have measurements of only four stars and the errors in the measurements are rather large, so we cannot say whether the results obtained here are quantitatively correct, even if we believe that they provide meaningful indications. A conclusive answer will only come when many measurements with good spectral resolution on early-type main sequence stars at distances greater than ~ 500 pc are available. If we wish to determine the mean diffuse component of the interstellar gas, stars with normal reddening must be observed, whereas observations of abnormally reddened stars will contribute to an understanding of the clouds that produce the abnormalities.

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Optical Variability of 20.08.01 Cancr

THE variations of the variable radio object (VRO) 20.08.01 in the photographic spectral region are of great significance. The first announcement was made by Kurochkin¹ who had observed an outburst of the object in September and early October 1971, the amplitude having been of the order of 3 mag. (minimum photographic brightness 16 mag., maximum around 13 mag.).

An investigation of the object on numerous plates of the Sonneberg collection taken between 1930 and 1971 showed that the object had been continuously active; the maximum of autumn 1971, although the brightest, was by no means the only outburst.

Table 1 Eruption Data

Duration	2 month
Amplitude	3 mag.
Interval	1 yr

On our plates, eleven maxima and five minima could be detected^{2,3}. The apparent scarceness of the minima is caused by the fact that they can only be ascertained on the far-reaching 14 cm triplet plates (limiting magnitude 16 mag.), whereas the more intense parts of the eruptions can easily be traced on patrol plates (limiting magnitude 14 mag.). The eruptions are characterized by the rough data shown in Table 1. As the object reaches $V=12.5$ mag. to 13 mag. at maximum it can be observed much more easily than the peculiar VRO 42.22.01 = BL Lacertae, the variations of which in the optical spectral region are insufficiently known. Coordinated spectro-

scopic, photometric, and radio observations of VRO 20.08.01 are urgently needed.

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Thin Solar Convection Zone and Sunspots

THERE is a remarkable coincidence between the depth of a sunspot (1.05×10^4 km according to Hong Sik Yun¹) and my recent determination² of the depth of the solar convection zone, namely 1.04×10^4 km.

Further evidence for a thin solar convection zone is suggested by the results of Leighton³, who has given a magneto-kinematical model of the sunspot cycle which agrees very well with observed patterns of sunspot activity. Absolute values of two critical field strengths are, however, not forthcoming from Leighton's model unless a value is chosen for the ratio between the radius of the sun, R , and the thickness of the layer in which the magnetic field is sheared, H . The two critical field strengths are B_c , the minimum field required for field eruption and the appearance of sunspots, and $B_{\phi m}$, the maximum value of the toroidal field attained during the sunspot cycle. Leighton gives values of $B_c(H/R)$ and $B_{\phi m}(H/R)$ for various models of assumed variation of angular velocity with depth. Values of R/H can be deduced if observed values of B_c and $B_{\phi m}$ are substituted.

We take (i) $B_c = 1,200$ gauss (ref. 4) and (ii) $B_{\phi m} = 5,350$ gauss (ref. 5), the latter being the largest observed field in a sunspot, and therefore a lower limit on the value of $B_{\phi m}$ inside the convection zone. With these values, Leighton's results lead to the values of R/H given in Table 1. (We have numbered Leighton's models 1 to 12 consecutively from top to bottom of his Table 1.)

The logarithmic averages of R/H (i) and R/H (ii) are 107 and 45 respectively, and the latter must be considered to be a lower limit. Thus, values of R/H in the range 50 to 100 are suggested by Leighton's models. My solar model² has $R/H = 67$, and this is consistent with the values deduced from Leighton's model if the shearing zone of the magnetic field extends throughout the entire convection zone. Moreover the value $R/H = 67$ agrees closely with the two values derived from Leighton's results for the case in which the angular velocity of solar rotation is depth independent (Leighton model No. 1).

Hitherto accepted models of the solar convection zone have $R/H = 5$ to 10, an order of magnitude less than Leighton's figures suggest unless the shearing zone of the magnetic field is confined to the outer 10% of the convection zone. It is not clear why shearing should be confined in this way, and it is simpler to suggest that shearing exists throughout the convection zone.

Inferences from sunspots on the basis of the results of Hong Sik Yun and Leighton seem, then, to be consistent with a

Table 1 Values of R/H using Results of Ref. 3 and Two Values of B_c

Leighton model No.	1	2	3	4	5	6	7	8	9	10	11	12
R/H (i)	60	60	200	43	36	286	34	60	80	800	1,200	48
R/H (ii)	76	43	82	33	31	76	30	54	76	215	2.7	43