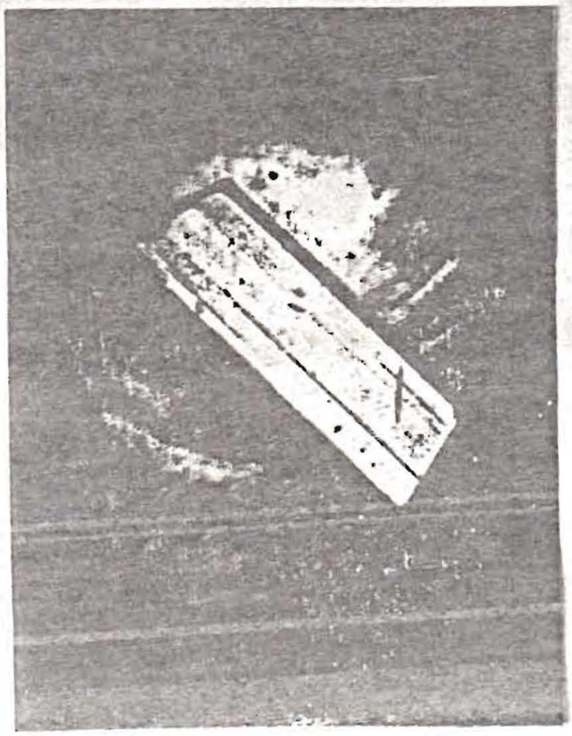
EJ 10 Nuclear Magnetic Resonance Studies of $Hg_{2.86}AsF_6$. E. EHRENFREUND, P. R. NEWMAN, A. J. HEEGER, N. MIRO and A. G. MacDIARMID, U. of Pennsylvania, Phila. PA -- We have measured the ^{19}F and ^{199}Hg nuclear spin lattice relaxation times (T_1) in a sample of powdered crystals of $Hg_{2.86}AsF_6$, in the temperature range from 1.5K to 300K. The relaxation of both the ^{19}F and ^{199}Hg nuclei, at a resonance frequency of 10 MHz, shows characteristic metallic behavior at low temperatures, i.e., T_1T is nearly temperature independent with $^{199}T_1T \approx$ 0.007 secK and $^{19}T_1T \approx 340$ secK. The very long $^{19}T_1$ compared with $^{199}T_1$ indicates a very small amplitude, at the fluorine nucleus, of the conduction electron wave function averaged over the Fermi surface, and in turn suggests that the metallic properties are nearly completely determined by the electrons of the interpenetrating



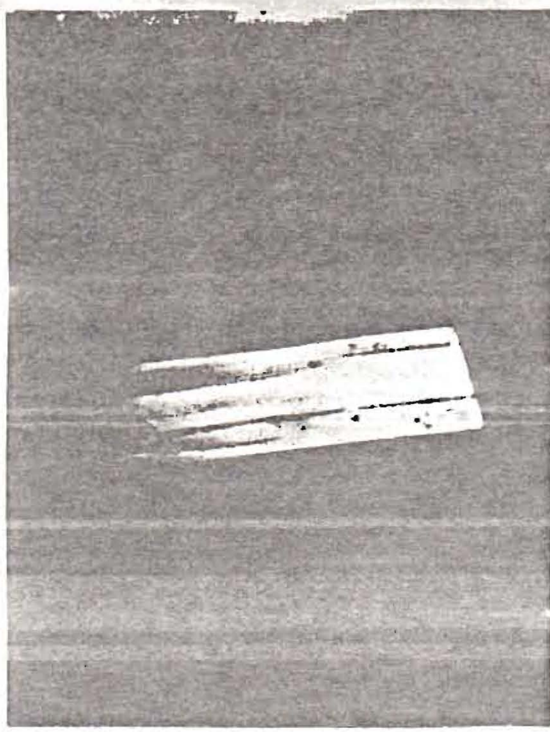
(SN)x
E ll b
P=0
R
80
60
40
20
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
eV

