too small. With $X_e=0.65$, $t_{\text{HB}}/t_{\text{GC}}\sim 0.8\times 10^{-2}$, in much closer agreement with the expected ratio.

Remarks on the Problem of Identifying x-Ray Sources. HUGH M. JOHNSON, *Lockheed Missiles and Space Company, Palo Alto*.—The problem is similar to the one which radio astronomy faced in 1949. In 1965 we know about a dozen x-ray sources, one of which (the Crab Nebula) has been identified. The unidentified sources are also near the galactic plane, and about half of them are clustered within 16° of the galactic center but none is at the galactic center. Ambiguities in the published positions of cluster sources are discussed. The *cluster* is probably centered 10 kpc away and the sources are probably hidden in the galactic zone of obscuration. The remaining *field* sources may be near enough to be unobscured, and a bremsstrahlung or synchrotron spectrum predicts them to be bright enough to be seen. The extrapolated spectrum of the x-ray source in the Crab Nebula joins the optical continuum rather smoothly, but we have not identified the brightest source in Scorpius (X-1 Sco), predicted to be an 11th-magnitude object by the observed bremsstrahlung spectrum, at a position known to about $\pm 15'$. This probably means that the source is between $1'$ and $7'$ in diameter, with a surface brightness too low to be ordinarily photographed above wide-band sky noise, or the optically visible part may be $<10''$ in diameter. Certain features of the interstellar matter over a large area around X-1 Sco may be related to it, and they may indicate its distance.

A few objects of filamentary structure or high excitation can be found at the positions of x-ray sources, e.g., CI Cyg at the position of Cyg XR-1, KW Sgr at Sgr XR-1, NGC 6302 at Sco XR-2, and No. 114 in the catalogue of Rodgers, Campbell, and Whiteoak at Sco XR-3. These instances suggest the possibility that some x-ray sources may be the hot cores of combination variables or objects related to terminal red giants. Too little is known of the x-ray spectra, and source positions, to check this idea.

This work has been done under the Lockheed Independent Research Program.

Rapid Compilation of Isophote Contours of Extended Astronomical Objects. IRVING L. KOF-SKY, *Technical Operations Research, Burlington*.—The application of the automatic isophotometer of Miller, Parsons, and Kofsky (*Nature* 202, 1196, 1964) to photographic images of extended astronomical sources is described. In this instrument a microbeam from a stationary optical system scans and steps its way across the section of negative under study, the measured microdensities being simultaneously plotted to scale in either a 3- or 12-symbol

code. The transfer characteristic of the film can be rectified, or its contrast enhanced, by adjustment of the grey wedge in a null-balancing reference beam. The cyclic three-symbol code (line, closely packed dots, space) allows unambiguous determination of the direction of the density (or brightness) changes, along with a dense, conveniently viewed packing of data points on the output presentation. A 12-symbol "redundant" code can be generated by printing the three symbols in each of four colors; this greatly shortens the time needed by the interpreter to identify individual isophote contours. The instrument has been used for photogrammetry of the moon's surface by both the shadow and photometric slope analysis methods; for reducing the brightness structure of the solar corona, the solar disk at x-ray wavelengths, meteor trails, and the West Ford needle belt; on photographically recorded spectra; and for measuring the uniformity of brightness over the fields of telescopes. Examples are given of these and other applications of the instrument, with special reference to the use of the isophotometer "image" of low-contrast, low-spatial-frequency brightness distributions.

$I(6300,6363)/I(5577)$ Ratio of [O I] in the Spectra of Comets. N. S. KOVAR, *University of Houston*, AND R. P. KOVAR, *Rice University*.—It is not possible to explain the variation in the intensity ratio of the $\lambda 5577$ and $\lambda\lambda 6300,6363$ lines of [O I] in comets in terms of the fluorescence process or electron collisions. By considering the contributions of various atomic and molecular processes (such as dissociation, recombination, etc.) to the above processes, the various observed intensity ratios can be explained simply in terms of the electron density and temperature within the coma. Reasonable electron densities for the coma suggest that an electron temperature in the $10^5-5\times 10^5\text{K}$ range would best produce the conditions necessary for an understanding of the observed intensity ratios of [O I].

Stellar Rotation and Stellar Evolution among Cepheids and Other Luminous Stars in the Hertzsprung Gap. ROBERT P. KRAFT, *Mount Wilson and Palomar Observatories, Carnegie Institution of Washington*.—From a consideration of the shapes and associated time scales of the evolutionary tracks computed by Iben and by Kippenhahn and his associates for stars of masses 3, 5, 7, 9, and $15\odot$, together with Schmidt's main-sequence luminosity function, one is able to account for: (1) the observed population of stars in the Hertzsprung Gap, and (2) the shape of the period-frequency function for the classical Cepheids. The tracks suggest also that (3) the line profiles of all cepheids and supergiants *brighter* than MK Class II are a result of