New Approach to High-Stability Drive Oscillators. DONALD E. TRUMBO, *Kitt Peak National Observatory*.—A telescope drive oscillator using digital techniques and the principle of the binary multiplier has been in use at Kitt Peak National Observatory for more than a year. The basic stability is determined by a fixed-frequency crystal oscillator and thus a stability of a few parts in 10^7 is easily attained. This oscillator is completely insensitive to any reasonable temperature or supply voltage fluctuations. An outstanding advantage is the ease of setting it to particular frequencies, either locally or from distances of up to 200 ft. The quantization and drift is such that the telescope error due to the oscillator should be less than $\frac{1}{2}$ sec of arc per hour. Careful logical design has produced a simple compact unit.

Neon and Oxygen Lines in 10 Lacertae. ANNE B. UNDERHILL AND MART DE GROOT, *Sterrewacht der Rijksuniversiteit, Utrecht, The Netherlands*.—Observed profiles of lines in multiplet 2 of *Ne II*, in multiplets 1 and 2 of *O II*, and in multiplets 3 and 15 of *O III* in the spectrum of 10 Lacertae are compared with the profiles computed from a model atmosphere which is in radiative and mechanical equilibrium and which gives a good representation of the wings of the Balmer lines in 10 Lacertae. It is necessary to introduce a turbulent velocity about four times the thermal velocity in order to predict profiles of the observed shape and to obtain equivalent widths about the same as those which are observed.

Good agreement with observation can be obtained by reducing the neon abundance by one-half from the usually recommended value. A fractional abundance by weight of 3.45×10^{-3} is recommended. The weaker *O III* lines are predicted about as observed with a fractional oxygen abundance by weight of 9.70×10^{-3} . However, *O III* 3340.74 is predicted too weak and the *O II* lines are predicted too strong. Very likely a hotter model atmosphere is required to represent the atmosphere of 10 Lacertae. With such an atmosphere, better agreement between predicted and observed *He II* lines could be obtained with a fractional helium abundance by weight of 0.32, particularly if turbulence is introduced. There may be difficulties, however, in predicting correctly the Balmer series and other low excitation lines, such as *Mg II* 4481.

The observed line at 3311.30 Å is too strong to be due only to *Ne II*. The most likely blending line is *Ar III* 3311.25. Weak *Ar III* lines appear to be present also at 3301.88 Å and at 3285.85 Å, but no evidence is found for the other *Ar III* lines listed in the *Revised Multiplet Table*. A strong unidentified line occurs at 3341.6 Å. This line is nearly as

strong as *O III* 3340.74, but the only possible line listed in the *Revised Multiplet Table* at this wavelength is *Ar II* 3341.77, which seems an improbable identification in view of the weakness of other *Ar II* lines.

Manipulative Derivation of some Equations of Invariant Imbedding. PETER D. USHER, *Harvard College Observatory*.—Two transformations are established which convert a linear nonhomogeneous system *S* of ordinary first-order differential equations into a system *R* comprising a matrix Riccati equation and a linear nonhomogeneous ordinary matrix differential equation. If the boundary values of system *S* are two-point, then under certain conditions the solution of system *R* is uniquely determined by one-point boundary values. In the case when the system *S* is homogeneous and with boundary values evenly distributed over the two boundaries, the resulting initial value problem is identical to that of invariant imbedding, with the transformed variables retaining their classical meaning. The transformations are generalizations to large-order nonhomogeneous systems of the wide class of transformations which convert linear homogeneous second-order systems to scalar Riccati equations. A simple third-order system with two-point boundary conditions is solved for illustrative purposes.

Five-Color Photometry of Variable Star Field IV in M31. SIDNEY VAN DEN BERGH, *David Dunlap Observatory*.—Photographic photometry of 52-in. Schmidt plates in the ultraviolet, blue, yellow, red, and infrared is reported. The *UBV* data were calibrated using photoelectric observations by Arp. The following results are obtained: (1) The reddening of the association OB 184 is $E(B-V) = 0.06 \pm 0.03$ (m.e.). This low value of the reddening is supported by *UBV* observations of foreground field stars. (2) The globular clusters in the halo of M31 are redder, and hence possibly metal richer, than are the globular clusters in the galactic halo. (3) The mean ultraviolet excess of field stars in the galactic halo is approximately +0.16. (4) The density gradient in the outer regions of the galactic halo is surprisingly small. (5) The luminosity function of the inner halo contains more M-type dwarfs than does the luminosity function near the sun. (6) Photographic photometry with the 200-in. and the *f*/3.67 Ross corrector appears to be slightly affected by coma at distances larger than 205'' from the field center. (7) The combination 103aD + GG 11 does not appear to reproduce the photoelectric *V* system for M-type supergiants.