

**Experimental Physics - II**  
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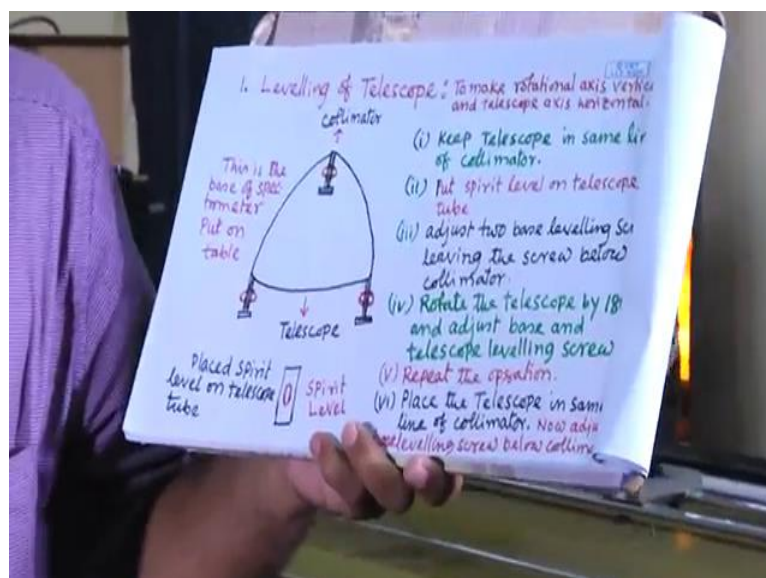
**Lecture - 22**  
**Basic discussion on spectrometer and prism (contd.)**

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before experiment we have to make sure that vertical axis of rotation and the horizontal axis of the telescope and collimator, they are perfectly positioned

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for that basically, we have to go step by step; we have to go step by step. first leveling of telescope what is the; what is the purpose? Purpose is to make rotational axis vertical and telescope axis horizontal for this for this we use the; we use the speed level; we use the speed level.

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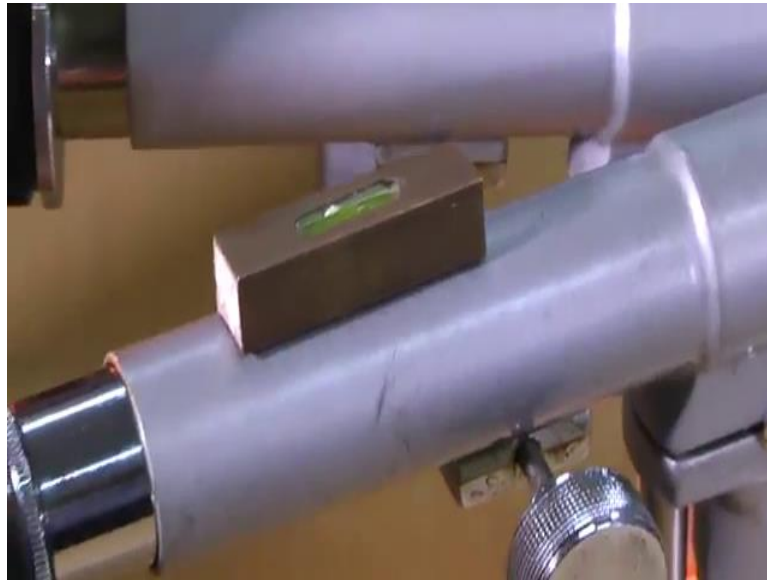
keep the speed level the along the tube of the telescope and here it is telling that adjust two base leveling screw, leveling the screw below the collimator, leaving the screw below the collimator. base level, this is the base level there are two; there are two leveling screw, base leveling screw and third one is here, below the collimator.

leaving this one, you use these two leveling screw base leveling screw to bring this one at the middle. it is already almost it is in middle; it is almost it is in middle. if it is not exactly in middle, then you should; you should; you should rotate this one in opposite direction rotate, this one in opposite direction. if I rotate this clockwise, this is the clockwise and this I should rotate anticlockwise this say you try to bring them ah, you have to check whether it is going, moving in middle or this other side. I can see it is moving in other side. I have to rotate in opposite direction, I have to rotate in opposite direction.

