

Experimental Physics - III
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Lecture – 48
Determination of Wavelength of Spectral Lines using Constant Deviation Spectrometer (Contd.)

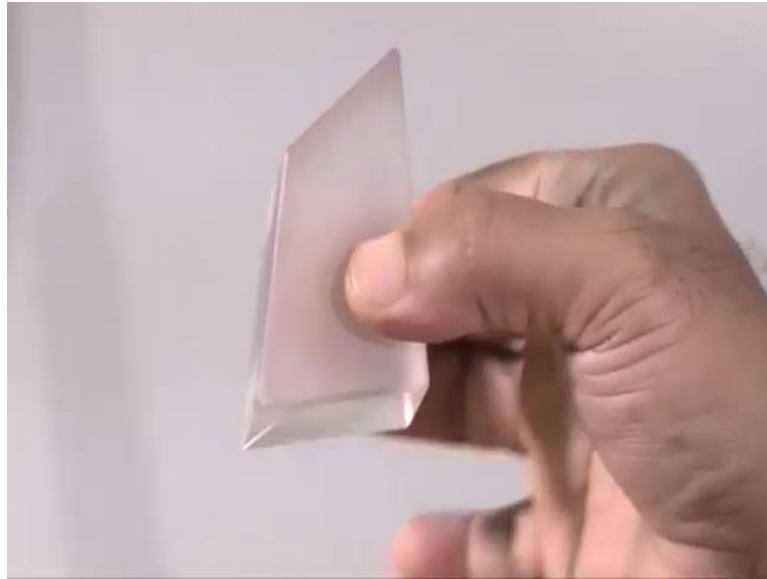
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Now I will demonstrate you how to measure the wavelength of unknown light using the constant deviation spectrometer. this is the setup for the constant deviation spectrometer, as I showed you in the schematic diagram; that this is a source this is a source. Here we are using I think this is mercury source. one of the line we will use as a known source known wavelength ok.

Now, this is the collimator, this is the collimator there is a slit and light parallel light will come through this slit. that way we have using the Schuster's method, we have set this collimator for parallel rays. This from the source this parallel rays will come and then, here this is the prism table. Prism is put on the table, Pellin Broca prism. I will show you Pellin Broca prism.

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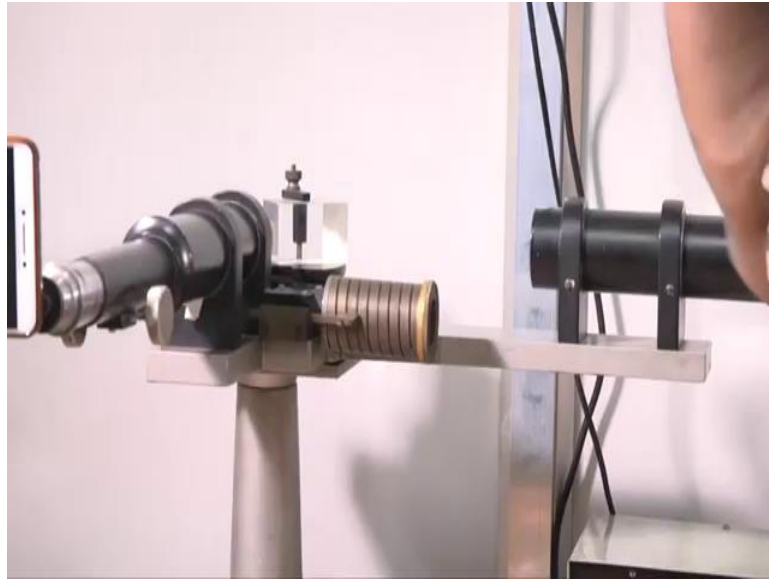


The same prism we have placed here. As I told this is a trapezium kind of a prism. It has you see this prism can see here this is the angle 135° opposite that angle is 90° . And then this is 75° and other one is 60° that is what whatever I have shown you in schematic diagram.

