

The Fergusson College

Poona 4 .March 12,1934.

Dear Prof.Krishnan:

You know that I was dabbling with some spectroscopic theories, and probably guessed that nothing much would come of it. As a matter of fact, I am unable to spend much time in the laboratory; ~~and~~ my worthy collaborator brings only a moderate enthusiasm, and not much knowledge of the technique with him. Add to that our lack of apparatus worth anything, and you have the expected result.

I meant to try for an explanation of photographic hypersensitization, particularly the recent work on infra-red photography. A whole series of substances, of which the best known ~~are~~ are Eosin, Erythrosin, Dicyanin, Dicyanin A, Neocyanine, and Kryptocyanine, are used for this purpose. About all that is known of them is that they sensitize for a region of the spectrum where they have a marked absorption region.

The effect, I believe, is not due to the chemical action of these substances [the isochinolin dyestuffs] but rather to the scattering of the absorbed light. The silver compounds used for the sensitization of the gelatine coating are not readily affected by light of wavelength greater than 4800 \AA . The sensitivity maximum is between $4200-4510$ but light in the ultraviolet is also effective. It seemed obvious that the sensitizing dyestuffs absorbed light in the region for which sensitization was intended, and ~~x~~ scattered it again at those wavelengths which act ^{rapidly} on silver ~~x~~ nitrate or bromide.

The next question would be the nature of the scattering: I am led to believe that it is a type of fluorescence. Now so far as known, the substances in question show no absorption in the violet, and the possibility of fluorescence would seem to be excluded. On the other

hand, it seems probable that the usual work on the absorption spectra of these substances would be complicated by precisely these scattered rays, and show more light in certain regions than is actually transmitted. So, with tests for scattering, there would have to be conducted a study of the selective absorption, testing the absorption over ~~rather~~ small and overlapping portions of the spectrum, rather than ~~a~~ with a source that emits a considerable variety of light.

What I mean could be illustrated as ~~well~~ by means of the desensitizers: Pinakryptol-green or-yellow. The first of these has a dark green colour to the eye, and a thin film or a filter (constructed by coating a piece of ~~the~~ film or ~~photo~~ gelatin-coated plate) according to our observation, transmits only a narrow band in the green. But if you look at an ~~incandescent~~ incandescent bulb through ~~a~~ a Baly tube filled with Pinakryptol green, and increase the thickness of the liquid, the colour of the light transmitted changes to pink and red. That is, the desensitizers work the other way, absorbing light in the violet, and scattering it towards the red. Here again, the absorption photographs should show an anomaly, the thicker ~~layer~~ volumes in the tube "transmitting" -apparently- more red light than the thinner layers, though the time of exposure be ~~only~~ strictly proportional to the thickness, as usual.

I have not the happy gift of expressing thoughts clearly, but I think that I have outlined a theory of sensitization and de-sensitization by means of the known dyestuffs. Actually testing it is another matter, and I conclude that if there is anything in these ideas, your students at Calcutta are far more competent to work upon them than I can ever hope to be. If the work has not already been done by physicist elsewhere, could I persuade you to take it up?? Eosin and Erythrosin are

available anywhere, and any department of biology can supply you with all forms of each. I myself have Neocyanine and Kryptocyanine in stock, with a certain amount of Dicyanine A. The last is not in the best of condition, having arrived in a ~~xxxx~~ crushed bottle, but I think that you could still get results out of it. The purer stock is on its way, and if you are interested, I could send that also. Dicyanine proper and the ordinary sensitizers like orthochrome could be tested later.

scattered by the
1

With the spectrum test for scattering and selective absorption must come an investigation of the colour and scattering in the solid state. If the sensitization of the photographic plate is due to the deposit of a layer of the dye on the plate surface, as I think, proof could be obtained by coating a film separately [any ordinary plate cleared in hypo without developing should do], and superposing it on an ordinary photographic plate, which should show an increased region of sensitivity when the two are clamped together and put into the spectrograph. Another method would be to photograph the spectrum on ~~an~~ a natural colour [Agfa or autochrome] plate, and then for comparison, ~~register the xxxxxxxx photographs~~ repeat the performance with the superposition of a ^{separate} film of the hypersensitizing material to be tested upon the colour plate. In the result, there should ~~be~~ be a noticeable difference of colour for the individual lines or bands in question, although their position on the plate will not be changed.