it is more or less it is in middle; it is in middle. this way you have to bring this here bubble at the middle. then rotate the telescope by 180 degree and adjust the base and telescope leveling screw next step is telling that you rotate the telescope at 180 degree

almost 180 degree, we cannot make it exactly 180 degree, then put again this one here. Now, to bring it at middle, so you have to adjust again these two, this adjust base and telescope leveling screw

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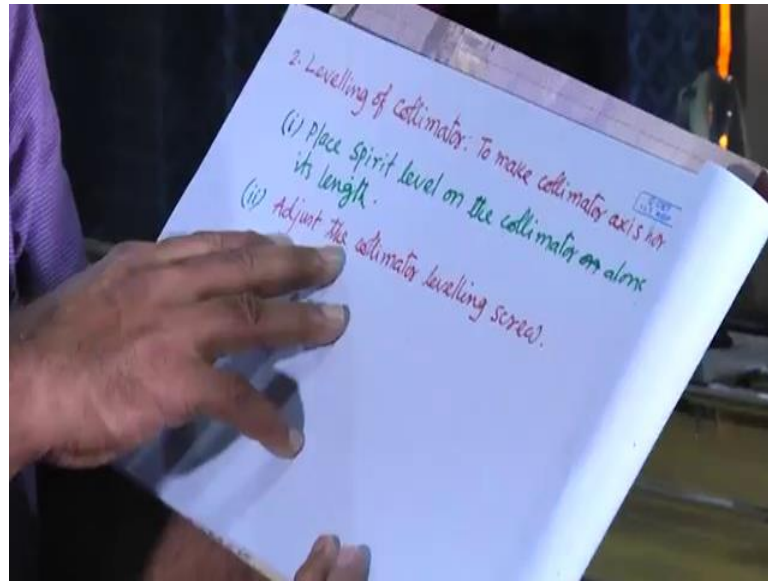


These two you can adjust as well as these two we have to adjust. it is more or less it is more or less at the middle; it is more or less at the middle I am not disturbing (Refer Time: 04:09). I think I have to bring it middle it is more or less in middle. this way you just repeat the operation again, bring back and check it whether it is in middle, if not then you can adjust these take back there, just one two three time, just you can try and keep it in middle.

now this way this your telescope, this axis is horizontal and the axis of rotation; axis of rotation of the telescope is vertical. place the telescope in same line of the collimator now, adjust the base leveling screw below the collimators if necessary, you keep in same line and then, if you see that it is not exactly in middle it need to adjust slightly.

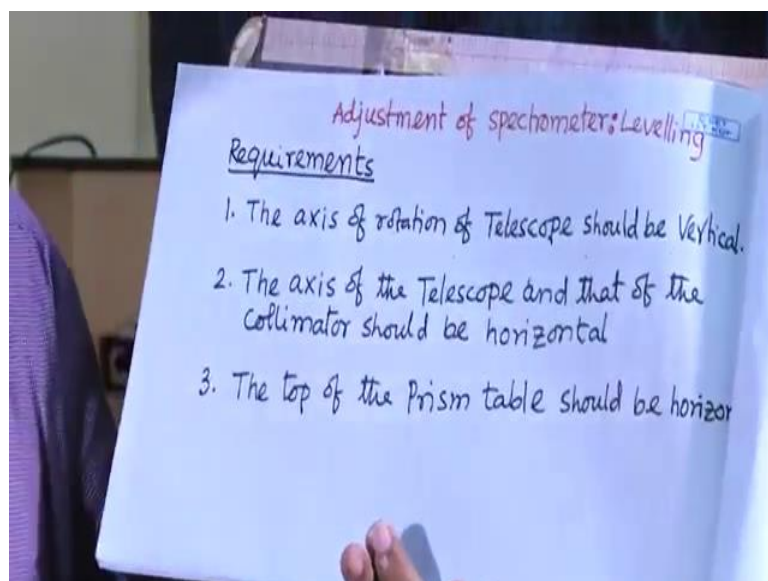
you have to use this leveling screw base leveling screw below the collimator, but here this one is fixed you cannot change. keeping it fixed so you have to adjust basically, other two screw and the telescope leveling screw. next after leveling the telescope you have to; you have to; you have to go for leveling of the collimator.

