Experimental Physics - III
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Lecture – 46
Study of Absorption Spectrum of Iodine Vapour
(Continued)

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This is the experimental setup for ab instruments absorption spectrum of iodine molecules. this is quite familiar to you this the spectrometers grating spectrometer. The spectrometers have this collimator and then prism table, on prism table we have put the grating these grating have 600 lines per millimeter. grating element d will be equal to 1 by 600 millimeter.

That is the telescope. before starting experiment what about the procedure to level the spectrometers to get the parallel rays that Schuster's method that you have to use. In experimental physics II, many times I have described this Schuster's method as well as the labeling of the spectrometer. here is all they do we have we have level the spectrometer as well as we have used Schuster's method to get the parallel rays.

I will not do it again here. this is the spectrometer where using these grating we can see the diffraction pattern of the light in front of, in front of collimators we have here is we have here iodine; we have here iodine gas and other side we have light source white light

source. this white light source will pass through the helium gas; not helium gas sorry iodine gas iodine molecule in gaseous form and then that light is falling on the collimator. There is a slit here that is the now it is source for this experiment. the sleet is the source for the experiment, on the sleet white light is falling after absorption some wavelength by the iodine molecule ok.

For that, we should see the black lines in the spectrum. now, this is the collimators it is making the parallel rays of all wavelength and now falling on the grating. Now there will be diffraction, different orders on both sides of the central fringe central maxima on the both side we will get different orders here is let me show you first the molecular the absorption spectra of the iodine molecule.

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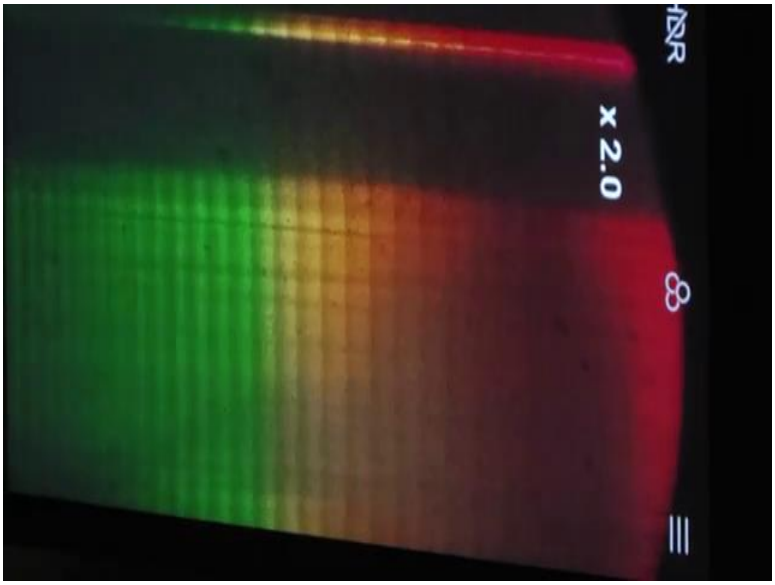

In this, I have said it later on I will describe and explain more. Here I have used the camera. here you can see the spectra; you can see the molecular absorption spectra. Whatever the black lines you see, it was continuously red yellow and green color ok.

Now, you can see this division of the continuous color with some black lines you will understand better when I will remove this iodine gas and then you will see the continuous color.

We have to cursors of the of the IP's that cursor we have to we have to we have to set a different black line and we have to. we have to start from the red side. red side we have

to start and then we have to come towards the black lines we have to come towards the black lines not black lines; go towards the green side and then you can see the separation of the black line separation of the absorption spectrum; absorption lines are that decreasing, decreasing, decreasing if you go more this side it will be continuous this is the absorption spectra of iodine molecule.

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Here we have an iodine in a tube we have an iodine in a tube this is the iodine in a tube you can see iodine in a tube. I have removed that one I have removed that one now only this white light is coming there is no iodine here.

