X. SOFT X-RAY SPECTROSCOPY

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RESEARCH OBJECTIVES

The soft x-ray spectroscopy program has as its objective the experimental study of the structure of the conduction band of electrons in a series of metals, particularly the alkalis, alkaline earths, and some of the transition metals. The filled portion of such a band can be studied by observing the emission spectrum produced by transitions from this band to the nearest available sharp levels below this band. In most metals this corresponds to an energy in the range 15-250 ev (wavelength in the range 900-50 Å), so that techniques of extreme ultraviolet vacuum spectroscopy need to be used. The energy widths of these bands usually lie in the range 2-10 ev.

In order to avoid serious contamination of the metal that is being studied, an ultra-high vacuum ($5 \times 10^{-10}$ Torr) spectrometer has been constructed. Another feature of the device is the elimination of the usual ruled grating as a dispersing element. Analysis of the emission spectrum is accomplished by using a neutral atomic beam from which photoelectrons are ejected after absorption of the x-rays to be analyzed. This instrument has been completed and some preliminary tests have been run.

The absolute positions of the energy bands in solids, in addition to their widths, are of considerable interest. Design work is under way for a double-focusing electron spectrometer of high precision for use in accurate determination of such positions.

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