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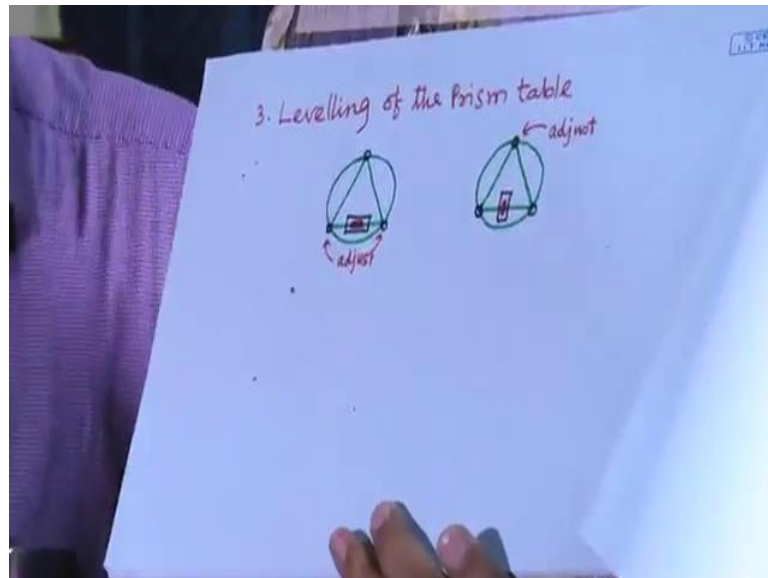
collimator to make collimator axis horizontal, place again just it is simple, place this one in middle and then just adjust the collimator leveling screw. I will not disturb this one, this base leveling screw, I will not disturb anymore this one also I will not disturb anymore its level. here you can do leveling just adjusting these two here, already it is in middle. I am not disturbing it is necessary to be this middle. use this leveling collimator leveling screw ok, bring it at middle now, your whatever requirement I told that part is done that is the leveling that part is done.

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What was the requirement? I told this requirement was the axis of rotation of telescope should be vertical axis of telescope and of that of the collimator should be horizontal. Now, next that part is done. Now, top of the prism table should be horizontal Next part is leveling of the prism table, leveling of the prism table.

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here I will not disturb any other leveling screw only, these three are left, these prism table these three are left. here one prism table so this leveling screws three screws, they are connected. keep the leveling spirit level. parallel to the one connecting line of the; one connecting line of the leveling screw this way you place. Now, you adjust these two bring it in middle. it is in on middle.

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again, this also I have to rotate it opposite direction; I have to rotate in opposite direction. other way I have to rotate, opposite direction, I am rotating in opposite direction. Yes, it is in middle. Now, it is in middle.

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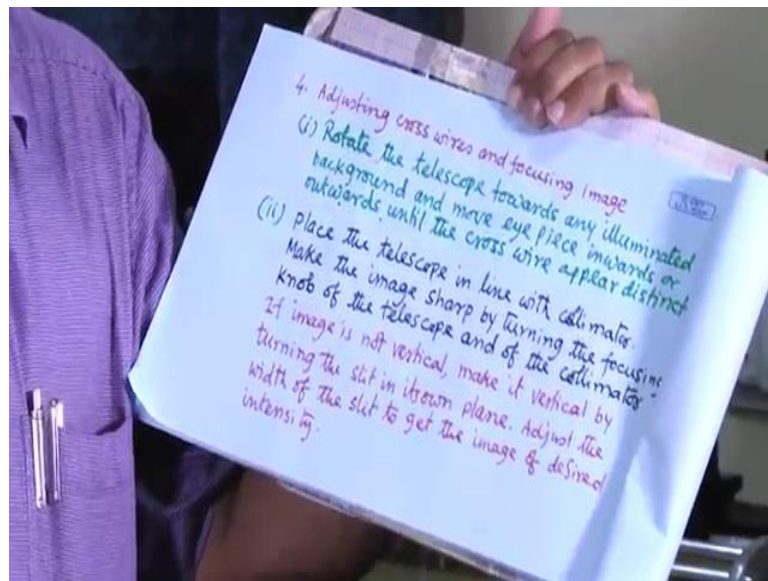


then we have to put this one we have to put this one in the same line in vertical vertically, same line will put vertically and then we will adjust this screw leveling screw to bring it at middle. let other way, I have to rotate to bring it in middle, to bring it in

middle. repeat the process once more you see this, once more you see yes, this is almost in middle and this way you see it is almost in middle.