This is the prism. That same prism we have put on the prism table now this is the telescope this is the telescope. generally in spectrometer you have seen this collimator and telescope in the same line, but in this spectrometer is the telescope is at 90° ok.

This is set; the telescope and the collimator they are at 90° ; you can see the stand it is a 90° only you will be able to only light will emerge through this telescope, when the deviation will be 90° . That deviation will come from this Pellin Broca prism ok.

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In addition, as I told that this is the drum; it has scale.

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You can see the scale, I can here you can see the scale. I think it is a written you see, it is I think let me just, here you can see this is 500 here it is written you see 500, 500; 500 nanometer.

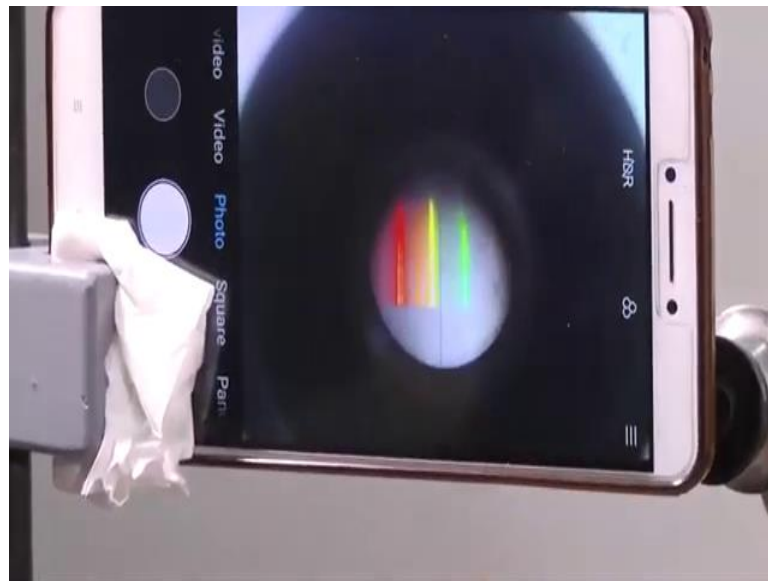
If I go up then 510; this one 510 then 520, 530; that way. here actually here you can see t this is the indicator. Here in the middle of this there is a line. we take the reading that

indicator position will tell us the reading. Let me this is 600 you know this is 600. this is 610. Between 600 and 610, there are 10 division.

Therefore, list count of this scale is 1 nanometer. this 600 is a nanometer. Between 600 and 610, it is 10 divisions are there. smallest division is 1 nanometer. List count for this scaling drum it is 1 nanometer that you have to note down if I go other way. It is here, it is written 90; that means, 590 nanometer; then here it is an 80 580, but actually this is not my reading my reading is my reading is a here you have to see.

I think yes I have I have mobile torch I can use ok, to show you the. Here you see there is a marker there is a marker exactly here in middle. That marker it is now reading I can see this is 571, 571 this is mercury source; mercury source have many colors; one of the color we will take as a known wavelength known source.

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That I have set here mobile camera. whatever you will see whatever you will see that that is the spectra; we are seeing of different color, but you can see the cross wire you know. I can I can rotate and then you can check this cross wire you see cross wire I will enlarge it I will enlarge it. This is the cross wire ok.

I am changing the drum you see. this cross wire is moving ok, cross wire is moving. I am changing the angle of the incident angle of the prism light on the prism this cross wire.

Now, I will select this beam line green line cross wire I set at this green line green line this wavelength is known to us say is known to us.

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MERCURY λ	
COLOUR	λ
RED	6328.50
ORANGE	6149.50
YELLOW	5779.63
GREEN	5460.74
BLUE	4358.33
VIOLET	4046.56

$A = 10^{-8}$ cm

For mercury, for mercury this prominent color that we have noted down. for red color the wavelength is 6328 nanometer it is in angstrom. For green color, you can see this is 546 nanometer 546 nanometer; because our list count is nano 1 nanometer. I cannot think about the accuracy beyond that. 546 nanometer ok.

