TRANSMITTED OR REFLECTED: OBLIQUE EPI-ILLUMINATION

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INTRODUCTION:

Last December 2016 an article of mine was accepted in *Micscape* about the use of the microscope lamp, (that is intended for transmitted observations), when combined with a camera with the properties of allowing the passage of Near Infrared Light (NIR).

At the time I stated that: **“One advantage that I got with this approach is that it is possible to see under the lenses, thick objects such as needles, coins, staples, etc that in brightfield would be difficult if not impossible to see.”**

Which I attributed to the fact that the NIR camera detected the Near Infrared Radiation around the objectives because of the tungsten lamp of my microscope and that partially was true,

Nevertheless, in further applications of the lamp I also noticed that it was possible to see the surface of a coin which is a thick object with the transmitted lamp turned ON.

The question that arises is - What? A transmitted lamp for thick objects? If we have always been told that observing thick objects is only with epi-illumination systems.

The answer is YES, a transmitted lamp for thick, very thick objects, such as a coin. See below.

DEVELOPMENT:

How can we achieve that a transmitted lamp can be used for reflected observations? Is it a joke?

No, it is not a joke and it can be achieved in a very easy form:

The first step is to turn on the lamp.

The second step is to remove the condenser, which will allow light to pass by the side of the object and some to reflect back from the surface of objectives that in the case of mine are chrome, creating an environment of light around them like this:

If the objectives have a black finish, it will be enough to cover them with for example aluminum foil to produce the reflected light.

The third step is to place a thick object on the stage, let me say that the wider the object the illumination will be a little less.

I should also make clear that although it is possible to see through the eyepieces and get beautiful results, this experiment works better with the help of a camera.

In my case I used two, a special microscope camera and a camcorder, the benefit of using a camera is that the sensors sometimes have a very good response even to a little light, so it is possible see the surface of the thick object clearer than just through the eyepieces.

In the title of this article, I mention that it is oblique epi-illumination and the question could be how I know that.

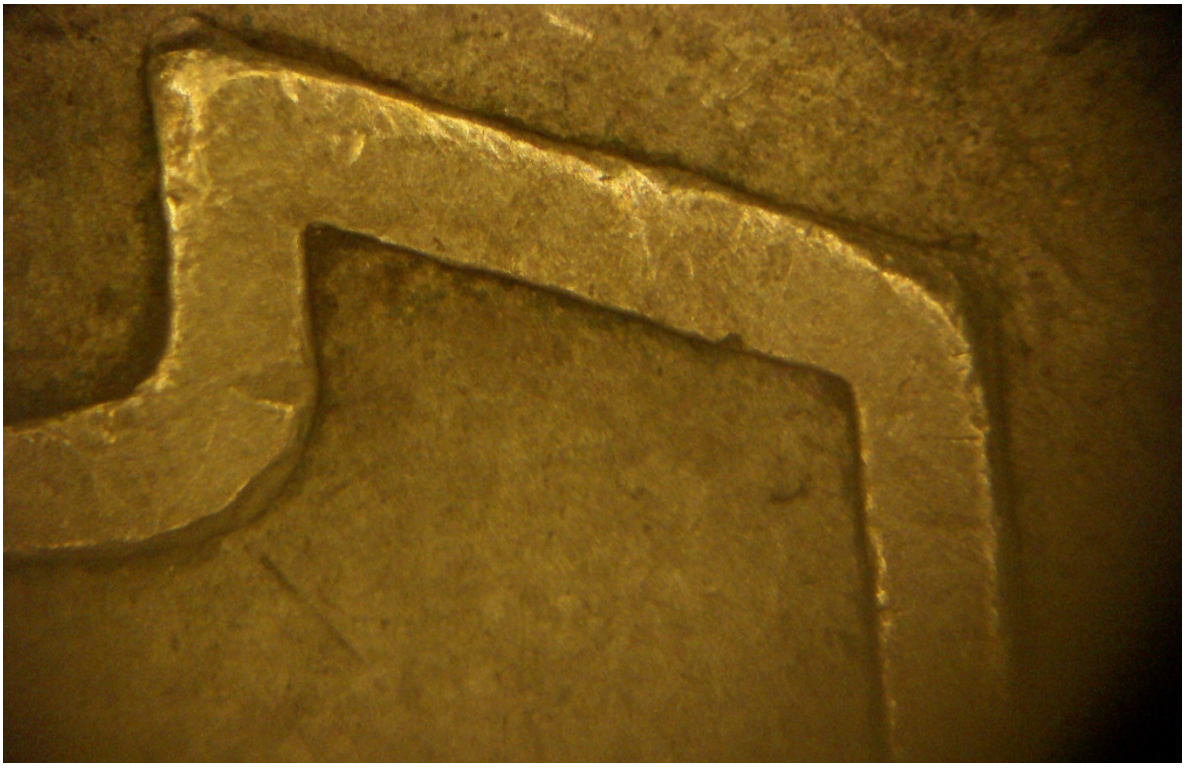
Very easy, just because I have never directed against the object any beam of light, it becomes illuminated by the light that passes by the side of it. Light reflected by the chrome objectives as I mentioned above creates an environment of light, but never from a direct incident beam.