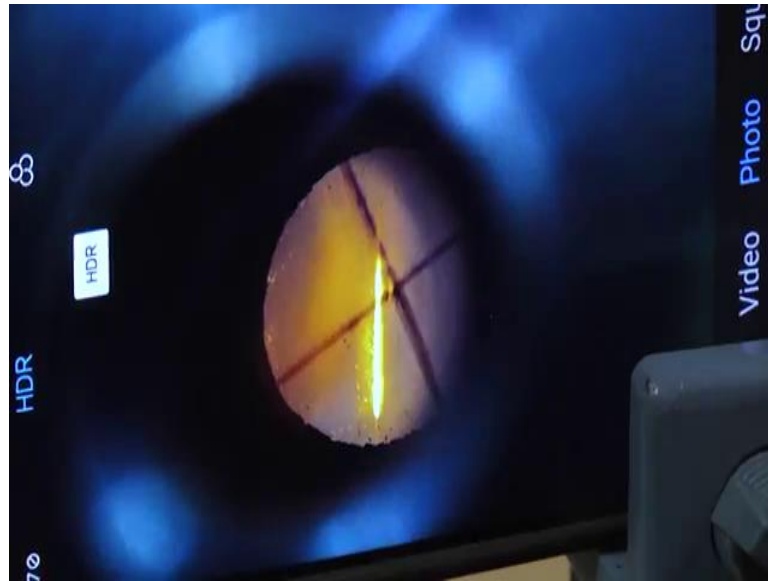
this way you have to repeat the operation and bring this then this table is perfectly horizontal. I have not disturb any others, leveling screw only for prism I have used this three. now, prism table are is horizontal fine. this way this call basically, mechanical leveling after this mechanical leveling what are the next step? You will go for the next step; next step is adjusting cross wire and focusing image

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already I have showed you this rotate the telescope towards any illuminated background and move eye piece towards inwards or outwards until the cross wire appear distinct. that part already I have done ok, I have showed you. Next, place the telescope in line with the collimator line with the collimators. Make the image sharp by turning the focusing knob of the telescope and of the collimator place the telescope in line with the collimator make the image sharp by turning the. you have to see this image you have to see the image and it is telling that make it sharp using these two, I have make it sharp.

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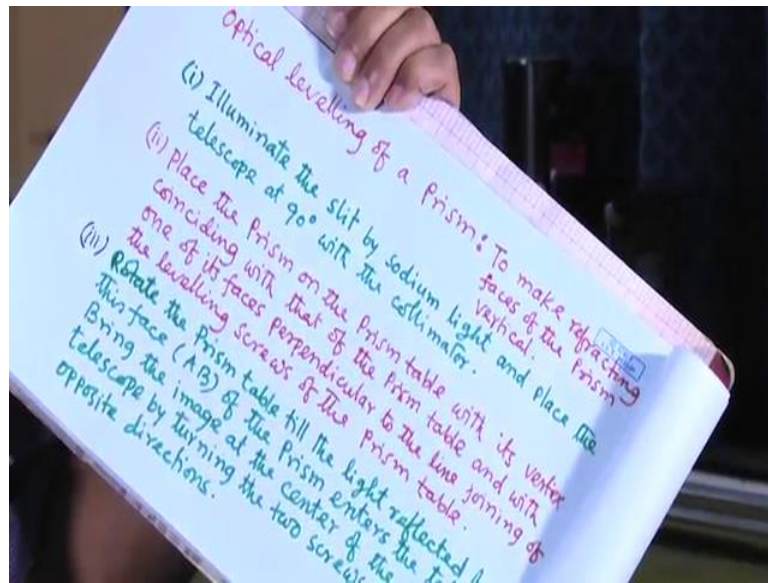
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you can see the image of the slit; this is the image of the slit for our source. you can see the cross wire and this image. adjusting the just focusing knob of the telescope and the collimator, you can get the sharp image, but here this is the approximately we have done this is approximately, we have done, just to see the image basically, but we have to for getting the parallel rays there is a method. that method we have to apply so that, I will apply later on.

this way we adjust the cross wire and focus the image as I showed you if image is not vertical, then you have to; you have to turn the slit and make it vertical there is a scope of turning the slit in its own plane. you can make it vertical, cross wire slit have put here in cross position so you can put also in plus position just rotating the cross wire there is a scope.