Please let me know whether the notion interests you. You can see the main idea, and undoubtedly apply far better technical means ^{and methods} than I dream of. I myself cannot afford to come to Calcutta, ~~though if I~~ ^{could} for any period of time, though it might be possible to ~~get in~~ ^{come for} in a week or two in the place if your experiments show any exciting results. You will recall that we obtained something of the sort for Eosin, ~~but~~ and test photos showed no leakage through the filters as you suggested.

MADE IN INDIA

but after the first ~~photo~~ couple of spectrographs, we were swamped by constant changes of apparatus, and practically nothing has been done ~~si~~ since for reasons which will not interest anyone. If the effect is a type of fluorescence, it should fall off rapidly with increase of density of the solution beyond a critical point. Also, the Raman spectra of these substances might offer curious phenomena. But all that lies in ~~th~~ the hands of your workers; with me, it will remain conjecture.

Please let me know whether the work interests you. If you think the whole scheme wild, and not to be compared with the work already undertaken by ~~your~~ laboratory, please don't let your habitual courtesy ~~stand~~ stand in the way of your saying so.

Yours sincerely,

D. D. Kosambi

Bhandarkar Institute Colony

Poona 4.

July 5, 1936.

Dear Prof. Krishnan:

I was told by Mahajani that you extended your stay in Poona by another day, but the news came too late for me to make any effective use of it, particularly as several new guests turned up just then, and have been coming as well as going in large numbers ever since. I wanted to know from you:

1. Details of the chemicals you wanted manufactured by the Ranade Institute for your work.
2. What ~~is~~ am I to tell Athavale, who asked me two days ago whether you had made up your mind about the specifications of the goniometer that you meant to order from him?
3. Can you give me exact references and ways or means of finding ~~it~~ out, preferably getting copied into writing, the spurious Mahābhārata ślokas which, according to ~~xxxx~~ what you said about controversies between ~~and xxxxxxxx~~ southern Pundits, were freely quoted in the south though rarely to be found in a manuscript anywhere. Dr. Sukthankar, of the Bhandarkar Institute, is interested in getting copies of these extra verses, provided the trouble and expense are not excessive, and also provided some information can be had as to why the pundits concerned claim authenticity and authority for such verses.
4. In case you work out the crystallography of the isoquinoline dyestuffs, in particular, of the infra-red sensitizers, along with the corresponding absorption spectra, please look up the photographic data, and see if some theory of the sensitizing properties can be formed. I am interested to know why the sensitizing maximum is sometimes to one side and sometimes to the other of the absorption maximum, though always reasonably close to it. Of course, I refer to ^{Wants from Eosin, Erythrosine, and so on to neocyanine.}

standard figures such as those given by Eder and others, wherein the absorption spectra are undoubtedly worked out for liquids and ~~solutions~~, solutions, not for the crystal proper. I suspect that there is, ~~xxxx~~ for each of these sensitizers, either some other hitherto undiscovered region of absorption to the right of ~~xxxx~~ 3100 Ång., or a curious sort of emission in that region of the light absorbed at a much higher wave-length. The latter would be quite surprising, if there were no absorption phenomenon.

Although, chemically, it does not come in the same series as the sensitizers, the desensitizers [Pinakryptol Green and P. Yellow, etc.] ~~also~~ might ^{also} give some interesting results, of a similar type, if your other work allows, it, I should be very greatly interested to hear of any results that you obtain in investigating these ~~dx~~ dyestuffs as well. If you look at a solution of Pinakryptol Green, and then put it into a Baly tube and see ~~x~~ what colour it exhibits as you gaze at a [not too powerful] source of light ~~through an increasing layer of the solution, you will see the reason for my suggestion.~~

In all this, keep in mind the fact that I am a dilettante. You must have far more valuable ideas of your own, and are probably too busy to waste time on such things as I might suggest in my ignorance.