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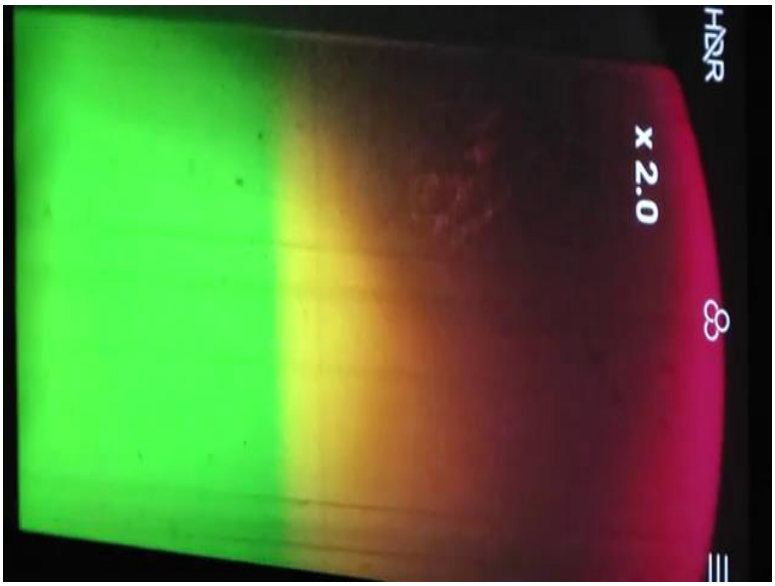

Here you can see then you can see these you see it is a continuous spectrum of different wavelength not different of continuous wavelength you see these green, then yellow, then red ok.

White light. now, that of different all of color of all colors are coming now it is now diffracted by the grating and here first order pattern we are grating for different wavelengths. It is a continuous again I am putting again I am putting these putting these iodine. we kept iodine here again I am putting iodine.

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I think I have to slightly heat this iodine to make it gaseous form. You can hear it. now you will see this. Black lines will be more prominent; because the more molecules will be in gaseous form and there will be more absorption and that lines absorption lines it will be more black, I have just realized more; I think it is there ok.

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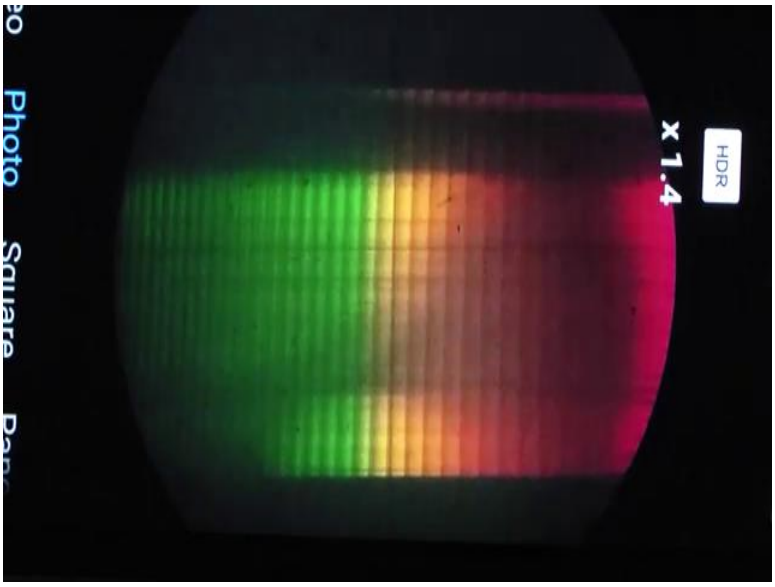

This is now more prominent. if I see through this telescope I can see better it is clear if you go towards grid side. It will be continuous it will be continuous.

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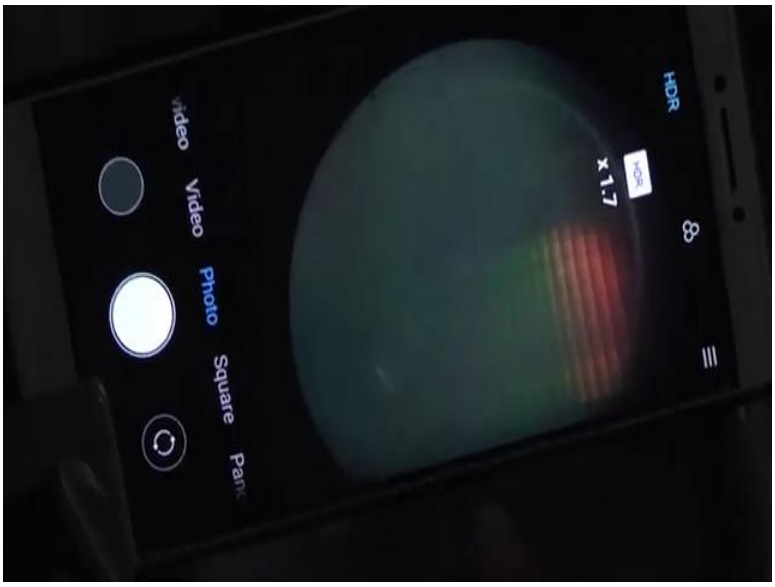

