where $A = \left[\sum_{i,j=1}^{p} \frac{D_{ij}^2}{(\tau_i^2+t_j^2)}\right]^{\frac{nk-p-2}{2}}$

and D_{ij} is the coefficient of $c_{ij}/(\tau_i^2+t_j^2)^{\frac{1}{2}}$ in the determinent $|c_{ij}/(\tau_i^2+t_j^2)^{\frac{1}{2}}|$ and c_{ij}'s are defined as

$$c_{ij}^{2m} = 0, \quad c_{ij}^{2m+1} = 2^{\frac{2m+1}{2}}\,\Gamma\left(\frac{2m+1}{2}\right)$$

$$c_{ij}^{2m+1}\, c_{i'j'}^{2n+1} = 2^{\frac{m+n+1}{2}}\,\Gamma\left(\frac{2m+1}{2}\right)\times \Gamma\left(\frac{2n+1}{2}\right)$$

where $i \neq i'$ and $j \neq j'$

These substitutions are to be made only after expanding out A and multiplying it with other factor in (2.3). The distribution of $r_1, r_2, \ldots r_p$ are obtained from (2.3) by making the transformations

$$t_i^2 = \frac{1+(k-1)r_i}{1-r_i} \quad (i=1,2,\ldots,p) \quad (2\cdot4)$$

(3) It is interesting to observe that the distribution (2.3) is similar to the distribution of the p-statistics of Roy (1942) on the non-null hypothesis. A fuller discussion of this subject will be attempted in a paper to be published in *Sankhya* shortly.

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November 18, 1944.

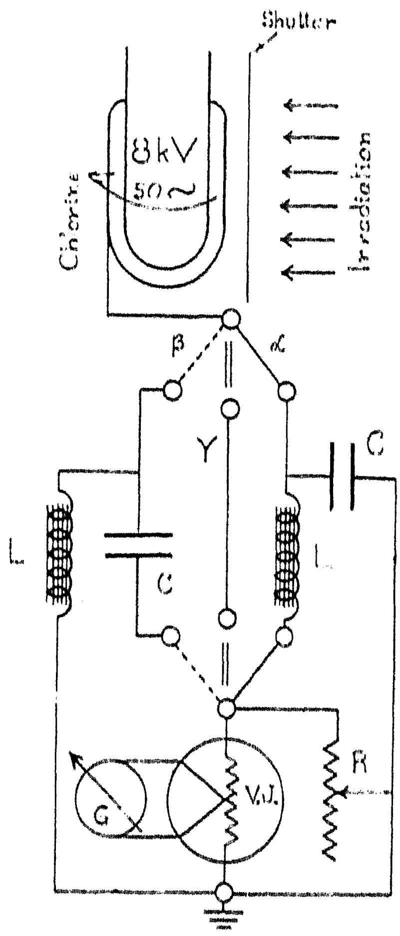
1. Roy, S. N., *Sankhyā*, 1942, **6**, 16-34.

THE PREFERENTIAL INCIDENCE OF THE *LIGHT-EFFECT* IN THE HIGH FREQUENCY REGION OF THE DISCHARGE CURRENT

THE apparent variation of the light-effect Δi, with the *mode* of the measurement of the discharge current i, was noticed soon after the discovery of this phenomenon.[1] Thus, *e.g.*, when i was observed with some *soft* diodes, the light-effect was negligibly small; using triodes, tetrodes, pentodes as also certain metal oxide type rectifiers, the proportionate effect $\%\Delta i$, *i.e.*, the current decrease under light expressed as a percentage of i in the dark, was marked but variable. Usually, $\%\Delta i$ was greater with a vacuo-junction than an oxide type A.C. indicator.[1] This was traced to limitations in the latter's efficiency of rectification observed *inter alia* under certain conditions of the container surface exposed to the discharge;[1] n, the frequency of the A.C. supply; and especially the strength and the range of frequencies generated under the discharge; these last are the chief determinant of Δi.[2,3,4]

Fig. 1 shows th main apparatus used for a study of the distribution of light-effect amongst H.F. and L.F., the high and low frequency components of i. This enters the vacuo-junction (*V. J.*, Fig. 1) *via* α, β or γ. In α, the iron core inductance L admits preferentially L.F. and inhibits H.F.; the latter are by-passed by the capacity C which comparatively impedes *L.F.* Similarly, β filters out L.F. and

Fig. 1



admits H.F. In γ, i consists of both the L.F. and H.F. characteristic of the discharge.

Table I shows a typical set of results. The ozoniser (Fig. 1) filled with chlorine was excited at $V = 8$ kilo-volts and 50 cycles frequency. The net effect Δi is largest for i, the

TABLE I

R (ohms)	Circuit	i in dark	i in light	Δi	$\%\Delta i$
300	α L.F.	2·0	1·23	0·77	39
	β H.F.	5·57	3·16	2·41	43
	γ H.F. + L.F.	6·78	3·88	2·90	43
1000	α L.F.	4·58	2·65	1·93	42
	β H.F.	12·7	6·9	5 8	46
	γ H.F. + L.F.	16·4	8·7	7·7	47

unfiltered, *i.e.*, the total discharge current; Δi is sensibly greater for the high than low frequencies. The presence of these frequencies, in addition to n, and the instantaneous diminution on irradiation of their amplitudes, was observed in the oscillographic studies of this phenomenon.[2,3,4] From the amplitude-changes in the oscillograms, Δi appeared greater the higher the (output) frequency; the proportionate effect $\%\Delta i$ was similar at all the frequencies.[3,4] Subsequent work with different types of discharge and of the A.C. detector has shown that (*a*) both Δi and $\%\Delta i$ predominate in the H.F.