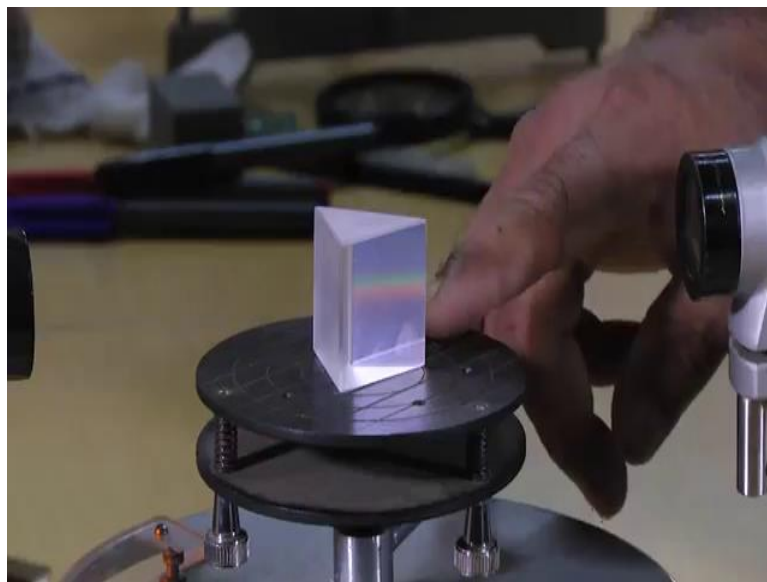


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now, next we have to go for optical leveling, optical leveling of the prism. things are already leveled, but why we need the optical leveling. Now, question is to make refracting faces of the prism vertical.

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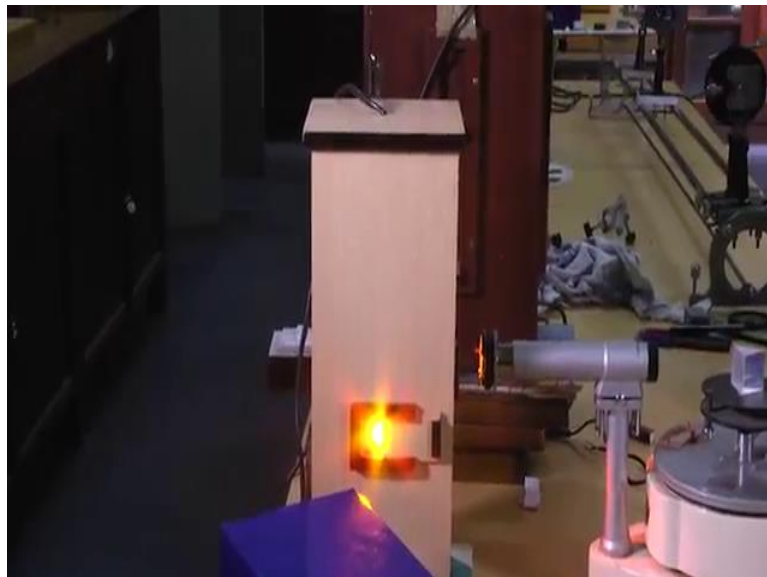


Now, this is the prism ok, if this prism, this surface is perfectly, smooth and horizontal so then I do not need to do the optical leveling or when we will use the grating so grating surface getting this base may not be perfectly horizontal. if it is not perfectly horizontal so; that means, there will be some till tilting. that part, so to make it; to make it; to make

it this refracting surface, this refracting surface, what is a refracting surface? This is the refracting surface; this is the refracting surface. these refracting surface has to be vertical on the prism table. that is the condition you know if it is not this, base is not perfectly horizontal if any up down is there. it will, it may have some tilting; it may have some tilting.

for that what will happen this whatever image we will get. that image one side it will it may go down and other side it may go up. that is why we have to do this optical leveling. that image in all side we get on the same in the middle of the view. it is telling that we illuminate the light, sodium light, sodium source you use.