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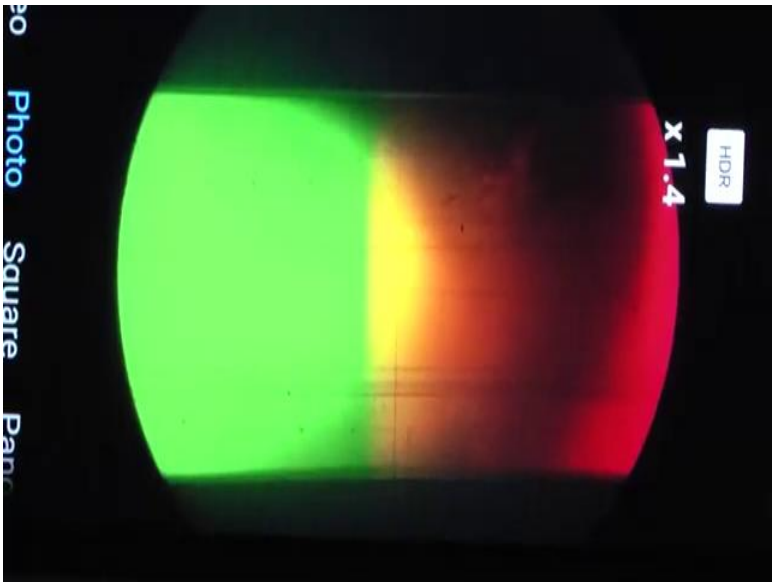

It is a red side red then I am going towards yellow then green in other side this is the molecular spectrum whatever.

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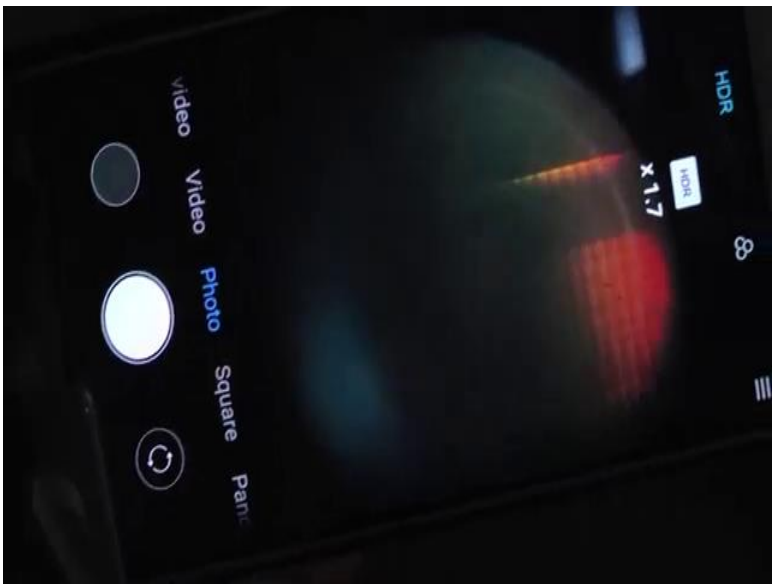

I think I could cannot show better than this but when you will do experiment when I see through the telescope I will see clearly.