RESULTS:

With the camcorder:

The year of coining of a Mexican one-peso coin with a camcorder 4x.

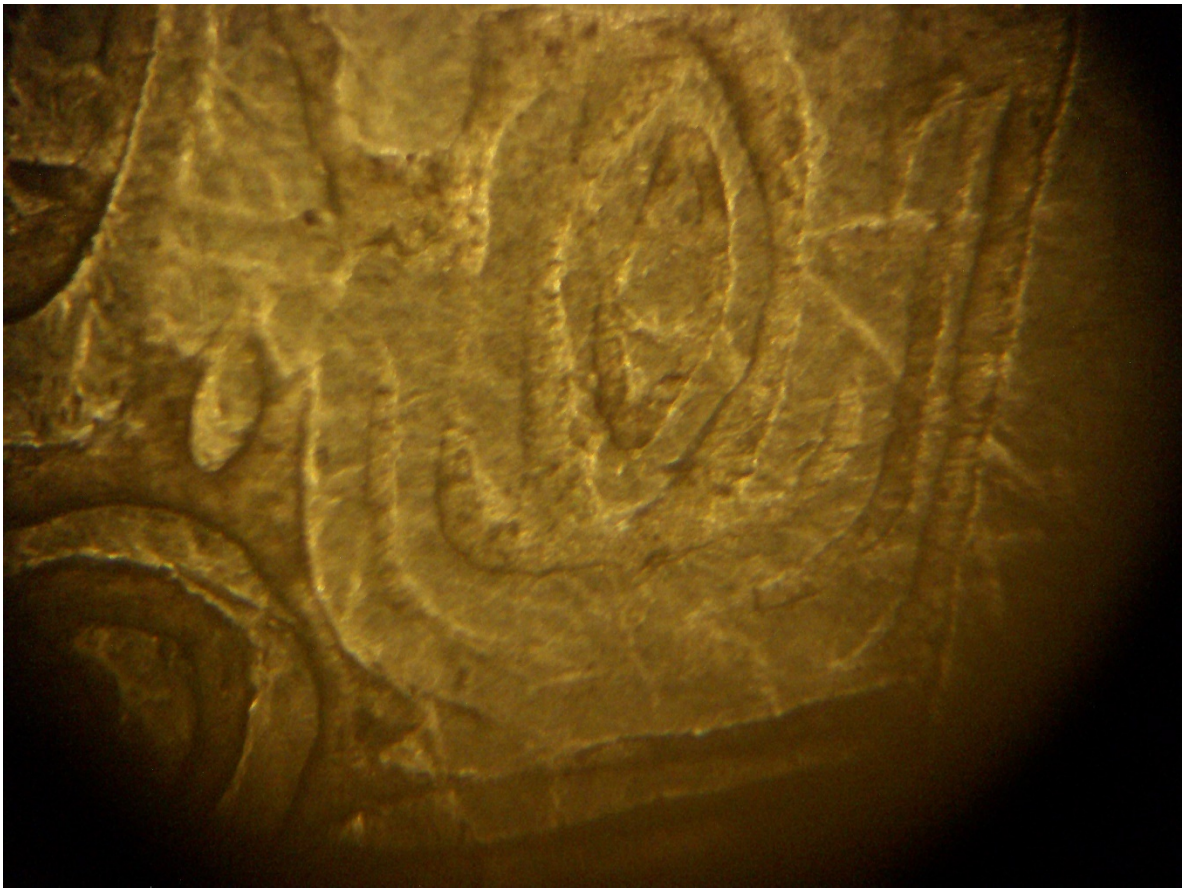
The coin is 2 cm in diameter.



Part of the symbol of the same Mexican one peso coin 4x

This coin is 2 cm in diameter.

Part of a Mexican 10 peso coin 4x, this coin is 2.5 cm in diameter; it is the largest coin in circulation in Mexico.