Vijayaraghavan writes - by air mail - most interesting things of the favour with which your work is regarded by British scientists; the only reason I can give for this is that there are some real scientists in England, whereas in this country, we give personalities first choice as against science. T.V. also asks me to meet Chandrasekhar when he comes to India. I am not sure whether I can get away from Poona, but in any ~~xxx~~ case, when you meet C. in Bombay, extend my invitation to him to visit Poona as my guest, and of course, arrange to come yourself. Also, keep me posted as to the dates of his itinerary.

Yours sincerely,

D. D. Kosambi

Poona, August 14, 1936.

Dear Prof. Krishnan -

I regret to inform you that your chemicals cannot be manufactured in Poona. Limaye would have tried to get Tolane, Bi tofl, and one or two of the others; but that means importing a good deal of raw material from Germany. And it would be quicker to get the finished product.

Dr. D. D. Kane has had a good deal of fuss to ~~engage~~ at home to engage his attention; but he will give all available details as to prices and addresses of the chemicals from his huge collection of price-lists and catalogues. Probably, you can do as well if inquiring at Calcutta.

I haven't heard from you about Chandrasekhar. He must be in Bombay now unless his original plan has changed. I had one brief but informationless card from Vijayaraghavan. Have you any news of interest?
Yours
D. D. Kosambi.

Poona, August 28, 1936,.

Dear Prof. Krishnan:

I am sorry that illness prevented me from writing this earlier. Karvé says that any of your list of chemicals can be prepared; but the yields are very small; with the apparatus available at our college or elsewhere in Poona, not more than 0.2 grams at a time would be possible. Moreover, a compound like pentacene, though beautifully simple on paper, would take an ungodly amount of time for each preparation. On the other hand, Tolane and Bitolyl, if not Bifluorene ought to be available from a company like the Schering-Kahlbaum, ready made, though they do not list it. This is very unsatisfactory, but the best that can be done in this locality.

I understand that Chandrasekhar was in Bombay earlier in the month, and is expected there towards the beginning of ~~September~~ October. I was sorry not to be free when he came last, and as his next visit coincides with the college examinations at the end

of the first term, I am likely to be held up again. Anyway, give him my regards.

But for a very curious souvenir card from Oslo, I have no information from T. V. He must be at Harvard, or at the very worst, off the New England coast by now; the American Math. Soc. has an important meeting there on the thirty first which he would be sure to attend.

With the compliments of the season,

Yours sincerely,

D. D. Kosambi

POST CARD

ADDRESS ONLY

TO

Prof. Dr. K. S. Krishnan

Ind. Association for the
Advancement of Science

210 Bowbazar Street

CALCUTTA



Poona, Nov. 26, 1936.

Dear Prof. Krishnan,

I received your money order today, two days late, as I was away in Bombay on the occasion of a simple appendectomy performed on Mrs. K. There is no danger, and everyone is happy that the whole affair passed off so nicely. The cash and a plenitude of instruction have ~~xx~~ been delivered to the photographer, who was also away ~~x~~ from work till last night. He will start the work within a day or two, and give it the utmost care possible. In distributing the copies, remember that Ramadas has one, and that Ramanathan in Bombay has ordered one from me, which will be delivered before yours arrive at Calcutta. By the way, ~~Kx~~ K. R. R. told me some very interesting news about your immediate future.

I delivered a lecture in Bombay a few hours after the said operation, and it was not too poor in outcome, all things considered. But I wanted the opinion of some real expert, someone like ~~x~~ T. V. Possibly, we might induce the Bombay people to have T. V. deliver some lectures ~~x~~ there on his way back. That, if it materializes, will hel-

out in compensating the deficit
that his trip must have ex-
caused, and which is likely
to be increased in case he
manages to overstay his leave.