What I have to do. here reading if this is the known wavelength to us. I have to set reading here 546 nanometer it is the here you can see 550; now division 1, 2, 3. I have to it is a 546 yes. I have set it at 546 I have set it at 546 and this cross wire you can see this exactly it is matching with this spectra lines of beam; because I have I have set I have set this prism already for this wavelength ok.

Actually, I can disturb it I can disturb it and show you, I think later on I will do that after. this prism actually one has to put and then change the angle to get the green line coinciding with the cross wire. Because crosswire we have set cross wire, we have set at the wavelength of 546, with which is known wavelength for the green light, which is known wavelength for the green light of mercury source ok.

That way one has to calibrate one has to calibrate. Calibration is done calibration is done now, other wavelength you can take as an unknown wavelength now, what I have to do?

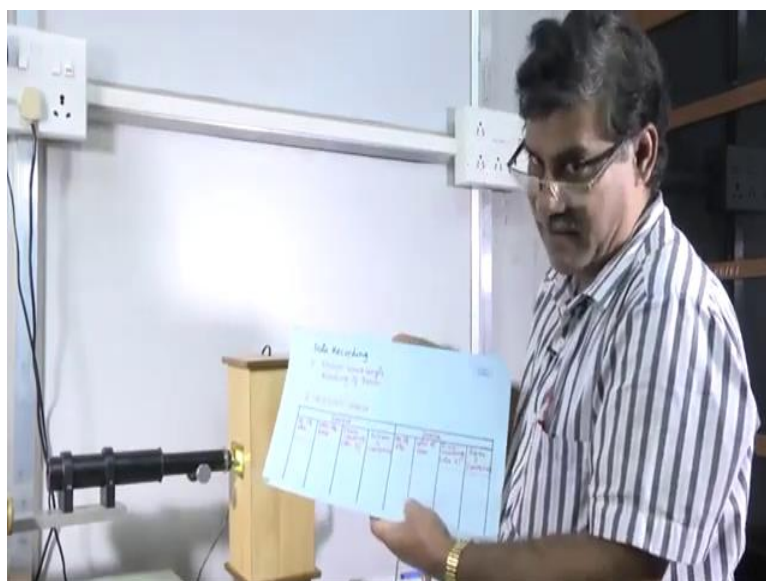
I will just bring that yellow one at the cross wire position. I am rotating the drum and tracing the yellow one. Actually there are two lines yellow lines very close, but on this camera I cannot resolve it, but when I see through this telescope I can see clearly two wavelengths now, what is the reading of this I have to take reading I have to take?

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I think this reading is it is the, this above it is 80. 500 575, 76 yeah 576 nanometer 576 nanometer. you have to note down on the as I told that you write the source.

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This diagram a table I have shown you. Known wavelength 546 you write drum reading you can write keep it undisturbed. Now recording source is say it is same source you can use or different source you can use. This is this it is a mercury source.

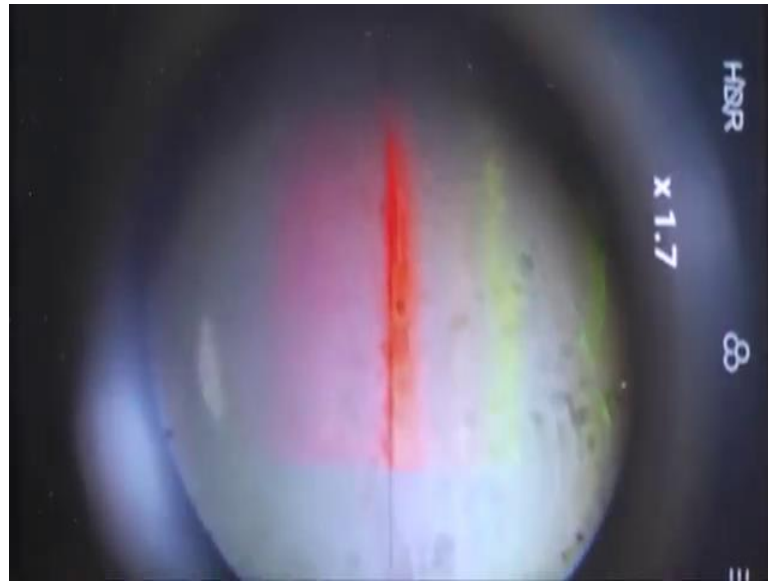
Now, color green color already we have taken now yellow color yellow color. reading I got from the drum this is 476 576. I will write this 576 here now compare with the standard value compare with the standard value here compare, if you compare with the standard value. 570 here they I as I told this two uh spectra lines are there; one is 576 another is 578 or 579 we are getting very close to there since it is not separated on the camera screen. it is a more or less 576 or 577 ok.

