

# Images painted by the Sun

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## 1. The meaning of the Sun

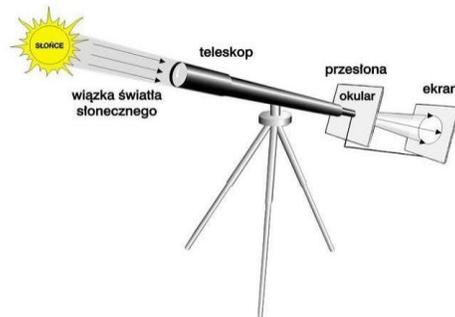
Sun is one of the main sources of the energy on the Earth. It is a central part of the Planetary System and also the brightest object in the sky. Sunlight provides the total amount of energy necessary to course the phenomenon of weather in the Earth's atmosphere. Visible radiation, commonly known as light, takes a fundamental part in the process of photosynthesis, human and animal sight and has influence on various circural phenomenon in the world of plants and animals. Humans can preceive the visible radiation, as the light and the infrared light fell as warmth. The angle of incidence of sunlight on the Earth's surface determines the existence of the Earth climate zones and the change of seasons. So the total solar radiation reaching the Earth's surface is composed of direct and scattered radiation. The sun's rays passing through the atmosphere are dispersed, encountering dust particles, gases and water. The shorter the light wave, the stronger is the scattering. The Sun provides such energy resource the Earth surface, but only 43% of it is absorbed and the rest is reflected from the surface, or even earlier from particles in the air. The Earth splits this energy between land, water and living organisms (plants) . Oceans absorb 95% of solar radiation and convert it to warmth, which allows aquatic organisms survive. Water under the influence of the heat (solar radiation) begins to evaporate, forming clouds, which later turn into the rain in the lowlands and highlands , and in the mountains turn into snowflakes or hail and fall back to earth, where they form mountain streams, which flows into rivers and they into seas and seas into oceans. The sun is also a source of food for the inhabitants of our planet. Green plants have chlorophyll, that allows them to produce starch, sugar and cellulose, which they need to live. These products, produced in this so-called photosynthetic reaction. They are formed from water and carbon dioxide contained in the air, thanks to the solar energy.

## 2. Sun observation methods

Solar observations are inter alia: observations of the photosphere (eg. spots), daily and annual motion of the Sun, and eclipses . There are two safe ways of the Sun observation : The projection method (indirect) and the direct method by use of a special solar filter.

At the physics club we had the opportunity to carry out observations of the Sun directly, and by using the method of projection. We carried out the direct observation by using several optical tools. The first and the simplest were glasses, which we have made by ourselves . For this purpose we have adapted glasses for viewing geometric solids in three dimensions. We have cut out colored foils from them and paste the filter from the ND 5.0 foil. We were also observing our sun by using welding lenses number 14. These are safe methods of observation, but the image of the solar halo is unfortunately small.

Much more satisfaction gives observation by using binoculars, of course through the sunscreen and the telescope with the UV filter. We made the Filter of the Baader Planetarium ND 5.0 foil, framing it myself.



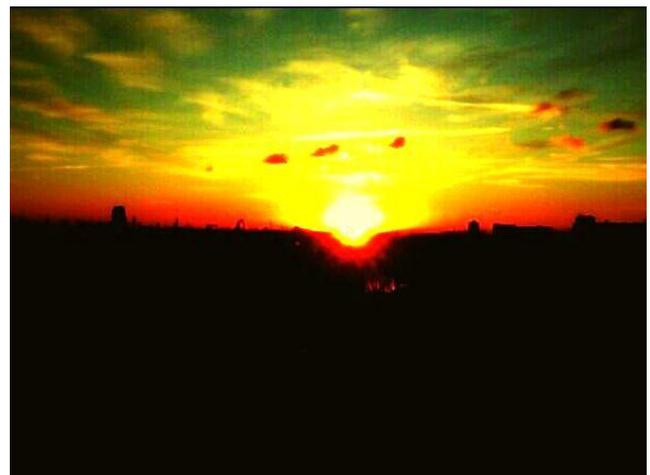
Pic. 1. The schema of the projection method.

