Experimental Physics - III
Prof. Amal Kumar Das
Department of Physics
Indian Institute of Technology, Kharagpur

Lecture - 09
Gaussmeter/ Teslameter (Contd.)

we are in solid state physics laboratory of Department of Physics and again I will you show that magnet electromagnet as I showed in earlier class. there this I will show the how the magnetic field is measured using the gaussmeter ok.

whatever principle I described, I will try to show in the instrument.

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this as I told that when you come in the lab teaching laboratory we will see that there is a magnet and there is a probe. Now, probe is put inside the between the pole gap and there we want to where we want to measure the magnetic field ok.

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this is the probe and this probe connected with this meter. as a whole these are gaussmeter.

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now if I give if I apply current, if I apply current ok; if I apply current some 1 point, say 1 ampere current I applied and now field we noted down the field, it is 1254 ok.

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then we increase the field; increase the current to 1 point say 3; 1.3 then it is the field is increasing current versus magnetic field current versus magnetic field, we can note down and we can plot and from that plot you can find out a slope. that is the calibration of this electromagnet with current ok.

later on I know this for different current what are the different magnetic field. Later on I will just do the experiment just removing this probe removing this probe.

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Here we can put our sample and we can apply magnetic field we can do the experiment applying different current and for that current what is the magnetic field from calibration curve I one can find out that way we just use this magnetic field.

today what I am interested to show you that how this hall probe works, how this hall probe works I have described that I want to show you in the laboratory ok.

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I we have many hall probes we have many hall probe. this is one hall probe let me keep it. I will not disturb that one.

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this hall probe is connected with this meter, with this meter and now as I told here, I cannot disconnect it, but I have another one where I am able to disconnect ok.

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this is probe you know. just let me open it. this is probe this is probe and this is the meter this together is we tell the hall probe or gaussmeter or teslameter ok.

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Now, you see what is there? How we use? Just we take out this just it is safe. something is red, some something is there stripe red stripe.

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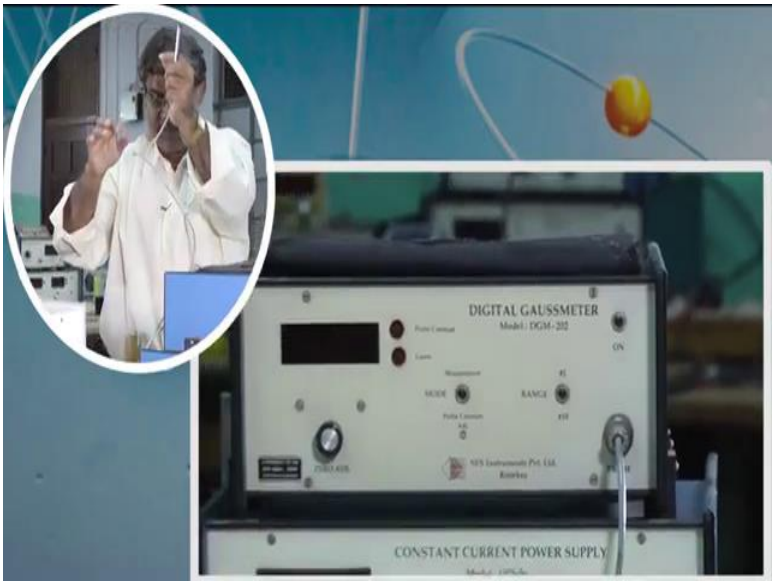

Now, this is meter this we connect with this; this we have to connect, there are some direction to connect it this connect and then if I put here, you see if I switch on see current is 1.3 current is there.

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it is it will show that it is a magnetic field, it will show the magnetic field you see ok, it is showing the magnetic field ok.

now how this meter knows this magnetic field how this meter knows the magnetic field ok? Just through it information is going to this through this system. what is there here, as

I described in previous class that this is a probe means it can sense the magnetic field at a place where we will place it ok.

its name called hall probe this may be in another region this, what about this 4 electrode we are using 4 electrodes, we are using for connection two for current and two for hall voltage. this we tell really this electrode this we will tell really probe, this we will tell probe; 4 probe method, it is called 4 probe method. that is why probably it is also called hall probe ok.

now, whatever the I explained there must be somewhere, there must be somewhere here that sample and there should be 4 connection, there should be 4 connection with the sample; two for the current and two for measuring the hall voltage And the current we have to apply current to the sample and someone has to supply current and that and two will measure the voltage source from here this voltage should go somewhere which will measure the voltage of till about the voltage there must be some from meter as I told in inside meter that is there what power supply is there, one volt meter is there and also electrical electronic circuit for multiplication or division ok.

this communication this meter and this sensor that piece of sample, piece of material, this wire is connecting these two this wire should have.

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here if I open it you see, here you see this, there are 4 electrodes, there are 4 electrodes, there are 4 electrodes.