Exactly it is whatever the observed standard one it is more or less it is matching. then I will go say red one is there orange, blue. I think red one I think let me go the other one next I can go the other one orange one orange is there. If I go to the orange one, I am moving towards the orange yes it is coincide with orange now, what is the reading; I have to take what is the reading? It is a 596; I am getting reading 596.

Orange one orange one here it is showing 614, but then I am not at the one it may not be the orange one it maybe yellowish it is not the one I think it is a different one. let me go to the other one it is not orange probably here maybe this maybe the orange ok.

Now reading is 26, 526. for this for this one 526 500 sorry 626. It is a 632 is the red one. it looks red it looks red.

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I think yes it looks red but red it is a diffused one is difficult to set anyway. that way one has to. It is, I am showing you on a screen, but through this telescope, very nicely you can adjust the position of the cross wire on the tins. Then, you can you can match with different colors and take the reading of the diagram.

If I change the source, if I change the source with the. I think uh let us change the source with the source that is neon source neon source. If I want to put a neon source just I have to, I have to replace this source with neon with neon.

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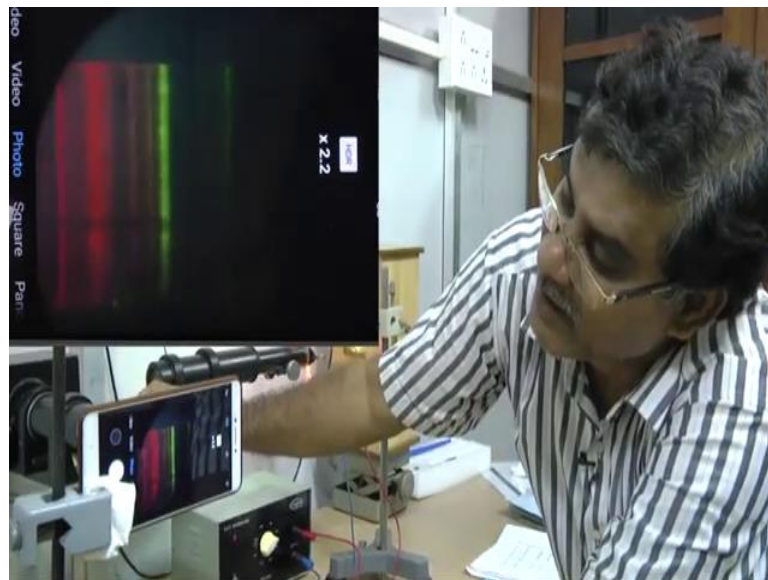
This is the neon source. I have to I think yes high voltage power supply. I have to put it is the output, I think I will this is the red I should put this is the discharge tube. You need higher source. I will switch on this one I will switch on this and then, I will apply voltage yes, you can see this is now getting. Up to 4 I can give up to 4 I can give.

I am using another source. I am using another source this is the neon source I have put the neon source, say unknown source. Now I want to measure the wavelength of the neon source. Then I cannot see this or let me show this way I have to bring it to the yes it is there this spectrum I can see I think what we will do? We will just closed it we will just close it.