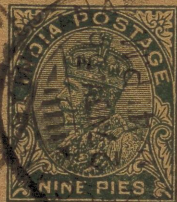
There is nothing more to
say, even if I have not ex-
hausted my three pice worth
of writing space; so, with
the best wishes, I conclude
this epistle.

Yours sincerely,

D. D. Kosambi

POST CARD

NOV 36
ADDRESS ONLY



TO

Prof. Dr. K. S. Krishnan

210 Bowbazar Street

CALCUTTA

Poona, November 30, 1936.

Dear Professor Krishnan,

I send your receipt herewith, the delay being due to my having gone again to Bombay. The photos must have reached you by now, for the photographer promised me that he would send them on Saturday, the ~~28~~ 28th by registered post.

The photograph is too good to distribute promiscuously. Remember that Ramadas, Ramanathan, Vijayaraghavan should not be sent any copies. If you want just ordinary mementoes, post cards can be printed off for about three rupees per ~~dozen~~ dozen. But they won't look half as attractive. By the way, I have kept ^P the negative with Bhat [W.N. Bhat] and if any more enlargements are wanted, he should be written to directly. "Photograph of Dr. K.S. Krishnan" is the description that he will recognize.

I am pretty well done up with all the travelling that I have had to do this month. And naturally, scientific effort has had to go by the board. But there are two or three papers in the press now, including one on Milne's cosmogony, which will appear during 1937. What I need is a long rest with a complete change of surroundings.

By the way, you can do me a favour if you have the time. I have been ^{M.A., M.Sc.} examiner to the Calcutta University for mixed mathematics for the last two years. I do not want to be continued for the next season. In fact, ^{examination} ~~the~~ work this year was beyond me, and I had to take the help of Prof. R.P. Shintre, our vice-Principal. So, please suggest to N.R. Sen when you meet him next that my health and leisure are both greatly reduced, and that Shintre should be put in for 1937, if possible. If I am appointed again, I might have to go to the length of refusing.

With the best of good wishes,
Yours, sincerely,

D. D. Kosambi

Poona, December 29, 1937.

Dear Prof. Krishnan,

My friend S.V. Chandrasekhar Aiyar, professor of physics at the S.P. College, Poona, has some very interesting theoretical work on the behaviour of elements at low temperatures and associated phenomena. He must have sent you a copy of his privately printed paper on the subject. As he is coming to the Science Congress, and anxious to discuss his results with real physicists, I trust that you will do me the favour of giving him some of your time, and of introducing him to people like Darwin and Lennard-Jones.

I met Fisher when he came to Poona. But it is out of the question for me to go to Calcutta, or even to Bangalore. I meant to send a couple of my papers to you to be handed over to Eddington and Jeans as well as others interested, but it would be a waste of your ~~time~~^{energy}, and in the light of the recent publications by these great names, a waste of the reprints as well.

There is just a chance that I might induce one of our demonstrators here to go to your laboratory for some training in the observation of crystal spectra. Please keep this in mind, and when the flurry of the visiting scientists is over, do drop me a line as to whether you would find it possible to give some time and laboratory space for such a person, say during the summer months [March-June].

With the best of good wishes, I remain,

Yours sincerely,

D. D. Kosambi

P.S. Fisher has some very interesting problems that would be good for ~~Vijayaraghavan~~ Vijayaraghavan. I have suggested V.'s name to F.

K.

Poona, August 13, 1939.

Dear Prof. Krishnan,

We haven't heard from you since you left. Have you begun to send the pamphlets to my friend in Poona, as requested? He seems a bit quieter than usual. At any rate, don't stop if you have begun.

Also, what about Vijayaraghavan? Are his family affairs and his mental condition any worse than usual? Why is he not doing any real work. Do tell him that both V.G. Iyer and Seetharaman were appointed at Annamalai, as Ramamurti had left, creating a second vacancy.