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already we have sodium source Place the telescope at 90 degree with respect to the collimator. place the 90 approximately, if I place at 90 degree with the collimator with the collimator. Place the prism on the table; place the prism on the table with it is vertex coinciding with that of the top table and with one of its faces perpendicular to the line joining of the leveling screw of the prism table. what would be telling? in prism let me tell you what there is you see in this prism it is the triangular prism.

it has two triangular face this is one triangular face, and this is another triangular face and the other three faces are rectangular. here these two triangular face and that other one rectangular face, they are opaque, they are not transparent; they are not transparent. out of three rectangular faces, one is opaque nontransparent and other two rectangular are

transparent. these two we are we tell the refracting surface refracting surface. now here this base of this prism is basically, this one nonreflecting refracting surface this opaque surface, this one is the base.

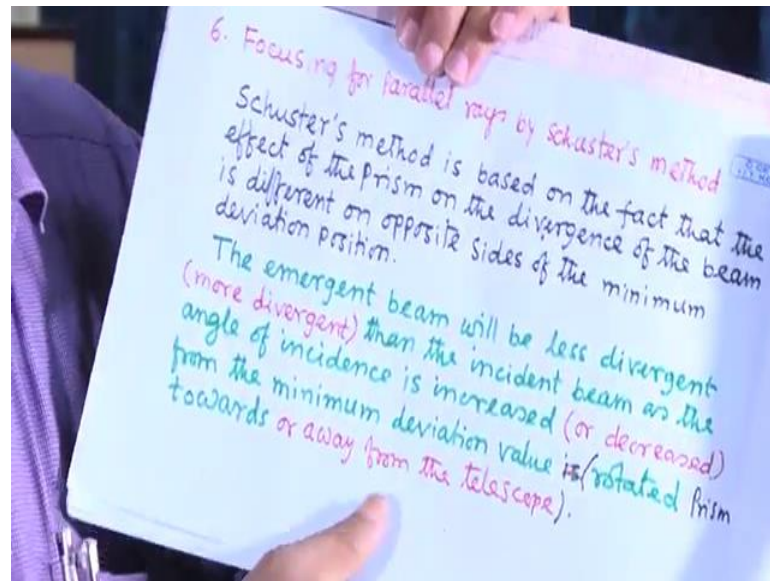
these two are transparent and these we tell apex or these we take as a prism angle, apex angle, prism angle. it is telling that place the prism on table with its vertex, with its vertex means this with that of the prism table, with the vertex that of the prism table. means these vertex will make it at the center, these vertex at the center of this prism center of the prism table and with one of it is faces; one of it is faces, these two faces two faces, refracting faces perpendicular to the line joining of the leveling screw of the prism table and then you skip at 90 degree. See the image; see the image, I can see the image and it is, I can see the image.

if image is not in middle. these two screw whatever, these two screw you have to rotate in opposite direction. it is more or less it is level I am not rotating. in opposite direction you have to rotate and bring this image at the middle of the field ok, then you take the reflection from the other surface reflection from the other surface. this surface and see it see it, I can see it; I can see it.

now, this one the third screw, you have to rotate to bring it in middle if it is not in middle it is more or less in middle I do not want to. slightly I can take down slightly, I can a takedown this is the optical leveling. I am getting the view for both from both surface refracting surface, I am getting the slit image at the middle. I am not showing that one in the camera. next, so these spectrometer is now, completely leveled ok, it is ready for the experiment.