I think I have to be careful I should not disturb this, I should not disturb yes. just to protect from the outer light this is the cover, I have put there. If I see yes I can see the spectral lines I can see the spectral lines, I am rotating the yes. green yellow there are many spectral lines I can see slightly either you know it is a whether it is defocused in my eye.

This spectrum is there let me set this camera mobile camera.

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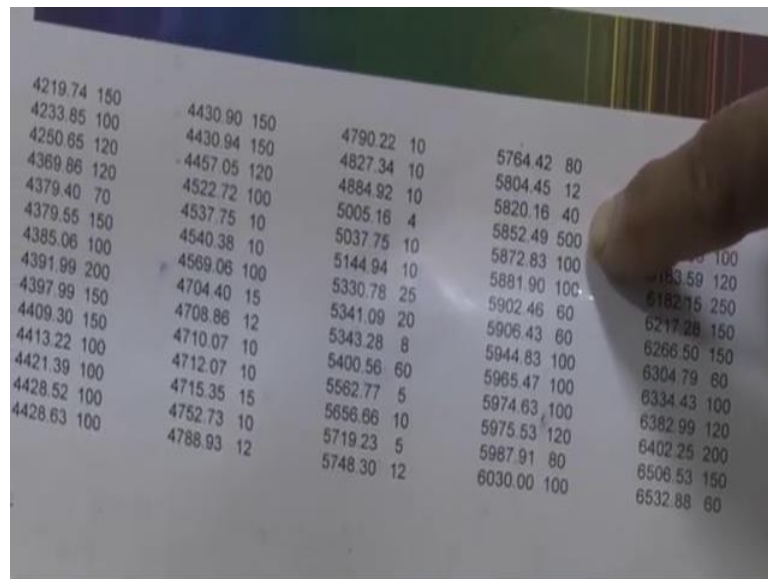


Yes, you can see the spectrum I am getting here nice I am getting nice this kind of spectrum neon spectrum we are getting. now, slightly I can slightly I can yes ok.

Now this cross wire where is that cross wire. You can see a crosswire this is the crosswire, but it becoming defuse. Now, crosswire should coincide with different. now, this it is with this with this color ok, now for that you have to take reading. you have to take reading for that why it is a I can see this reading is I think that I have to see it is how much I have to see this is a one more this 90 this is 600 above 90. crosswire should coincide with this yes it is coincide with this.

this reading is 500 580 it is a 580 you note down this reading and then later on you will you compare with the compare with the chart of the. I think I have chart 580 neon I have chart for neon ok.

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We are at a region we are at this region and this green region you see. Green region this is starting from the 576 to 580, 582, 585, and 580. There are many lines you know there are many lines. whatever I have coincide the prominent one intensity is very high; here you can see this intensity is given. Here I can see the highest intensity this is 500 intensity these are relative intensity.

58 it is 58, 52, 58, 52 then 5872; 500 588 our one how much I got? I got 580. It is a 580 around 580. This is the prominent one it is the 585 585 nanometer but here I have here I have approximately because this is the I am not seeing through the, I am not seeing through the yes. I am not seeing through the one has to oh there are two blue you see ok.

One has to really match with the carefully one has to do carefully one has to do let me check from here and match with this, I think this is I have match now, I have matched with this green one and then, I will show you here it is a slightly trickiest. Now I set you can see you can see it is a crosswire coincide with this one ok.

That reading is now 500 how much I am getting. Reading is 590, 580 yes, I am getting 500 I think 579. Slightly less than that. One has to I do not know when I kept it here it may be slightly disturb also when I putting cover. You will get this spectral lines, you have to do the experiment very carefully and it is a very easy to take it is very easy to take it.

you see now, it is coincide with the second one take the reading take the reading go to the other one that way you just change the drum, rotate the drum and crosswire will coincide with different color and correspond reading you take. That is the wavelength of that color and now you should compare with the standard one as I as I showed these are very convenient method to measure the wavelength in (Refer Time: 25:51), but it is the list count is 1 nanometer. Accuracy is not that very high. I will stop here.

Thank you for your attention.