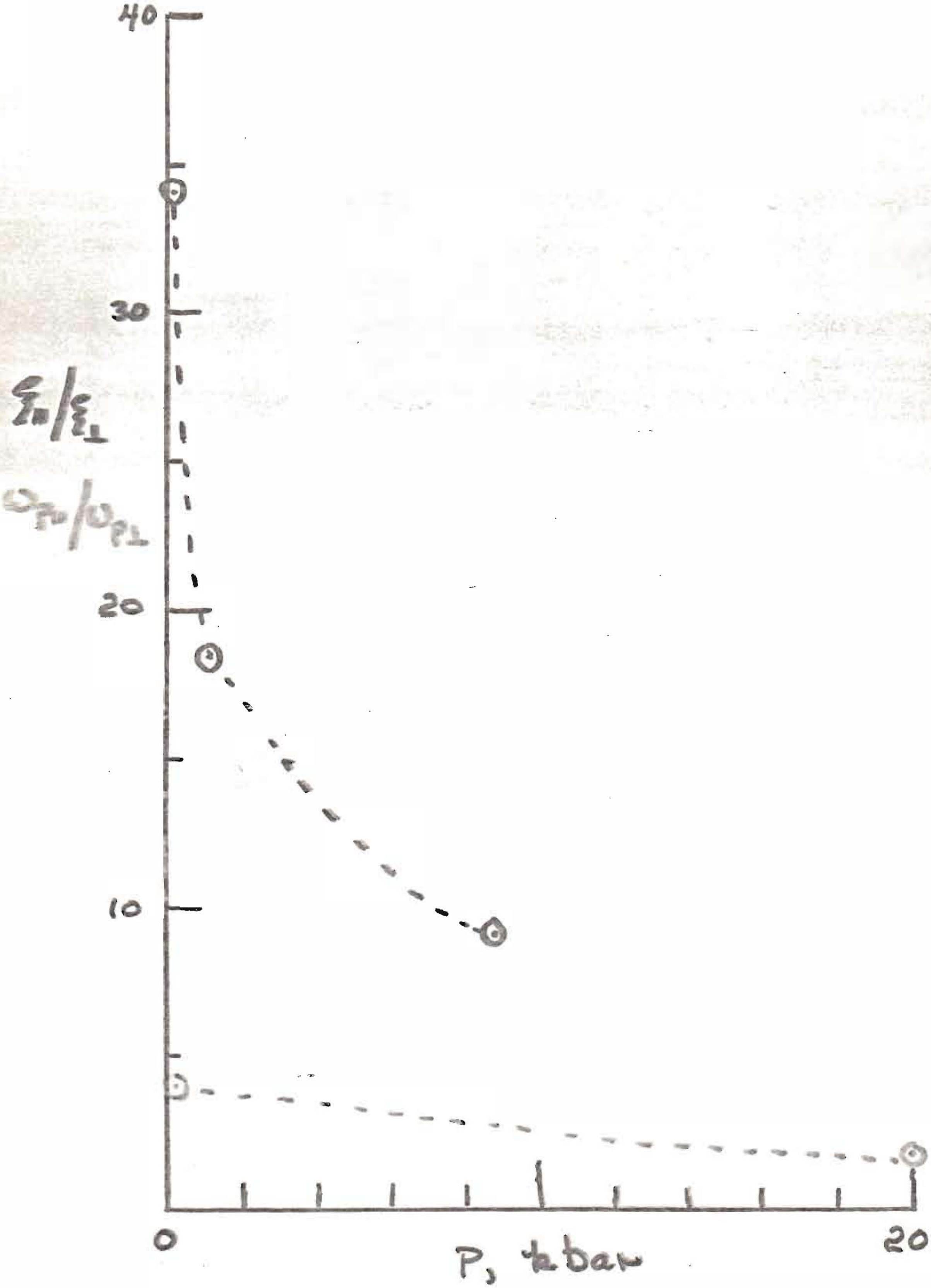
~~P = 0 kbar.~~

P ≈ 1 - 2 kbar



P=20 Kbar




40
30
20
10
0
20
P, kbar

COHERENCE LENGTH ANISOTROPY

$$\xi = \left(\frac{\sigma}{\gamma T_c}\right)^{1/2} = \left[\frac{\omega_p^2 \tau}{\frac{4\pi^3}{3} \hbar^2 N(\epsilon_F)\, T_c}\right]^{1/2}$$

$\therefore$

$$\frac{\xi_{\parallel}}{\xi_{\perp}} = \frac{\omega_{p\parallel}}{\omega_{p\perp}}\left(\frac{\tau_{\parallel}}{\tau_{\perp}}\right)^{1/2} = \left(\frac{\sigma_{\parallel}}{\sigma_{\perp}}\right)^{1/2} = \frac{\left.\frac{\partial H_c}{\partial (T/T_c)}\right|_{\parallel}}{\left.\frac{\partial H_c}{\partial (T/T_c)}\right|_{\perp}}$$

PRESSURE DEPENDENCE

P (kbar)	$\hbar\omega_p$ (eV)	τ (10^{-15} sec)
0	4.9	1.2
5	4.8	1.4
12	5.0	1.9
20	4.9	1.8

"THE BOTTOM LINES"

- $\sigma_{\parallel_{300}}(P)$ DOMINATED ENTIRELY BY $\tau_{DC}(P)$
- $\sigma_{\perp_{300}}(P)$ DOMINATED MOSTLY BY $\tau_{DC}(P)$
- T_c vs P ? IMPLICATIONS ARE THAT:
  - : IF $T_c(P)$ GIVEN BY $N(\epsilon_F)$ vs P,
  - : THEN $T_c(P)$ COMES MOSTLY FROM $\perp$ DIRECTIONS
  - : CONSISTENT WITH OPW
- $\rho_{\parallel}/\rho_{\perp}(P)$ DOMINATED BY $\tau_{\perp}^{imp}(P)$; NOT A BAND STRUCTURE EFFECT