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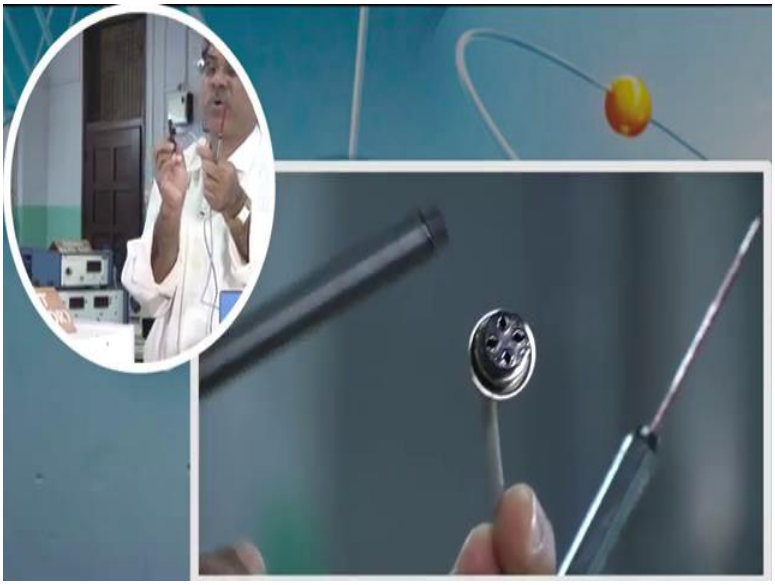

Here you can see there are 4 electrodes; here you can see you see. there are 4, there are 4 hole; female this is female type, this is male type ok.

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that means, there are 4 wires ok, there must be there are 4 wires coming and here you can see this some black spot at the end, just you can see some black spot that is sample very thin sample and from that sample there must be 4 connections ok.

for you I have I had old one it is broken one. I will show you that one ok, but I have to save it I am keeping this way. I have a broken piece. destroyed one, this destroyed one actually I think it was broken I have one destroyed piece this is the same as that one, but it is broken old one.

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whatever the red strip this I have taken out, see this one. Now to look at it here look at it here you can see here. You can see here this is the sample ok, these are small sample very thin sample, t has to be very thin and you can see this 4 wires, 4 wires you can see these 4 wires is connected with the sample; two along the length and two along the width and thickness direction is this, you see it is perpendicular thickness is in the perpendicular direction of this stripe.

Look at the geometry of the sample, that means, when if you want to measure the magnetic field or if you want to satisfy the hall condition hall effect condition, this probe has to put in the magnetic field in perpendicular direction you know, this magnetic field this type magnetic field has to be perpendicular to the stripe. If it is this way then it will not work, now this magnetic field along the width. it will not satisfy the condition, hall condition. magnetic field has to be perpendicular to the stripe, then it will be perpendicular to the current ok.

this to satisfy this condition. here I was able to show you I was able to show you a very small sample, see very small sample and this 4 wire is coming It is the wire that is the on

p c b it is done I think this is the p c b this is metallic wire is there. this is coming through this and this is connected with this wire ok.

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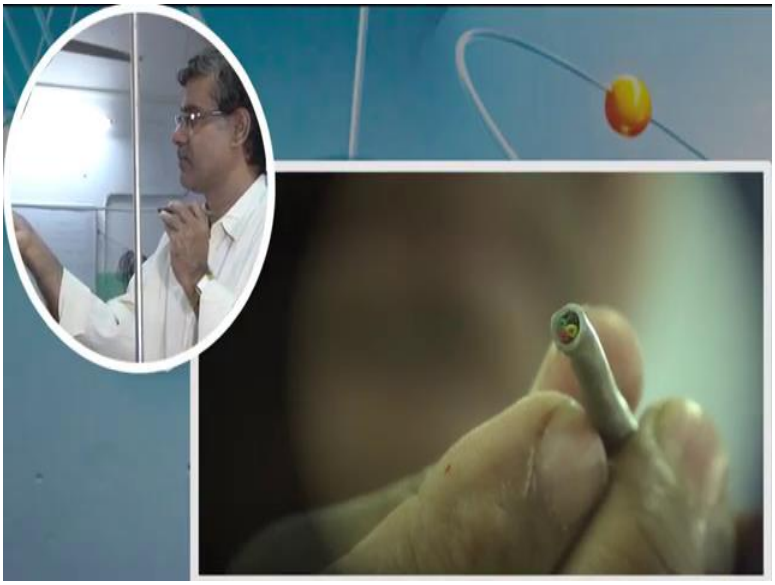

here you can see this 4 wires, but is difficult to see, but I can see this there are 4 wires, here there are 4 wires. I do not need to focus this camera is focused then you can see this 4 wires probably, is it possible to show? That I think yeah this is the 4 wires ok.

this is these 4 wires inside at the end you can show that this I can see more or less, but it anyway. this is the same wire, you see this is the same wire what is there? I showed you there is a very thin sample of this p c b and on p c b this 4 metal wires are there ok, 2 for current 2 for the voltage and magnetic field we have to apply along this; that means, probe magnetic field along the pole piece that is why probe is perpendicular to this we put in this way you know.

