shorter times appears from study of meteoritic nuclide ratios. Upper limits to the measured cosmic ray anisotropy indicate that approximate isotropy prevails. The calculations here assume that slight anisotropy and secular variations of cosmic rays could be attributed to supernovae or galaxy core flare-ups. It is also assumed that the (constant) mean time between supernovae is $T_{sn} \cong 10^{2 \pm \frac{1}{2}}$ yr in the galactic disk and over the Galaxy lifetime. Diffusion solutions for point instantaneous isotropic sources in an unbounded medium predict small secular variations and anisotropy. Combining these predictions with T_{sn} and limits on cosmic ray variations gives estimates for the age and distance of a possible supernova event. For example, a supernova 10^2 – 10^4 light years away which occurred 10^5 – 10^7 yr ago would be consistent with supernova frequency and with cosmic ray time and space variations. Estimates of Cygnus Loop parameters (Minkowski, R., *Rev. Mod. Phys.* 30, 1048, 1958) suggest that it could be an example which may meet the requirements of these calculations.

A flare-up at the center of a galaxy possessing a spherical halo is considered as a source of cosmic ray variations. This model provides estimates of the age and size of the outburst, and of the magnitude of the diffusion constants of the cosmic rays inside and outside the spherical boundary. The predictions of an infinite medium model (Charakhch'yan, A. N., and Charakhch'yan, T. N., *Geom. and Aeron.* 4, 509, 1964) are compared with these results.

Image Tube Spectra of Quasi-Stellar Objects. VERA C. RUBIN AND W. KENT FORD, JR., *Department of Terrestrial Magnetism, Carnegie Institution of Washington*.—Spectra have been obtained for 15 quasi-stellar objects with the DTM Cassegrain spectrograph attached to the 84-in. telescope at Kitt Peak and at Lowell Observatory with the 72-in. Perkins telescope of the Ohio State and Ohio Wesleyan Universities. The spectrograph incorporates an RCA cascaded image tube, and a typical exposure time is 30 min for an unwidened spectrum of an object with $V=17.5$ at a dispersion of 425 Å/mm. The spectra extend from 4400–8500 Å and, hence, cover the red region where normal photographic plates are less sensitive.

For 8 objects (3C196, 3C249.1, 3C263, 3C281, 3C298, 0922+14, 0957+00, 1217+02) with no previously published velocities, several spectra (up to 12) each have been obtained. Both 1217+02 and 3C249.1 have strong Balmer lines and [O III] 5007 in emission, indicating redshifts of 0.240 and 0.311, respectively. The Bolton source 1217+02 has an absorption break at 4887 Å seen on 3 plates which is interpreted as the redshifted *K* line of Ca II.

Curiously, 3C273 and 1217+02, the QSO's with the smallest known redshifts, are separated only by about 2° on the sky.

The spectrum of 3C196 has previously been described as featureless, but a compact feature of 6975 Å is seen on plates taken on four observing sessions. Extremely weak features at 5198 and 6057 Å are observed. These are identified with a $\Delta\lambda/\lambda=0.393$; the lines are redshifted $\lambda 5007$, H_γ , and $\lambda 3727$.

The spectra of 3C263, 0922+14, and 0957+00 each show one strong broad emission feature and several weak lines. In each case, the strong feature is identified with Mg II $\lambda 2798$ (at 4615, 5323, and 5339 Å, respectively), and redshifts of 0.652, and 0.908 are suggested. One well-exposed plate of 3C263 shows two sharp absorption features at 6516 and 6568 which, with the adopted redshift, are the *H* and *K* lines of Ca II.

For 3C281 and 3C298, no certain features have been identified. Spectra of seven objects previously observed (principally by Schmidt) show additional lines in the red, and confirm the published redshifts.

Color Distribution of White Dwarfs. M. P. SAVEDOFF, *Department of Physics & Astronomy, University of Rochester*.—The frequency distribution of color indices of white dwarfs can be computed from model calculations. Unlike the luminosity function, estimates of distance are not essential if the comparison is made with theoretical curves computed for stars brighter than a given apparent visual magnitude. An examination of the Eggen and Greenstein list of white dwarfs shows that the essential features of this distribution are unchanged for magnitude limits of 13, 14, or 15.

The absence of red stars is a reflection of the small volume of space searched. The absence of blue stars requires more rapid evolution for $T_e > 14\,300^\circ\text{K}$ than follows from the observed luminosity. The data imply either a bias against white dwarfs of high effective temperature in the observing list or a large energy dissipation by either mass loss or neutrino emission. The luminosity distribution of Eggen and Greenstein shows a drop at visual magnitude +9 which is an artificial product of the system of magnitude determination and not evidence for neutrino loss as suggested by Savedoff and others.

Laboratory Studies on Stark Broadening at Low Electron Densities. HANS SCHLÜTER (introduced by FRANK N. EDMONDS), *The University of Texas*.—Steady state hydrogen plasmas are generated by a rf-discharge arrangement with static magnetic field. Recombination controlled plasmas of