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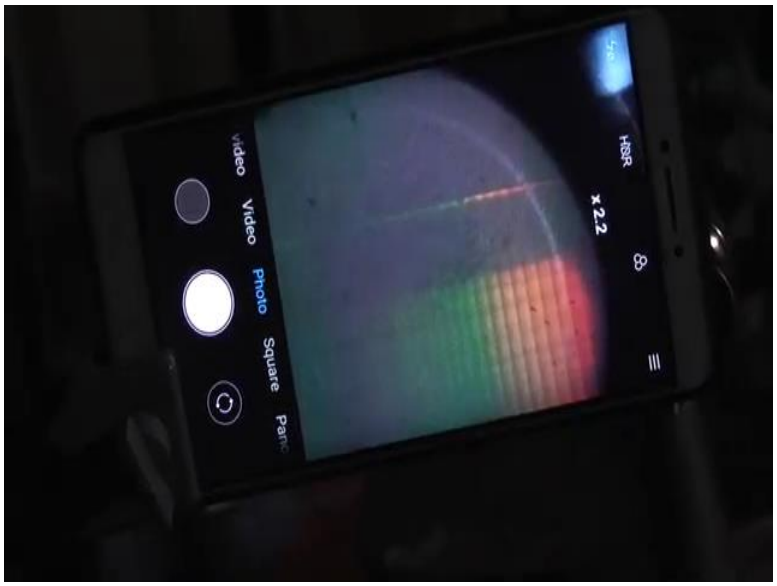

These are absorption specter now, starting from the red; starting from the red side that is the vibration that quantum number is the smallest vibration quantum number starting from the left side red side that will be the smallest vibration quantum number. we have to move cursor and set with the black take the reading take the reading from the spectrometer and then again move to the second one, third one, fourth one, fifth one ok.

That way it should you have to take the reading up to the almost whatever possible you can see, but this side gel is become very feint difficult to take. Take stick reading and then from extrapolation you will get the intersection of the; intersection of the x-axis and y-axis and you can find out the value as I told you.

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Direct reading you have to take. direct reading. If we have to take first now it is not at direct position you have. Later on also, you can take direct position.

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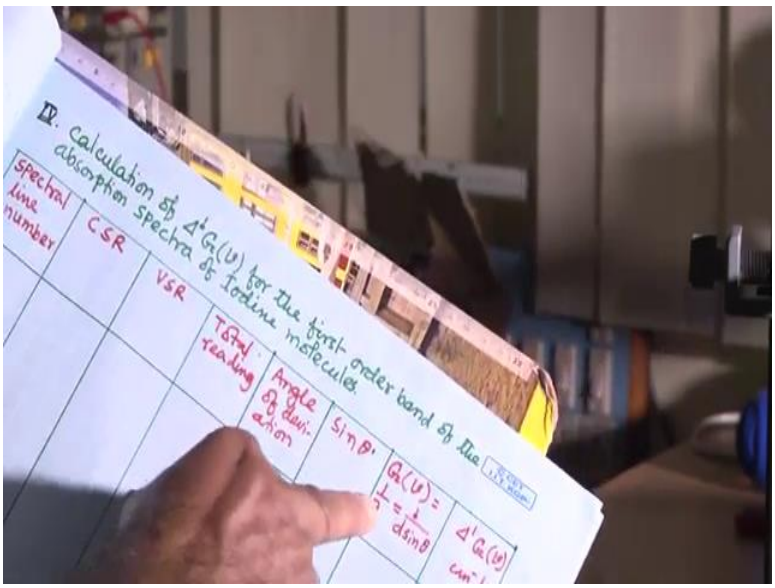

Then you take the reading for spectral line number. Starting from the red side you take say it is may not be 1, but just you try to get the extreme 1 at the red side. that will be close to the 1. you; that number can be n 0 n 0, then n 0 plus 1 and 0 plus 2, n 0 plus 3, n 0 plus 4 etcetera. The up to this you take as many as possible. you will not if in extreme side you will not get.

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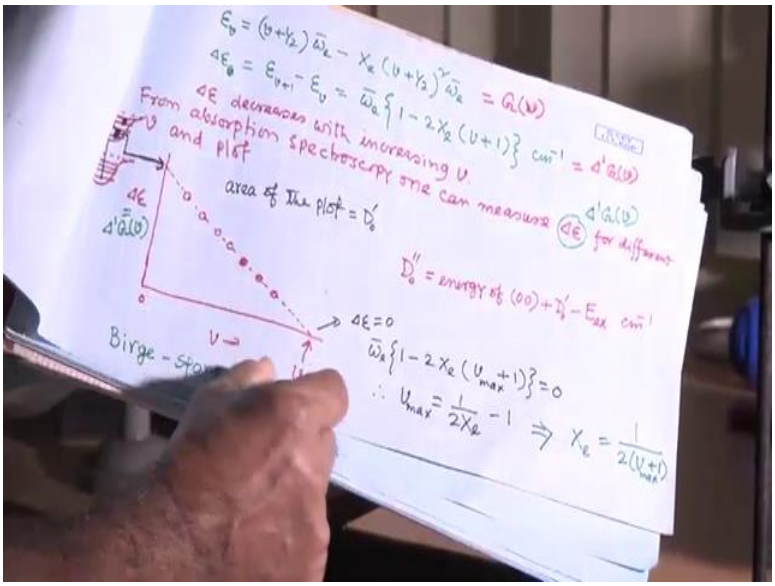