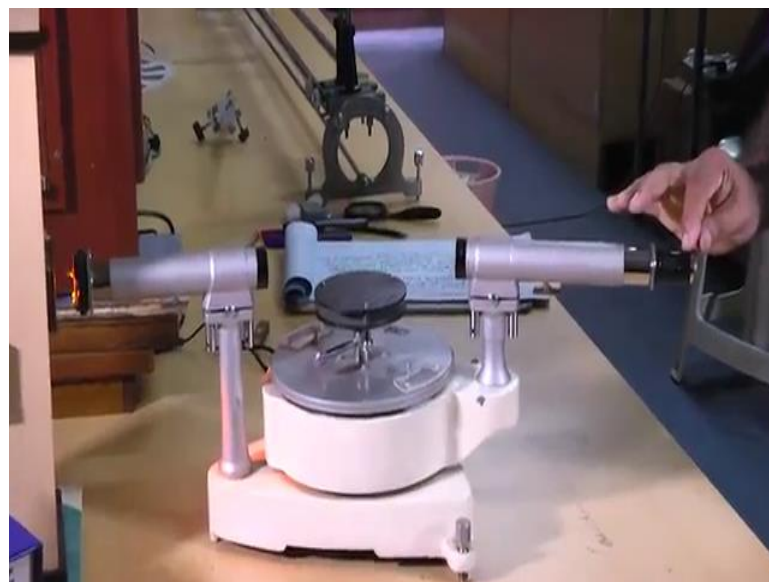
Now, for the experiment this so this for optical leveling, so this you can repeat for the both surfaces as I mentioned. Now, for experiment as I told that you have to; you have to go for some method for getting the parallel rays; for getting the parallel rays. that basically, for getting to focus or focusing for parallel rays there is a method is called Schuster's method, focusing for parallel rays by Schuster's method.

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this is one method; I think I will describe this method yes. Before that let me tell another simple method to make to get the focusing for the parallel rays.

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this simple method what is that let me take it out. first what we have to do for parallel rays. here eye piece is set at the distance from the cross wire in such a way that cross wire is focused; that means, cross wire is at the focal point of the eye piece.

Now, now this cross wire, I have to put exactly at the focal point of this telescope lens for that there is a Schuster's method. here another simple method I will describe that is;

if you what I need, I need parallel rays are falling on the telescope and that parallel rays will be converged on the focal plane and there would be formation of image and that image of what, the from where that light is coming and then there at the focal point, where image is formed. I have to put that cross wire.

now you know from distant object ok, from distance source, from long distance if light comes. we take that light is coming to us as a parallel rays. here if I take a distance object say, in this lab, if I take this the distance lab that is the almirah if I focus at this almirah, this long distance there I can see the almirah; I can see the almirah ok, it is a almost focused; almost focused.

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I will focused. from almirah it is long distance here this whatever light entering into this lens, entering into this lens that is the, then we tell that is the parallel rays. this parallel rays are coming and then image will format the focal point, I have to put the cross wire at the focal point so that is why I have to make that image sharp; I can make the image sharp. Yes, there is a of there yes, I have make the of sharp; that means, my cross wire at the focal; at the focal plane of the telescope lens

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that way distance object if we focused, then and we can see the sharp image of this distant object; that means, the cross wire is at the focal plane of the telescope lens that is the that the purpose for this setting of this telescope for parallel rays. in this case, we assume that from the distance object the rays are coming here, when it is reaching to the telescope their rays are parallel. Now, but this we are not going to then we will not disturb. let me just check once more it is the whether I need slightly any, because that was in different eye. in my eye I have to check sharp image, I can see.

now, we will not disturb this knob, because this is set; this is set for this focusing knob, we have set the cross wire at the focal plane of this lens ok, in this way Now, this parallel light is not coming from the source we have to make so here, we have to; we have to see this now, direct light we have to see this direct light and since it is not this source is not at infinity, but not at very distant place.

this knob we have to adjust to keep the source at the focal point of this lens, then whatever light will come that will be parallel. then we will see the very sharp image.

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this image is almost sharp, because already earlier we adjust it. now, you have to adjust this one to make the image of the slit is very sharp, to make the image of the slit very sharp. Yes, it is sharp, it is sharp, and I will reduce slightly, make it slightly thinner I have made it, I am not showing you, but so to make the sharp image as I have seen at infinity that distance one.

to get this type of sharp image, I have to adjust the collimator focusing knob so; that means, the light is coming from the collimator so that is parallel rays. this way we this way we have to make the parallel rays coming from the collimator and here this parallel rays, entering into this telescope lens and they are meeting at the focal point of this one and there we have put the cross wire.

there is the focusing for parallel rays by a method, this is the simplest method, another method is there that is called Schuster's method, I think I may discuss this one. one has to go step by step. let me stop here now, actually this setup is ready for the experiment different kind of experiment one can do using the prism so that one by one, I will discuss in coming classes. in next class basically, I would like to show you the Schuster's method is very famous method to make the parallel rays. step by step, we have to follow that method. in next class I will discuss that is method.

Thank you.