### 3. The evening sky

The sun's rays passing through the atmosphere are also dispersed. Rays with the shortest wavelengths are the most dispersed- violet and blue. This makes rays in these colors come to us from different parts of the sky and we say that it is blue.

If the path of rays in the atmosphere is long, then in the stream reaching the surface of the Earth are more long waves - red and yellow. That is why during sunrise and sunset we see sun as red. The reason is that the rays have longer way to go in the atmosphere.

These are another images painted by the sun. Beautiful yellows and deep reds. It always please the eye.



Pic. 1. and 2. Celina Ciecierska, 11th February 2016  
Vlaardingen in the Netherlands.

## 4. The roots of the photography - camera obscura

### a. Camera Obscura in the room

Coming back to the roots of the photography we encounter a camera obscura. This is a dark chamber into which light enters through a tiny hole. On the wall at the opposite of the hole appears inverted image of the object located in front of the chamber. The technique protects the sight, in the past it was used to observe solar eclipses and painters helped themselves, to make the faithful reproduce of reality. But theoretical outline will not make that we will understand how it works. It is worth to make it by yourself - find yourself inside of it.

A tape, a thick cardboard or a dark foil, even a bristol would be useful. Choose a window oriented in such way, that the sun is getting inside for a long time. In the middle of the window, stick the cardboard with a small hole, then cover the remaining parts of the window and cut off the other light sources. On the wall opposite to the window should an image should appear. If it did not appear, or you were not satisfied with the sharpness, gradually expand the hole until you get the desired effect.

When we were performing the camera in Celina's room, we have noticed that it is worthwhile to standardize the wall, on which the picture should appear, especially if someone has colourful wallpaper, or if there were a lot of items on it.



Pic. 3. The landscape outside Celina's window and the prepared window.

On the opposite wall we have obtained the real image, inverted, reduced of the landscape behind the window, but unfortunately, despite several attempts, we could not catch it in the picture. The most visible was the highest building that we see above.

### b. How to make the Camera Obscura

There is also another way to make the obscura. Get ready to use: cardboard box, a piece of aluminum, tracing paper, needle, tape, scissors and an additional piece of cardboard.

Start with covering the cardboard, so that the light can not get inside from the bottom and sides. Top of the cardboard should be left uncovered. In one of the sides, cut a small rectangle- there put the camera hole. In the opposite side cut a larger rectangle. In this rectangle put ground glass . In the piece of aluminum make a hole with the needle. Try to make it as small as possible, to get a sharp image. Stick the aluminium inside the box, so that the hole would be centered in the smaller rectangle, which had been cut previously. To a larger rectangle, from the inside, stick the tracing paper, to observe the image. Finally the last thing is to cover the top (closing). For the best results cover the box with pieces of cardboard on the side of the focusing screen.

This camera gives the best possible image on a sunny day. At the beginning it is worth to look into various places, because when the image changes, the eye can easier catch it. If the resulting image is dark, gently enlarge the hole. Additionally, you can hide yourself under a blanket, then you confine light coming into the camera. Remember, that the image is reversed.

The image features are also: gentle contrasts, no distortion (optical defect), which is a different zoom of the image, depending on its distance from the device. The technique used for artistic photography.

Ours construction looks like this:



Pic. 4. Training with the tube.

c. Eye, digital camera and Camera Obscura Comparison.

Comparing a human eye, a digital camera and the camera obscura we will notice that the camera is the simplest device. In the eye, light passes through lens which focuses it, iris regulates the amount passing through the pupil - the more extended the more reaches the lens of the eye. Digital camera, is built similarly, transmits light into the objective- lenses system and passes through an adjustable aperture, which works similarly to the pupil. The image in the eye is formed on the retina, and in the digital camera on the film or matrix. The camera obscura is a much simpler system. The lenses are not needed, only a hole- the smaller, the less light is let in. The image is formed on the wall opposite the hole. This technique is used in painting and photography till today, but it was also known in ancient times.