It is a difficult to get data from this side at the higher number of this vibration quantum number. Also difficult to locate the lower number of the vibration quantum number take this data. This n 0 plus 1 plus 2 plus 3 because here we are plotting here we are plotting difference it should be successive. n 0 plus 2 minus n 0 plus 1. That is it is giving 1 ok.

that way this this you should you should note down and you plot it here; note down here find out this angle theta from there you are calculating these and then taking difference del g. it is a 1 by lambda equal to one by d sin theta. sin theta from the spectrometer you are getting for setting the cursor at different lambda. here lambda is the black line which is absorbed by iodine ok.

You are doing. This is for first order, second order also you can do and this other side same very other side also you will find out. You will get 4 curve. here we have used to the grating of 600 lines per millimeter. With this one, you will get only first order, second order you will not get better one. However, if you use the grating we have another grating there 1200 per millimeter. they are you will get this higher order also.

depending on the grating element grating constant whether you will see first order, second order or even third order one can see, but that will be decided by the grating quality, grating element, grating quality also very important if grating quality is not good. there will be lot of absorption and you here you will not see the see the that spectrum absorption spectra clearly.

Good quality grating is also necessary. as already I have described how to plot the graph and find out the.

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Constant around it is a dissociation constant energy. That is what one has to do I think I just I will remove this camera I will remove this camera and through this I will see.

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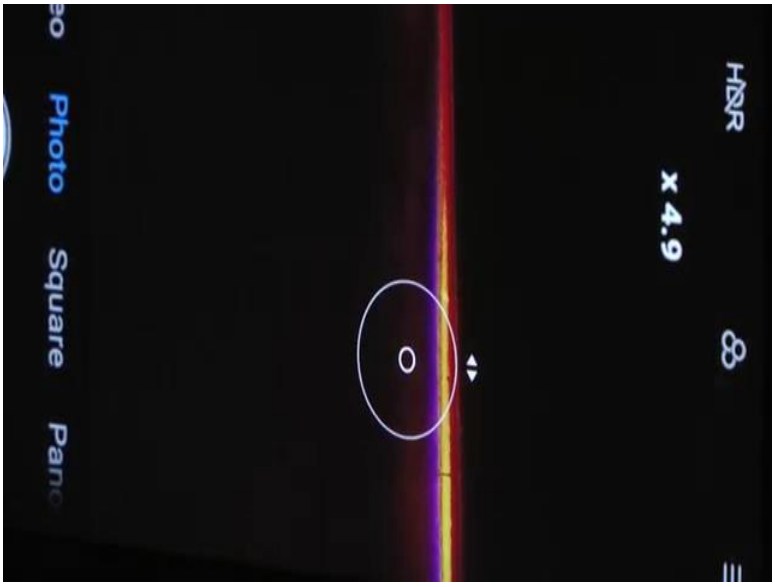

Yes, this the direct position. Yes, this is the direct line you know this reading you have to take from spectrometer. if I go to the other side if I go to the other side I should get.

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I should get the spectral line of first orders in the other side as I told you that you will get in both sides this absorption spectra let me check it whether I am able to show you yes I am able to show you this is see beam side. it is clearly you are seeing these are absorption; these are absorption. Yes, I am grating red side you see in red side this.