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In this way you have to put probe has to put this way. If you put this way then you will not get the field you see, I think that is the case you are it is (Refer Time: 13:37), it is not connected. let me it was not showing you see field because it is not connected. now, let me connect it I have connected it.

Now, it will show this you see here how I have put here ok, 720. Now, if I change the direction, perpendicular component is decreasing and when it is flat, when it is flat you see it is almost it should be 0, it is almost 0. You know it is almost 0 if you can adjustable it is almost 0. it is very important for measurement if you do not know the principle, how it works you will do mistake it has to put perpendicular to the field, then only you will get correct field this way you have put this way you have to put.

generally, you can maximize the, you can slightly change and maximize the field then you will say. Now, I am just making it horizontal you know this way, making it horizontally you see. Then you have to adjust then it is of field is 0, field is 0 ok.

depending on the angle of it is just slight change of this angle, slight change of this angle it will give slight change of the angle from the vertical position It will change this value for accurate measurement using this one condition is these have to be perpendicular to the magnetic field. magnetic field direction in this direction. you have to put, that field has to be perpendicular to the probe means there in that probe their sample is there. it

should fall on the perpendicularly of the surface of the sample or it should be parallel to the thickness of the sample.

how sample is put there? depending on that you have to put. I showed you, I showed you that this connection of 4 wires it is plain. this direction perpendicular direction is the thickness in which direction we have to apply magnetic field this way you can make that ok.

this; current is supplied by this through this wire, supplier is there inside this meter and voltage is going and this it is there is a voltmeter what is the voltage it is measuring and now with that some electrons circle inside there that c constant c is given by the manufacturer. it will multiply with that constant that constant remain constant if I is constant I can cannot change i, I means current I cannot change the I x because it is given by the box it is set inside. customer or the, we user we cannot change that one ok.

that I x also fixed, that is sample thickness and type of sample these are fixed. c is constant, c remains constant.

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And that constant is divided this the v voltage is divided by that constant through the electronics and whatever the value that is shown here. that is reading of the magnetic field ok.

I think I showed you, I showed you, it is important. here what is there, what is there? You have a you have a that nearly germanium is used you have this germanium, and then it is the other side yes germanium.

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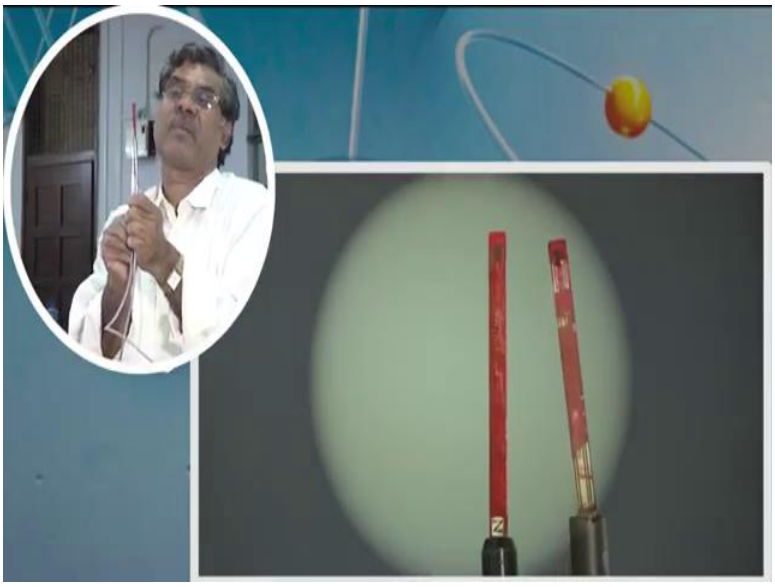

you see, you can see this you can see here. this 4 wire 4 connection has come this is good ok.

I think this way one should for proper use of an instrument, one should know the principle of that instrument, how it works. If you do not know then you cannot use properly you will do mistake if you know then you can use confidently.

I think that is the thing gaussmeter or teslameter or hall probe whatever we tell that is the that is used for measuring the magnetic field and it is very easy hall effect is very simple way one can explain and based on this alit is hall effect everyone will know, but from using the hall effect one device can be used, whole world is using this device you know all life ok

how this device is designed, fabricant and how to design the device ok? from here one can learn that is that way I try to explain you it is not only this for other defect one can think of doing the fabricating the device design to design the device and if one can think this way ok

I think this magnetic field is very important parameter external parameter for studying different properties. I will in this experimental physics III, I will demonstrate some experiment in solid state physics laboratory that is also called condensed meter in this laboratory. today I will stop here.

Thank you.