spherules in tektites indicates that if produced by comets the comets must have been similar to meteorites. It is further shown by reference to the great comet of 1882 that comets must possess a considerable amount of mass per unit area and either a density like that of water or a nonzero tensile strength. It is further shown that even the impact of a comet less dense than the great comet must result in the formation of a crater.

Hence, the effects of cometary impact appear to be indistinguishable from those of a meteoritic impact.

The Passage of a Flare Spray through the Solar Emission Corona. FRANK Q. ORRALL and HENRY J. SMITH, *Sacramento Peak Observatory, Geophysics Research Directorate*.—On March 7, 1959 a flare spray of importance class 2 occurred at the east limb of the sun. Monochromatic observations of the event were obtained at Sacramento Peak at $H\alpha(\lambda 6563 H\gamma)$ through a birefringent filter of $\frac{1}{2}$ -A bandpass with the flare camera, and at the green coronal line ($\lambda 5303 [FeXIV]$) with a coronagraph of 6-inch aperture and a birefringent filter of 2-A bandpass (Evans, J. W., *Publs. Astron. Soc. Pacific* **69**, 421, 1957). The passage of the spray through the green corona could be followed in the light of its continuous emission at $\lambda 5303$.

The flare occurred near the base of a pre-existing coronal arch. The spray was observed to follow a curved path, *being constrained to move along this arch*, until it reached the vertex. The coronal arch was still visible, apparently without change, after the event. The brightest part of the spray had a velocity of about 250 km/sec. A disturbance visible in $\lambda 5303$ of $[FeXIV]$ that looked like a hemispherical shell moved in front of the spray with roughly the velocity of the spray.

Radio spectra obtained by Dr. Alan Maxwell and his colleagues at Fort Davis show several groups of type III bursts, a faint slow burst with some characteristics of a type II burst, and a "U burst." The first type III burst occurs at UT 1723.6 beginning a 100 Mc. At this time, the hemispherical disturbance visible in $\lambda 5303$ had reached a height of about 10^5 km, where the plasma frequency is roughly 100 Mc computed by the Baumbach-Allen formula. The velocities implied by U bursts and other type III bursts are, of course, much too high to be directly associated with any optical event described here, but we suggest that one of the outer concentric coronal arches was the path taken by the disturbance causing the U burst.

Variable Stars in the Small Magellanic Cloud. CECILIA PAYNE-GAPOSCHKIN, *Harvard College Observatory*.—In a recent paper (*Astron. J.* **65**, 404, 1960) Arp has suggested that a number of Cepheid

variables in the Small Magellanic Cloud show changes of period. An examination of the Harvard data for these stars does not reveal any appreciable changes of period. If there are changes of period, the material is not refined enough to reveal them.

The relation between period and amplitude derived by Arp is confirmed and amplified, and the difference between this relation and the one shown by well-observed galactic Cepheids is emphasized.

Free Hydrogen in the Pegasus I Cluster of Galaxies. A. A. PENZIAS, *Columbia University*.—Twenty-one-cm hydrogen-line observations were made on the Pegasus I cluster of galaxies in order to determine the free-hydrogen content. This cluster was selected for study because it was expected to yield the highest antenna temperature of the well-known clusters. The work was done with the 85-ft steerable paraboloid of the Radio Astronomy Branch of the Naval Research Laboratory. A modified Dicke-type radiometer with a tunable maser preamplifier was employed. Two sets of observations were made within the range of velocity distribution of the cluster, consisting of some eight drift scans per set. They were made at 1402.4 and 1403.4 Mc with one-megacycle bandwidths. An average antenna temperature of 0.3 degrees Kelvin was observed with an estimated signal-to-noise ratio of 5:1. From this result, a mass of $3 \times 10^{11} M_{\odot}$ was calculated for the free hydrogen present.

This observed free hydrogen accounts for less than one-tenth of the total mass of the cluster as calculated with the use of the virial theorem. Furthermore, because of the considerable number of spiral galaxies in the cluster, the galactic hydrogen in the cluster could account for all the hydrogen observed, or at least a considerable part of it. Therefore, it is possible only to put an upper limit on the density of intergalactic free hydrogen in this cluster.

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Asymptotically Singular Differential Correction Matrices. SAMUEL PINES, *Republic Aviation Corporation*.—This paper contains the results of a study to determine the maximum time arc that can be spanned in a differential correction program as limited by the choice of the orbit parameters used in reducing the observation residuals. The paper proves that the differential correction matrices used in conventional iteration techniques become asymptotically singular in time in the event that more than one parameter affecting the energy of the orbit is used as a correction variable.

The key result is that the loss of numerical