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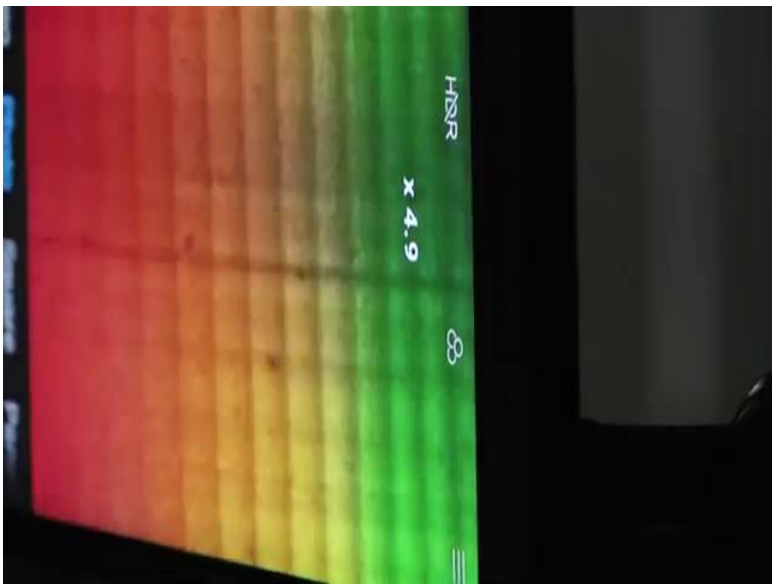

Separation more this separation are more ok.

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Spectral line separation are more though. Then you are not able to see. I think starting from here you can take reading you know. One should adjust this; now if I heat it if I heat it you may get more prominent. sometimes we have to heat it because then you will get more molecules in gaseous form.

Yeah I think. At least I could show you very nice molecular spectra molecular spectra. once more I will just take out I will just take out, now it just white light it just white light I have taken out the iodine.

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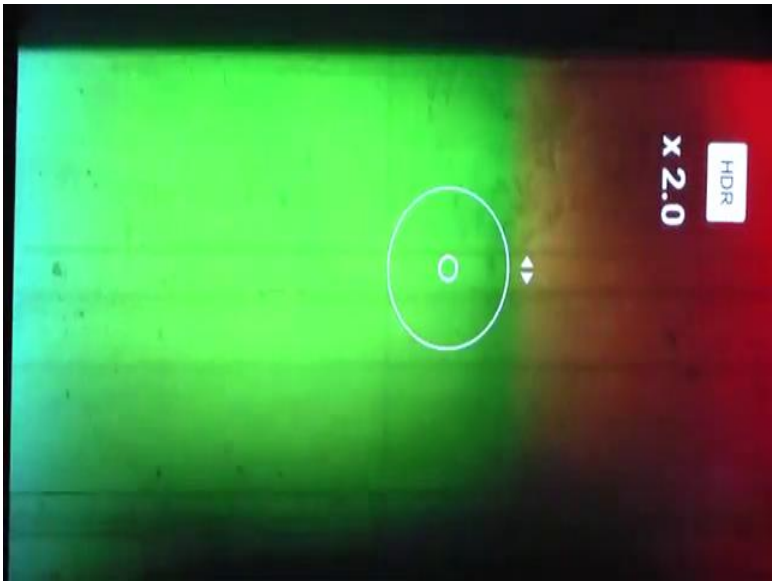

This is green side, green I think this is the continuous there is no black line now, but one has to slightly adjust properly. I think this experiment is similar to the experiment is similar to the atomic spectra. Same spectrometer we are using only additionally what we have done here one this in a tube that is the iodine. Iodine we are heating and then it is in gaseous form.

This is the light source and this is the collimator sleet. in between we have option to put; we have option to put here the these iodine ok.

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Light will pass through this iodine. then it if some lights will be absorbed. That absorption we are seeing as the black line and now we have to measure the wavelength of these black lines counting from towards from red to towards the green side because green sides. This higher quantum; higher vibrational quantum number ok.

Or other side other way alone can do it starting from continuous and then going other side that alone can do and accordingly you have to calculate del g as a function of v and then the difference of that del g you have to plot as a function of v and you can from that graph you can get everything; that disassociation energy then the fundamental frequency then the anharmonicity constant ok.

It is not very the experimental setup is not new at all to you because many times spectrometer you have you have used in experimental physics on and same way one has

to use and make ready for doing the experiment may Schuster's method. And, these other labeling and just additional we are putting the iodine gas it can be other gas for what you want to study for the that is molecular spectra.

This is the very good experiment to demonstrate molecular spectra and find out different parameters important parameter for molecules. I will stop here.

Thank you for your attention.