galaxy of 373 km/sec toward $l = 160^\circ$, $b = +22^\circ$. The pole of the rotational plane of the system is placed at $l = 14^\circ$, $b = +10^\circ$, and the center of rotation, indeterminate by 180° , at $l = 104^\circ$, $b = +5^\circ$, or $l = 284^\circ$, $b = -5^\circ$. A , the change in radial velocity produced by rotation, is of the order of 10^{-4} km/sec per parsec of distance from our galaxy.

The following are estimated to be a consistent, though not necessarily unique, set of constants of the universe:

Radius of the universe	10^9 parsecs
Mass of the universe	10^{21} solar masses
Distance of our galaxy from center of rotation	10^7 parsecs
Rotational velocity of our galaxy	1000 km/sec.

*Department of Astronomy,
Cornell University,
Ithaca, N. Y.*

Sen, Hari K., and J. Feinstein. Radio wave generation by multistream charge interaction.

The excitation of plasma oscillations in traveling beams is reviewed; analytic and graphical methods are employed to ascertain the ranges of parameters over which wave growth may exist, and to determine contours of constant amplification factor. The effect of thermal velocities is taken into account by utilizing approximations to a Maxwellian distribution.

The magnitude of the wave growth is found to be sufficiently large to produce a saturated equilibrium within a few meters or less. Only a small amount of energy conversion is obtained, however, under highly mismatched conditions.

It is found that the possibility of growth exists even for beam injection velocities much smaller than the mean thermal motion in the region: Narrow band widths are encountered under these circumstances, of the order obtained experimentally for many of the smaller bursts of solar radio noise. For beam injection velocities larger than the local mean thermal motion, a truncation appears in the curves, indicating the possibility of bursts at separated frequencies with no activity at intermediate frequencies.

An investigation of the effect of the initiating disturbance upon the frequency band generated leads to the conclusion that where the possibility of growth in time exists, a spatial description of initial conditions gives rise to a broader band than does a temporal prescription.

Previously suggested mechanisms for the conversion of the longitudinal plasma oscillations into transverse electromagnetic energy, e.g.,

presence of transverse static magnetic field or transverse mass velocity, are considered quantitatively, and found to be inadequate.

A more promising mechanism is suggested, viz., the occurrence of physical conditions which require, for a net energy delivery, only a matching either in frequency or in wave length between the longitudinal space charge wave and the transverse electromagnetic oscillations. Such a situation can arise if steep gradients are present in the medium characteristics, as might occur near the edges of prominence eruptions, or in a rapidly growing wave. A quantitative investigation of energy transfer under these conditions requires a non-linear theory, which is beyond the scope of the present paper.

*Harvard College Observatory,
Cambridge, Mass.
and National Bureau of Standards,
Washington, D. C.*

Seyfert, C. K., and E. E. Mason. The eclipsing star AK Herculis.

A photoelectric light curve was obtained of AK Herculis, a 9th magnitude, W Ursae Majoris-type eclipsing variable star. The observations, which were made during the summer of 1950 with a 1P21 photocell attached to the 12-inch DeWitt telescope, are well represented by the expression:—

$$\text{Prim. Min.} = \text{JD}2433515.714 + 0^d.42152143\text{E.}$$

The present minima indicate that the period of AK Herculis is now increasing after a long interval of gradual decrease.¹

Combining Sanford's² velocity curve of the brighter component (F8) with the observed light curve yielded the following approximate elements based on a partial eclipse, transit primary minimum, and darkening coefficient 0.6.

Eccentricity (assumed)	0.00
Ellipticity coefficient (Z_u)	.300
Reflection coefficient (c)	.013
Ratio of radii (k)	.625
Inclination (i)	$66^\circ.3$
Luminosity larger star (L_1)	.83
Luminosity smaller star (L_2)	.17
Ratio of surface brightnesses (J_1/J_2)	1.9
Estimated mass ratio (μ_1/μ_2)	1.5
Distance between stars (a)	1.23×10^6 km
Mass of larger star (μ_1)	.25 $\odot$
Radius of larger star (r_1)	.94 $\odot$

1. E. J. Woodward, *Circ. Harv. Coll. Obs.* No. 446, 1941.

2. *Ap. J.* 79, 89, 1934.

*Barnard Observatory,
Vanderbilt University,
Nashville, Tenn.*