If a line of the series spectrum of an element be given by $\nu_{m,n} = R [1/m^2 - 1/n^2]$ are there any shifts represented by $R'x$ ~~$R'x$~~ $R'[1/m - 1/n]$, where R' is a constant depending upon the "initial conditions", in particular, ~~temperature~~ temperature, magnetic or electric field intensity, and so on? I get the result theoretically, using a new set of postulates, but don't know whether it represents any real phenomenon. This shift might be zero $R'=0$ and so unobservable, or it might also have the general form $R'/m - R''/n$, with two different constants instead of one. The only thing that I can ~~say~~ say is that it will be present in the same way for every (m, n) line in the original series spectrum. Do you suppose this represents anything in the fine structure, or is it just a meaningless result?

Things are going on as usual in Poona, but your friends have fallen down ^{at} ~~in~~ their job, and the rainfall has been so deficient as to make a famine likely.

Yours sincerely,

D. D. Kosambi

Poona, August 19, 1939.

Dear Prof. Krishnan,

Thank you very much for the prompt reply. The $R[1/m-1/n]$ terms are worth thinking about, because the effect will be very small compared to the series terms, and the constant is not a universal one like the Rydberg constant, but depends upon the condition of the substance. As a matter of fact, the full spectrum would be something like $\sqrt{R[1/m^2-1/n^2]} + R'[1/m-1/n] + R''\epsilon$. The constants R', R'' would not be universal. The R'' term is familiar as a shift that is not ~~in~~ linked to the ^{series spectrum} frequency: the Zeemann or the Raman shift. What I should like to know is ~~is~~ whether there can exist, under proper ~~circumstances~~ circumstances, a shift corresponding to the middle term of the expression given above. It is likely that these ^{shifts or extra lines} would be in the fine or the hyperfine structure, *or give faint lines.*

I heard from Vijayaraghavan just after I wrote to you. He took up the whole of his epistle describing your triumphs in Europe! Under the circumstances, it is very ~~strange~~ strange indeed that he should not have written to you as soon as you returned.

Don't forget the pamphlets. And if you see N.R. Sen, tell him in as pleasant a way as possible that I find it very difficult to examine papers in astronomy - a subject for which I have been twice appointed at Calcutta at the applied Maths. M.Sc., and for which I have not the least aptitude.

Yours sincerely,

D. D. Kosambi

Poona, October 26, 1939.

Dear Prof. Krishnan,

You will recall that I spoke to you when you last came here about some arrangements for encouraging our [rare] physics students; that is such as are not lost in the tangle of the I.C.S examination. Khot, who was chairman of the physics colloquium at our college [when you lectured on low temperature work] seems to me to come in this category.

Khot's history is rather peculiar. He had a first class ^{in Physics} at the B.Sc. in 1937, and was sent to me by one of his professors. I suggested that he go to you at Calcutta, and that six months would show whether or not research was his métier. If not, he could revert to our college and go through the regular mill. At that time, I had money and could have helped him a little. But seeing that he was not interested, and had made up other plans, I ~~did~~ kept quiet when my suggestion was rejected.

This year, Khot has passed his M.A. and M.Sc., one in mathematics and the other in physics. He has good marks in both, but the work is all examination work. You know just what this means. Now he finds that even after getting the highest paper qualifications in these examinations, the University, in the usual manner of all intrigue-controlled institutions, is not willing to give him any of the available scholarships. In fact, two others who have taken the ~~same~~ exams with less success have been preferred because of stronger backing [research is not thought of here]. When he again asked me about his future, I repeated my old suggestion, ^{because I still think that he has possibilities}

The question remains whether you are interested in testing out a student who has wasted two years ~~of time~~ in going through the wrong mill and has no inner urge for research, as far as can be discovered. If you take him on, the understanding would be that after a reasonable period, say six months, you would tell him whether or not he has the requisite ability in him. Till that time, he must work with you on his own resources. But if you think him fit, it will then be up to you to find him some sort of a scholarship to carry on the rest of the work.

You must now be busy with the Science Congress, and I know how full the life of an active sectional president ~~will~~ is. But here is some possible human material going to waste, and I wondered whether you might find it worth while to have a closer look at the person.

Yours sincerely,
D. D. Kosambi

P.S. - Did Vijayarajkumar send in my notes about the structure of Bangalore? (K.)