

BOWDOIN



COLLEGE

SEARLES SCIENCE BUILDING

DEPARTMENT OF PHYSICS

NOEL C. LITTLE

B. W. BARTLETT

R. F. DERBY, Instrument Maker

Brunswick, Maine,

Sept. 11, 1933

K. S. Krishnan  
210 Bowbazar St.  
Calcutta, India

My dear Dr. Krishnan:

May I acknowledge with pleasure the receipt of your paper on Magne-crystalline Action. I have read it with much interest, and wish to congratulate you on the thoroughness with which you have attacked the problem. Your success with the method of oscillations in a homogeneous field indicates that it is probably the most sensitive method of measuring magnetic anisotropy. For my own interest I have reduced your results to 27°C and volume susceptibilities (since that is what is actually measured by Rabi's method), and am enclosing a copy of a table of comparative results which may be of interest to you.

The agreement between your results, Rabi's, and mine, seems to be excellent qualitatively, and reasonably good quantitatively, although the spread is greater than the limits of error which I have estimated for my work. Personally I am inclined to attribute some of this spread to actual physical differences in the crystals themselves, since the differences in our results appear to be random rather than systematic. As I pointed out in my paper, I found in several instances a considerable difference in values for different specimens of the same substance, and that crystals which were apparently good specimens were not always so in fact when pierced by a drill. I should be interested in any theory you may have to account for the differences other than the crystals themselves and the personal equations of the experimenters. As far as the work of Jackson and Fincke is concerned, I think our results have shown that it is of little quantitative value.

You mention in your paper that you are starting measurements at various temperatures on crystals of this type. I am expecting a sabbatical leave of absence for the college year 1934-1935, and am desirous of continuing work of this nature at some institution where suitable magnets and, in particular, facilities for obtaining liquid air temperatures are available. It has occurred to me that your laboratories might have the facilities and equipment necessary. If this is the case would you welcome an additional investigator in this field, and if so under what conditions?

Very truly yours,

*Boyd W. Bartlett*

P.S. On looking over my data on values of  $\psi$  for the crystals containing copper I find you are right in assuming an error. Rabi's values for  $\text{Cu NH}_4$  and  $\text{Cu K}_2$  should be interchanged, and my values have the signs wrong. They should be  $\text{Cu NH}_4 + 79$   
 $\text{Cu K}_2 - 78$

BWB

Susceptibility Measurements by Krishnan, Rabi, and Bartlett

(Values given are reduced to 27°C, and are volume susceptibilities x10<sup>+6</sup>)

	K <sub>1</sub>	K <sub>2</sub>	K <sub>3</sub>	θ (ψ)	Densities used in computing mass susceptibilities
<chem>Co(NH4)2(SO4)2.6H2O</chem>					
Bartlett	56.8	40.6	49.3	-43	1.901 1.904
Krishnan	55.2	40.3	47.5	-43	
Rabi	56.2	40.7	48.9	-44	
<chem>Co K2(SO4)2.6H2O</chem>					
Bartlett	57.3	43.9	47.6	-13	2.218
Krishnan	58.9	45.9	49.5	-15.5	2.228
Rabi	57.6	44.6	48.6	-13	
<chem>Co SO4.7H2O</chem>					
Bartlett	70.4	58.2	62.6	-55	1.948
Krishnan	71.6	58.1	64.0	-54.5	1.962
<chem>Ni(NH4)2(SO4)2.6H2O</chem>					
Bartlett	20.2	19.7	19.7	-17	1.923
Krishnan	20.1	19.5	19.5	-14	1.945
Rabi	20.2	19.9	20.0	-17	
<chem>Ni K2(SO4)2.6H2O</chem>					
Krishnan	21.2	20.4	20.4	-12.5	
Rabi	20.5	19.7	19.6	-7	
<chem>Cu(NH4)2(SO4)2.6H2O</chem>					
Bartlett	7.08	5.65	6.83	79	1.926
Krishnan	7.15	5.66	6.83	77	1.952
Rabi	6.80	5.40	6.62	81	
<chem>Cu K2(SO4)2.6H2O</chem>					
Bartlett	7.14	5.80	6.98	-78	2.233
Krishnan	7.54	5.67	7.19	-79	2.259
Rabi	7.52	5.62	6.83	-74	
<chem>Fe K2(SO4)2.6H2O</chem>					
Krishnan	61.3	51.8	62.9	59	
Rabi	59.8	52.1	61.4	55	

27th November,

3

Dear Dr. Bartlett,

Many thanks for your kind letter which I received after some delay due to my absence from Calcutta. The tabulated data which you enclosed with your letter show that we are now sure at any rate about the magnitude for the various magnetic constants of these crystals. The small differences between your values and mine, are I believe within the limits of my experimental error and it may not be possible to attain higher accuracy ~~except in the specially well developed good crystals.~~ *with the kind of crystals I used.*

It is very unfortunate that Dr. Jackson's measurements on

$\text{CoSO}_4 \cdot (\text{Mg})_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ , which are the most extensive (regarding temperature range of the investigation) *now available*, should have been affected by errors. Probably from his old note books he may be able to recover the correct values.

For sometime past we have been engaged, as I mentioned in the paper, ~~on~~ *my* the measurements at liquid air ~~to room~~ *higher* temperatures.. The crystal is suspended by a long stout glass fibre from the end of the quartz fibre, the latter being wholly at room temperature (so that the torsional constant may be definitely known). The crystal is surrounded by a suitable liquid bath, and the maximum couple  $(= \frac{1}{2} m H^2 \Delta X)$  is determined by *finding the couple* rotating the of torsion necessary to just turn round, the crystal. The method works well for determining  $\Delta X$ 's.

I have not yet attempted absolute measurements. *at low temperatures.*

It will be great pleasure to us to welcome you to our laboratory (Professor C. V. Raman was the director till he joined the Institute at Bangalore last year), and we shall make you stay in India as comfortable as possible. Though our laboratory will not compare favourably with the large laboratories to which you are accustomed in America, it is fairly well-equipped for magnetic and spectroscopic work. We have some good magnets and a liquid air plant. (liquid air is also locally available for purchase) and a good workshop, so that there should be no difficulty in carrying out low temperature magnetic work. If you propose to join us next summer, I would like to postpone the low temperature measurements till you come.

We are looking forward to the pleasure of receiving you in our midst.

With best regards,

Yours very sincerely,

BOWDOIN



COLLEGE

SEARLES SCIENCE BUILDING

DEPARTMENT OF PHYSICS

NOEL C. LITTLE  
B. W. BARTLETT  
R. F. DERRY, Instrument Maker

*Brunswick, Maine,*

Jan. 22, 1934

Dr. K. S. Krishnan  
210 Bowbazar Street  
Calcutta, India

Dear Dr. Krishnan:

Economic conditions here have caused me to delay my reply to your cordial invitation to join you next year until I could do so with some definiteness. As no doubt you are aware, since I wrote you last fall our monetary system has gone through some radical changes. As a result it now seems out of the question for me to finance a leave of absence of the sort I then contemplated. Unless new developments occur I shall have to be content with a less ambitious program. I regret this exceedingly, for your letter leads me to believe that a year with you in Calcutta would have been very profitably spent on my part, and I hope of some interest to you.

I sincerely hope that my change in plans and delay in writing you have not held up your work appreciably. If I can arrange it I am hoping to be able to continue my researches along somewhat similar lines next year. If so it will be very gratifying if our results continue to be in such close agreement. I am very sorry indeed that the exigencies of finance have forced me to refuse your hospitality.

Cordially yours,

*B. W. Bartlett*