The decrease of the above quantities by decreasing *V* the applied potential is observed over a fairly wide range of conditions.[1,5,7,8] Furthermore, Δi depends upon $V-V_m$,[3,4] where V_m is the threshold potential required to initiate a discharge; V_m diminishes by increasing *n*.[3] From this it follows that a larger *n* would correspond to a lower *V*, and therefore, to a reduced light-effect which is actually observed.[3] This combined with (*a*) suggests that, *ceteris paribus*, the proportion of H.F. in *i* would increase by increasing *V*; this is to be expected also on general grounds. That *V* is more important than *i*, in the present phenomenon, is indicated by its non-observance below V_m[3]; secondary ionisation would appear to be a necessary condition.[3] It is to be anticipated, therefore, that despite a large *i* obtained, *e.g.*, with a high frequency *n* input to the system, the light-effect would not occur at less than the corresponding V_m. The (preliminary) experimental results are in accord with this deduction.

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November 19, 1944. S. S. Joshi.

1. Joshi, *Presidential Address*, *Chem. Sec.*, *Ind. Sci. Cong.*, 1943 2 —, *B.H.U. Journ.*, 1943, **8**, 99. 3. —, *Nature*, 1944, **154**, 147. 4. — *Curr. Sci.*, 1944, **13**, 253. 5. —, and Deo, *Nature*, 1944, **153**, 434. 6. —, *Trans. Farad. Soc.*, 1927, **23**, 227. 7. —, and Deo, *Curr. Sci.*, 1943, **11**, 306. 8. —, —, *Nature*, 1943, **151**, 561.

A SCIENTIFIC NEW YEAR'S DAY

January 1st has struck me, for a long time now, to be the most appropriate day for beginning the year from the scientific or astronomical point of view. This is the time when the earth in its yearly revolution round the Sun in a slightly elliptic path, passes through the perihelion of its orbit and is thus nearest to its progenitor and the giver and sustainer of all life on it.

Any day may be chosen to start the year but there are some which can be said to have a preference over others for this purpose on account of their *quasi*-uniqueness. These are the days of the equinox or of the solstice. But these days go in pairs and, therefore, there is no absolute uniqueness about them. The time when the earth is in perihelion is unique. There is another time which is also unique, namely, when the earth is in aphelion. But it seems more appropriate to consider the time when the earth is nearest the Sun as the suitable time for the beginning of its revolution than when it is farthest away.

Many people consider that the spring equinox day, *i.e.*, March 21st, would have been a more appropriate day for beginning the year for it is about then that new life for the year may be said to begin. But this day (or any other day or any other reason) has not the universality that January 1st possesses on account of the earth being in perihelion at about this time. For, if March 21st is spring equinox for the northern hemisphere it is the autumn equinox for the southern hemisphere. Similarly the days of the solstices have the same kind of duality and non-universality.

The Hindu New Year Day, whichever it may be, the 1st of *Chaitra* on the Lunar reckoning or the 1st of *Vaisakh* on the Solar, is regarded, of course, by the Hindus as the most appropriate day for beginning the civil year on account of its being round about the spring equinox. But these days are open to the same criticism as above.

If we compare the year with the life of an individual, life begins from small beginnings, grows to maturity and then decays. Life does not begin with even partial maturity. Similarly days begin to grow longer about the 1st January (really on the 23rd December), become longest in June, and gradually dwindle to the smallest on the 22nd December. But this again has a local taint inasmuch as it applies only to the northern hemisphere.

It is perhaps true that when fixing January 1st as the New Year's Day, no reasons of the type mentioned above were taken into account but the day was fixed perhaps on purely religious grounds. However, it must be admitted that it was a very good choice.

It may be mentioned that the time when the earth is in perihelion (or aphelion) is not quite regular. In the first place, the *Nautical Almanac* abandoned from 1927 the practice of giving the hour of the day in this connection as it is given for the equinoxes and solstices. Before then the hour in connection with perihelion and aphelion and even the minutes in connection with the equinoxes and solstices were also given.

In the second place, the day when the earth is in perihelion varies from year to year between January 1st and January 4th, but is never earlier than January 1st. The *Nautical Almanac* of 1921 (*N.A.*'s from 1914 only are available locally) gives the time of the earth in perihelion to be December 31, 1920, 16 hours. But uptil 1926 the astronomers began their day at noon instead of, like the civil day, at midnight. According to civil reckoning, astronomer's day, December 31, 1920, 16 hours, becomes January 1, 1921, 4 a.m., and thus the anomaly of having two "perihelion days" in the same year, 1920, disappears. This year, 1945, the perihelion day fell on the 1st January as it did eight years ago, in 1937 and previous to that in 1929 and 1921. This eight-year period, however, is merely fortuitous, for prior to 1921, the earth was in perihelion on January 1st in 1918.

Hence January 1st stands out to have a scientific basis, a uniqueness and a universality with which to start the New Year and which is not possessed by any other day.

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January 8, 1945. J. B. Seth.