be by a factor of 1000. Both the compression and the heating taking place in the flare would cause it to be a copious emitter of hydrogen radiation, including Lyman α , which is probably responsible for sudden D-layer ionization in the earth's atmosphere at the time of the flare.

We suggest, also, that the observed early radio bursts (Dodson *et al.* 1953, 1954) at the very start of the flare result from the sudden deformation of the magnetic field by the colliding diamagnetic gas cloud comprising the surge, and that the base level rises are subsequent phenomena coming from the flare heating. Radio bursts that occur later may arise from "flare surge" material moving rapidly through the corona, the flare surges possibly being a consequence of the pressure of flare radiation. Davies (1954) has independently suggested, from study of the radio noise emission from 600 to 9400 mc/s associated with flares, that the ionized gas is simultaneously moving upwards and downwards at the heights at which most flares probably occur.

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Rubin, Vera C. The form of the galactic spiral arms from a modified Oort theory.

The theory of differential galactic rotation has been employed by Oort to determine the form of the spiral arms of the galaxy, from measured radial velocities of hydrogen clouds in the galactic plane. This paper examines the consequences of the assumption that each hydrogen cloud in the spiral arms has a streaming velocity, V_s , along the arm, in addition to the rotational velocity predicted by the Oort theory.

The observations of the 21 cm hydrogen line are analyzed with the modified equations which are developed. The angle Δ between the tangent to the spiral arm and the line of sight is unknown at the outset. It may be found by a method of

successive approximations, where the first approximation to Δ at each longitude is the angle determined by neglecting the streaming motion.

With $V_s = +20$ km/sec, the following results are obtained:

1) The magnitude of the projection of the streaming velocity on the line of sight is less than 5 km/sec from $l = 55^\circ$ to $l = 205^\circ$, and reaches a maximum of about 10 km/sec in the region near $l = 345^\circ$.

2) The distance of each hydrogen cloud from the galactic center is less than the distance determined from the unmodified Oort theory, for all longitudes with the exception of the region $l = 250^\circ$ to $l = 300^\circ$.

3) The long semi-circular arm obtained by Oort, $l = 220^\circ \rightarrow 0^\circ \rightarrow 345^\circ$, is modified so that it spirals in toward the galactic center. Its maximum and minimum distances to the galactic center are 11.6 kpc and 9.4 kpc, at longitudes $l = 205^\circ$ and $l = 345^\circ$, respectively.

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Seyfert, Carl K. Emission B stars in the association I Persei.

The Perseus association in the vicinity of the double cluster has a fairly well-established distance and is rich in Be stars. In an area $5^\circ \times 5^\circ$ centered on the double cluster, 49 Be stars have been catalogued by Merrill and Burwell (1933, 1943, 1949, 1950). Fourteen new Be stars from 10.4–13.8 mag were found on objective prism plates taken with the 24-inch Baker-Schmidt telescope of the Arthur J. Dyer Observatory. New spectral classifications were made of the doubtful or missing cases where permissible. It was possible to obtain reliable spectral classifications of 45 Be stars.

Photoelectric color excesses, E_1 , are available for only 11 of the Be stars (Stebbins *et al.*, 1940). Since the absorption varies strongly across the association, color excesses were interpolated for the other Be stars using the photoelectric colors of the 52 B stars in the field. The visual absorption of 6.1 E_1 (Morgan *et al.*, 1953a) was found for each star and applied to its observed apparent visual magnitude. If we adopt 11.8 as the value of the distance modulus of the association (Morgan *et al.*, 1953b) the apparent magnitudes may be transformed to absolute magnitudes, under the assumption that the Be stars are in the association. The resulting H-R diagram for 45

Be stars was compared with a similar diagram of the B stars obtained by Bidelman (1943) with the following results:

- 1) Essentially all Be stars in the field are in the Perseus association.
- 2) There is a small group of supergiant Be stars of the same absolute magnitudes as non-emission supergiant B stars in the association.
- 3) Most of the blue emission stars in the Perseus association are Boe to B5e with luminosities between III and V.
- 4) The non-emission B4 and B5 stars in the association seem to have the same absolute magnitude as the B4e and B5e stars.
- 5) The Boe to B3e stars are about one magnitude fainter than Bo to B3 stars in the association.
- 6) The average absolute visual magnitudes for the emission and non-emission Bo-B5 stars in the association I Persei are shown in the table below. The values in parentheses are numbers of stars.

Bo- Bo.5	B1	B2	B3	B4	B5	Bo.5- B3 super- giants
Emission						
-4.0 (4)	-3.5 (8)	-3.2 (9)	-3.3 (8)	-3.1 (3)	-2.7 (7)	-6.9 (3)
Non-emission						
-4.9 (7)	-4.4 (6)	-5.0 (7)	-3.8 (8)	-3.3 (8)	-2.8 (10)	-6.8 (3)

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Sharpless, Stewart. The distances and dimensions of IC 1805, IC 1848, and IC 410.

The clusters IC 1805 and IC 1848 are each located at the center of a prominent emission nebula. IC 410 is a cluster of early-type stars almost indistinguishable from the field and is also surrounded by an emission nebula. Early-

type members of these clusters were identified either from spectral types in the *Henry Draper Catalogue* and its extensions or on the basis of visible association with the nebulosity. Through the courtesy of the Director of the Mount Wilson and Palomar Observatories the author obtained spectrograms of these stars with the Cassegrain spectrograph attached to the 60-inch telescope on Mount Wilson. These were classified according to the Yerkes system. Colors and magnitudes of the same stars were observed with a conventional photoelectric photometer attached to the 40-inch telescope of the U. S. Naval Observatory. Mean distance moduli based on observations of 23 stars were computed for the three clusters by means of these spectral types and photometric data.

The computed distance moduli of IC 1805 and IC 1848 are both 11.2 mag, corresponding to a distance of 1700 parsecs. This places them somewhat nearer than h— χ Persei, but at a distance such as to identify them with the same spiral arm that contains the double cluster (Morgan *et al.*, 1953). The distance modulus of IC 410 is 12.8 mag, corresponding to a distance of 3600 parsecs. This suggests that it may be more remote than the arm containing h— χ Persei.

The linear diameters of these nebulae and of the clusters which they contain have been computed on the basis of their angular diameters and distances. These data are given in the following table.

Object	Linear diameter of nebula	Linear diameter of cluster	Num- ber of O-type stars	Num- ber of B-type super- giants
IC 1805	40 pc	10 pc	5	0
IC 1848	35	15	5	0
IC 410	63	21	5	0
Orion	87	87	3	5
h— χ Persei	—	160	1	16

For comparison, similar data are included for the two well defined O-associations for which detailed information is available: Orion (Sharpless, 1952) and h— χ Persei (Bidelman, 1943). The linear diameters of the nebulae are the same as those predicted by Strömgren's theory (1948) provided a density of between 1.5 and 3 hydrogen ions per cubic centimeter is assumed. The linear diameters of the clusters and O-associations in the above table vary considerably from the smallest to the largest. Studies of O-associations by Ambartsumian and by Blaauw and Morgan (1953) have shown that they are expanding at a rate of approximately 10 km/sec. The great differences in the linear sizes of the groups of