Part of the center of a Mexican 10 peso coin 4x, this coin is 2.5 cm in diameter; it is the largest coin circulating in Mexico.

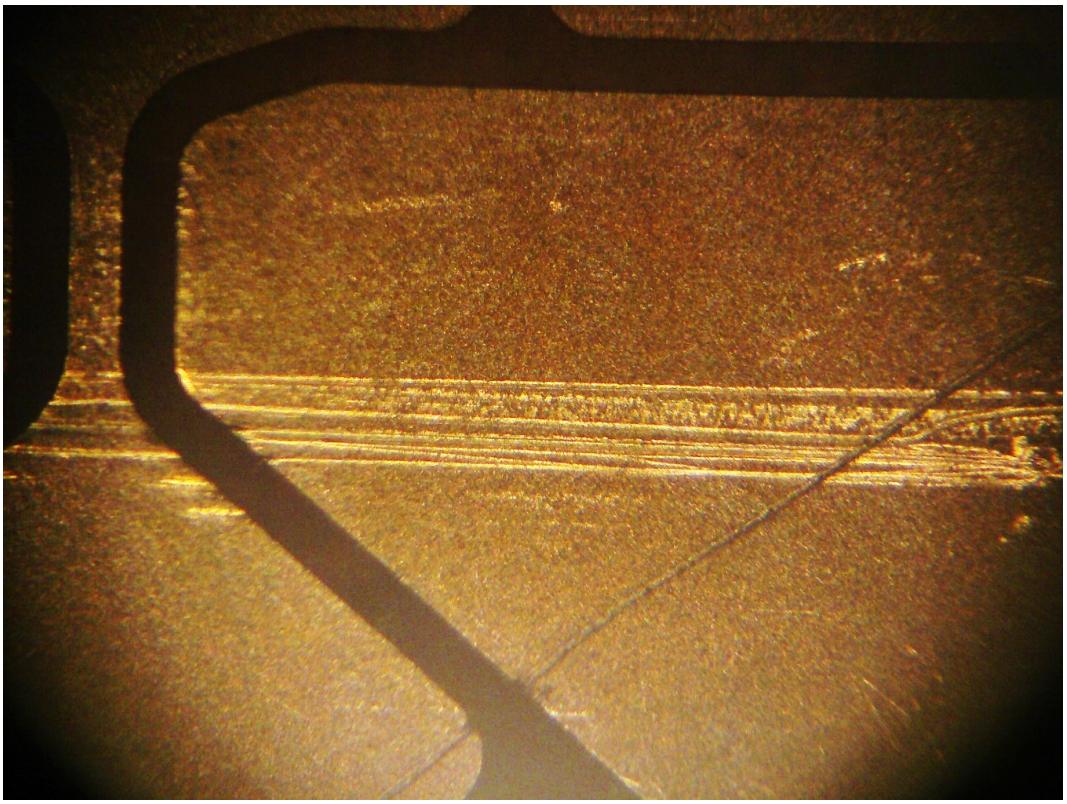
Part of the center of a button battery 4x, it is 1 cm in diameter.

With the special microscope camera:

Though, I have to make clear that with a camera such as this it is a little more difficult; because as it is seen it is possible to see more of the periphery of the object. When wider than 1 centimeter an object needs to be divided in order to see them; probably because the sensor of this camera is less sensitive than the previous one.

Part of a button battery 4x it is 1 cm in diameter.

Part of the year of coining at the periphery of the Mexican 10 peso coin 4x.



The surface of a SIM card 4x.

CONCLUSION:

What is the advantage of this?

It is a great advantage because:

First, it is possible to use the own illumination system that comes with the microscope and no modification is required.

Second, because any time there may be the possibility of exploring thick objects it is possible to expand the range of observations.

Third because with this kind of experiments it is learnt that nothing should be taken for granted because that stops great experiences such as this.

What would pass if we never dared to question the thought that a transmitted illumination lamp beneath the stage could produce epi-illumination observations?

This way it is possible to convert a “simple” compound microscope with just a simple transmitted lamp into an oblique epi-illumination microscope.

It is amazing isn’t it?

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(Above in anti-spam format. Copy string to email software, remove spaces and manually insert the capitalised

characters.)

Editor's note: From his own studies, Alejandro has explored the benefit of using the objective itself to reflect transmitted light onto the subject. Readers familiar with 19th century microscopy practices will appreciate that this could be regarded as a simpler form of the Lieberkühn mirror. A shaped mirrored collar of the correct focal length was attached to each objective to reflect transmitted light back onto the specimen sitting on a patch stop to block direct transmitted light.

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