limiting visual magnitudes photographed are, roughly, for slow meteors > 4 , for average meteors 3-4, and for very fast meteors 2-3.

The work was performed under a U. S. Naval Bureau of Ordnance contract.

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Williamson, Ralph E. Plasma oscillations and solar bursts.

An attempt is made at a semi-quantitative analysis of plasma oscillations as the source of bursts of solar radio-frequency radiation. The following question is considered: Given an isolated block of ionized material of dimensions of the order of 10^7 km, which is momentarily polarized to a slight extent, say an average charge-separation of 10 cm, which is energetically quite feasible; when the polarizing force is released, can one expect radiation from this block similar to that observed in solar bursts?

On the basis of the present work, the answer seems to be yes, and the following conclusions are indicated: The restoring forces between the separated charges near the surface of the block initiate a motion corresponding to a frequency of the same order as Langmuir's plasma-frequency. Neither collisions nor diffusion would disturb this motion for several thousand cycles. The electromagnetic forces set up by the moving electrons on the surface of the block destroy coherence over distances much larger than a wave length, but allow a number of cells to form, each of the order of a wave length in size. The motion within each cell is coherent, but of random phase with respect to neighbouring cells. Each cell radiates very efficiently, the radiation-damping time being of the order of one cycle. If one per cent of the area on one surface of a block 100 km on a side is involved in radiating cells, the total energy radiated per unit frequency-interval near the plasma frequency is of the same order of magnitude as that arising from a good-sized solar burst. For a given plasma frequency, higher-frequency radiation is much less intense; moreover, the radiation per unit frequency-interval varies inversely as the square of the plasma frequency.

In summary: granting the original state of polarization, it follows that solar bursts of the correct energy-content should be produced, with strong discrimination against burst at high frequencies, as is actually observed.

This investigation has been carried out under

the Radio Astronomy Project of the U. S. Navy and Cornell University.

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Wright, Frances W. Photographic Leonid meteors.

From Harvard photographic plates 36 meteors (1898 through 1950, 6 double-station, 30 single-station) between November 15 and 21, G.C.T., have been analyzed. The mean radiant of the Leonid stream moves eastward along a great circle in Leo at a rate of $39' \pm 3'$ per day, and southward $25' \pm 3'$. The path of this mean radiant is inclined 12° to the ecliptic, at a distance of 10° north. An extended single trail deviates from the calculated position with the probable error $13'$, the smallest deviation among the major streams. This activity attains its maximum on November 17, G.C.T., almost one-half of the meteors appearing within a 24-hour interval.

The corrected radiant for the Leonids, obtained by a least-squares solution, is given in Table I, along with the daily motion of the radiant.

TABLE I. LEONID RADIANT

Mean long. of sun at max.	233°94'	} Equinox 1950.0
Corr. α (at max.)	152°17'	
Corr. δ (at max.)	+22°17'	
$\Delta\alpha \cos\delta$ (per day)	+39' $\pm$ 3'	
$\Delta\delta$ (per day)	-25' $\pm$ 3'	
Total motion (per day)	46'	
P.E. residual (O-C)	13'	

Some of the fundamental data and orbital elements of five of the double-station meteors have been obtained. There is a tendency for the longitudes of the perihelia to increase with date. At the same time the perihelion distance remains practically constant. This constancy of the perihelion distance is in great contrast to the situation for the Taurid meteors, where this distance increases markedly with date. The fact that the individual Leonids show very much less scatter from the moving radiant indicates that they are more compact and a less disturbed stream.

From studies at Harvard of some of the major photographic showers it appears that the average deviation of meteor radiants from the mean moving radiant increases with the duration of the shower. The compact Leonid shower represents one extreme, duration 6 days, deviation $13'$, while the northern Taurid shower represents the other extreme, duration 46 days, deviation $60'$.