An evacuated high-transmission prism spectrograph using a microchannel plate detection system with resistive strip read-out was flown behind a precision pointing telescope on a sounding rocket. The construction, preparation, flight performance and calibration stability of the system are discussed. Despite the adverse environmental conditions associated with sounding rocket flights, the microchannel detector system performed well. Far-ultraviolet spectra (1160-1750 Å) of Saturn, δAur, and ηBoo were obtained; spectral features with fluxes as low as 0.06 photons cm⁻² s⁻¹ were detected. This was achieved by operating the plates at lower than normal gains, using sensitive pulse counting electronics with both upper and lower limit discriminators, and maintaining the spectrograph and detector at a pressure of ~10⁻⁶ torr until reaching altitude. This work was supported by NASA under grant NGR 21-001-001.

05.02.05A Sounding Rocket Observation of the Far Ultraviolet (1160-1750 Å) Spectrum of Arcturus. A. WEINSTEIN and H. W. MOOS, JOHNS HOPKINS U. - A low-resolution spectrum of Arcturus (R2 III p) was obtained with a rocket-borne spectograph with a multi-spectral element microchannel plate detector on 1975 March 15 at 7:06 UT. The sensitivity of this instrument was ten times that of any instrument previously flown by this laboratory. Extensive pre- and post-flight calibration tests enable absolute flux calibration to better than ±20% at 1200 Å and ±25% at 1600 Å. Detections of HI Ly, OI 1304, OI 1356, and a broad unresolved emission near 1500 Å are reported. Ly from ηBoo was simultaneously observed by the PEP on OA-O-Copernicus and this instrument for absolute flux calibration comparisons. The results are in excellent agreement: the Copernicus value is 4.75 photons cm⁻² s⁻¹ and our result is 4.3 ± 0.3 photons cm⁻² s⁻¹. There is a distinct difference between the relatively featureless spectrum of this K giant and the Sun. Lower limits to undetected emissions which are strong in the solar spectrum permit the calculation of coronal base pressure upper limits. These indicate a pressure lower than previously adopted. This research was supported by NASA Grants NGR 21-001-001 and NSG-5087.

05.03.05 An Analysis of the Chromospheric O I Lines in Arcturus. B. H. RAUSCH & L. L. LINNEY, JPL (U. of Colorado and JPL). A. WEINSTEIN, Johns Hopkins, & R. SHINE, LASP. - Recent published (McKinney et al., Ap. J., in press) and unpublished rocket observations (see previous paper) of the ultraviolet spectrum of Arcturus (K2 IIIp) show strong emission lines due to the O I 1302, 4,6 resonance triplet (¹P-³S) and 1356, 9 intercombination lines (³P-³S). Additional O I absorption lines apparent in Griffin’s Photospheric Atlas of the Spectrum of Arcturus include transitions among excited levels at 3771, 4,5 (³S-³P) and 1846 (³S-³P) and forbidden transitions at 1630, 6363 (³P-³D) and 1357 (³D-³S). The ultraviolet O I emission lines appear to be anomalously bright because their surface fluxes are twice that of the quiet Sun, whereas the surface fluxes of other chromospheric resonance lines such as Ly and C II 3935, 6 are ~0.2 of the quiet Sun or fainter. In order to interpret this anomaly in the ultraviolet and the strength of the absorption lines in the visible and near infrared, we have modified the complete linearization code of Auer et al. (KPHO Contribution No. 555) to include a 14-level representation of O I. For our basic atmospheric model we adopt the chromospheric model of Ayres and Linsky (Ap. J., 200, 660) based on an analysis of the Ca II and Mg II emission lines. We present modified chromospheric models consistent with the O I data and discuss changes in our ideas concerning the structure of K giant chromospheres suggested by this analysis.

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05.04.05 The Mass of Arcturus. T. R. AYRES, CTR. FOR ASTROPHYSICS, & H. R. JOHNSON, IND. U. - We exploit the barometric properties of the radiation damped and pressure broadened wings of the Ca I λ 4227 and Ca II λ 3968 (B) and λ 3934 (K) resonance lines to estimate the surface gravity of the red giant Arcturus (a Boo K2 III). Our method is based on the LTE partial coherent scattering approximation for computing wing shapes, and empirical van der Waals damping constants determined by fitting calibrated disk-center, quiet-Sun profiles of H, K and λ 4227. We apply our approach to Arcturus using a grid of detailed atomic and molecular line-blanketed, radiative-convective equilibrium model photospheres. The fundamental model parameters are T eff = 4250 K, as determined from narrow- and broad-band spectral colors, and a systematic factor of 3 metal deficiency relative to Lambert’s solar abundances. By comparing synthetic profiles for models spanning a decade in log g with calibrated wing shapes from Griffin’s Photospheric Atlas, we estimate that Arcturus’ surface gravity lies in the narrow range log g = 1.6-1.8. If the radius of Arcturus is between 25 and 28 R o, as suggested by interferometry and parallax measurements, then the mass of this evolved star is 1.0 ≤ M/ M o ≤ 1.8, and implies that Arcturus has not suffered substantial mass loss during its ascent towards the giant branch. In addition, we find that the ratio of [Ca II] λ 3726 and [Ca I] λ 6573 line strengths gives the same surface gravity and calcium abundance (A Ca/A Ca - 1/3) as H, K, and λ 4227 for a depth-independent microturbulence of ~1.75 km s⁻¹. Unfortunately, the CaII/CaI forbidden line ratio is probably too sensitive to microturbulence to be useful as a gravity diagnostic, unless microturbulence is constant in G and K giants.