Absolute Line Strengths for Cr I and Cr II. G. CHARATIS AND T. D. WILKERSON, *Institute for Fluid Dynamics and Applied Mathematics, University of Maryland*.—Shock tube experiments at the University of Michigan (Charatis, G., Ph.D. thesis, University of Michigan, 1961; Wilkerson, T. D., Ph.D. thesis, University of Michigan, 1961) have yielded absolute gf values for 38 lines of Cr I and 25 lines of Cr II. The test gas was neon with 0.03–0.30% Cr(CO)₆. Emission and absorption spectra were observed behind reflected shock waves at temperatures 5500–10 000°K. The gaseous state was obtained in two ways: it was measured directly, to check computations from shock-wave theory taking account of dissociation, ionization and excitation. Pressures and temperatures, respectively, were measured via piezoelectric transducers and the spectral line reversal method. These verified the computed state of the gas to within 5% for the pressure and 3% for the temperature.

Line intensities were measured by heterochromatic photometry, with the carbon arc as a radiation standard. Absolute gf values for the lines were obtained from calculated atomic level populations and radiative transfer theory. For Cr II, the body of useful data is greatly enlarged by these results. For Cr I, an earlier relative gf value scale (Hill, A., and King, R. B., *J. Opt. Soc. Am.* **41**, 315, 1951) is corrected (Charatis, G., and Wilkerson, T. D., *Phys. Fluids* **5**, 12, 1661, 1962) in accord with multielement arc results (Corliss, C. H., and Bozman, W. R., *NBS Monograph* 53, 1963). Moreover, our values confirm prior results for Cr I resonance lines (Ostrovskii, Yu. I., and Peinkin, N. P., *Opt. i Spektroskopiya* **3**, 193, 1957) and are slightly higher than those absolute values estimated by Corliss and Bozman.

Not only have our line strength measurements been supported by direct measurement of shock tube conditions; more recent results convince us that the attainment of LTE, the usefulness of shock theory, etc., were typical rather than unique or unusual. Indeed, the gas-driven shock tube seems well suited to studies of lighter elements and their ions at least up to 15 000°K. It is therefore likely that early experiments of the latter kind (Doherty, L. R., Ph.D. thesis, University of Michigan, 1961) gave approximately correct results. This regime is now under intensive study.

Absence of Crystal Structure in Interplanetary Dust. HENRY CHESSIN, DOUGLAS S. HALLGREN, AND CURTIS L. HEMENWAY, *Dudley Observatory*.—Previously particles collected by the Venus Flytrap experiment were studied by electron diffraction techniques. Of the 254 particles examined, only two particles exhibited diffraction patterns. However, pat-

terns could be obtained if the particles were heated (Hemenway, and Soberman, *Astron. J.* **67**, 256, 1962; Greenman, *Ann. N. Y. Acad. Sci.* **119**, 298, 1964).

In the present work hard x rays were employed to obtain x ray scattering diagrams using standard precession and oscillation techniques. To determine the sensitivity of our techniques, measurements were made of a calcite single-crystal particle ($8 \times 20 \mu$ —3 h exposure), an Odessa meteorite chip ($6 \times 19 \mu$ —1.5 h exposure), and an iron–nickel alloy particle ($8 \times 10 \mu$ —12 h exposure). Clearly detectable diffraction patterns were observed from these samples.

The cosmic dust particles, which we have examined by x-ray techniques, were collected during meteor shower activity by a balloon-top collection system described previously (Coon, Dugan, Hallgren, and Hemenway, *Astron. J.* **70**, 671, 1965). The particles, all irregular in shape, ranged in size from 20–130 μ . Only one of the 14 particles studied thus far has shown a detectable diffraction pattern, although 24-h exposures were made. Thus far it has been impossible to identify this pattern.

Four cosmic dust particles were observed by low-angle x-ray scattering techniques. No inhomogeneities in electron or mass densities were found. The techniques employed should reveal regularity greater than 10 Å.

Thus it appears that cosmic dust particles are amorphous. At present it is not known if their lack of crystal structure is the result of the method of formation of these particles or the result of cosmic ray proton bombardment in space. In any case, our surprisingly large particles have not been annealed by heating during entry into the earth's atmosphere. The theory describing their entry may require further consideration (Whipple, F. L., *Proc. Natl. Acad. Sci.* **36**, 687, 1950).

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Pre-White Dwarf Evolution and Neutrino Emission. C.-W. CHIN, H.-Y. CHIU, AND R. STOTHERS, *Goddard Institute for Space Studies*.—Recent observational work has shown that the central stars of planetary nebulae are evolving into white dwarfs and that at the end of their evolutionary track ($L=10^2 L_\odot$, $T_e=10^5$ °K) they have contracted to essentially white-dwarf radii. Hence the subsequent evolutionary track is quite certain. Models for pre-white dwarfs in the luminosity range $10^2 L_\odot$ down to $1 L_\odot$ (where a few white dwarfs are observed) have been constructed with and without the inclusion of the plasma neutrino process, which depends critically on the existence of the direct electron–neutrino