## 5. Solargraphy, how to make the solarography machine, and possibilities of the technique

**Solargraphy** - images painted by the sun. A box, a piece of light-sensitive paper and sun exposure. It's the same camera. It differs only in that, it contains the photo paper, which allows to capture the image, that it will create.

What is needed? Light-tight box with black interior, the already mentioned light-sensitive paper for black and white photography (It can be old - color effects will be better), needle, black insulation tape. Take a needle and make a tiny hole. Cut the paper that, so it could fit inside.

It is important not to illuminate the paper before placing it inside the box. It should take place in a darkened room or in low-light bulb conditions. Prevent a contact with the light, if not, the paper darkens. Also cut the "snapshot" from the duct tape, glue to the hole, and remove only after attaching the camera to the desired location. Fasten it in any way to firmly holding up, that it will not move on the wind. Chose such place, where the box won't get damaged. We can attach it vertically, horizontally, diagonally- each way will give a different image geometry. Unfortunately, the box can arouse the interest, which in the worst case could end up on theft, and thus we won't receive results. If it is necessary, disguise it. Put the camera high and aim the hole in such direction, so the sunlight would fell into the hole for the most time of the day.

When it is sure, that the can hung long enough, glue the snapshot on the hole and then take off the can. Pull out the paper in the dim light, to not lead to blackouts. Photos created in the box should be scanned or photographed by digital camera. After doing this, put back images into light-tight box. If you have chosen the camera, take photos. Turn from negative to positive, cut out the chosen frame, flip it horizontally (restoring the proper direction orientation). Adjust the contrast and exposure- strive to achieve a clear and saturated image. Then print the photos.

Obtained images surprise richness of colors, even though they are made on paper for black and white photos. The results are interesting, nature creates the unpredictable. We can notice buildings, grass, traces of the sun. Most often it is used to capture it's journey. The paper darkens in different colors: purple, pink, blue and brown.

Pulling out accompany a shudder and a voice in head " It succeeded?" . There is nothing to worry about, when you open the can you will see different effects. Each will be different. No matter whether the picture meets our expectations, each effect indicates that the technique solarography works.

It is a very simple and interesting method, worth a try to be convinced of this. This technique is a proof that the camera isn't the only way of taking pictures.

Most suitable season to carry out any of the described techniques is certainly the summer. We worked on it during the winter. There were a few impediments. An example would be the day on which we were making our own camera obscura. We have prepared everything early morning, but we had to wait for the moment where the sun would fell on window for several hours. However. We still think it is worth to see the effect of these simple and surprising techniques.

## 6. The results of our work – pictures and describes

The first attempts were not very successful. We carried them at the turn of November and December.



Pic. 5, 6, 7. The cans and places where they hung.

And the result:

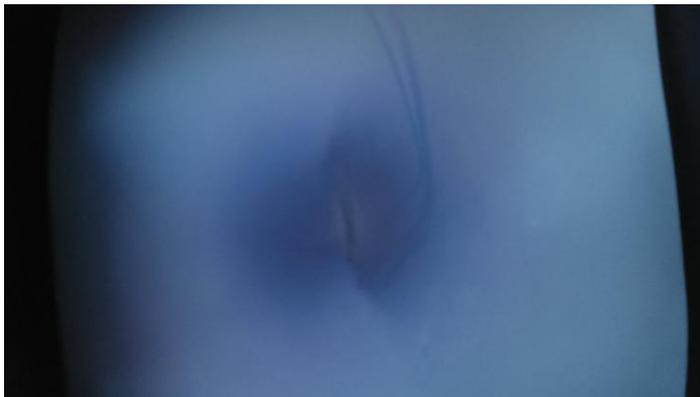


Pic. 8. The photo of paper after taking out from the can.



Pic. 9.

Pic. 9. The picture in the reversed colors in Paint program, and reversed and processed using Microsoft Office Picture Manager.



Pic. 10. The photo of paper after taking out from the can.



Pic. 11.

Pic.11. The picture in the reversed colors in Paint program, and reversed and processed using Microsoft Office Picture Manager.

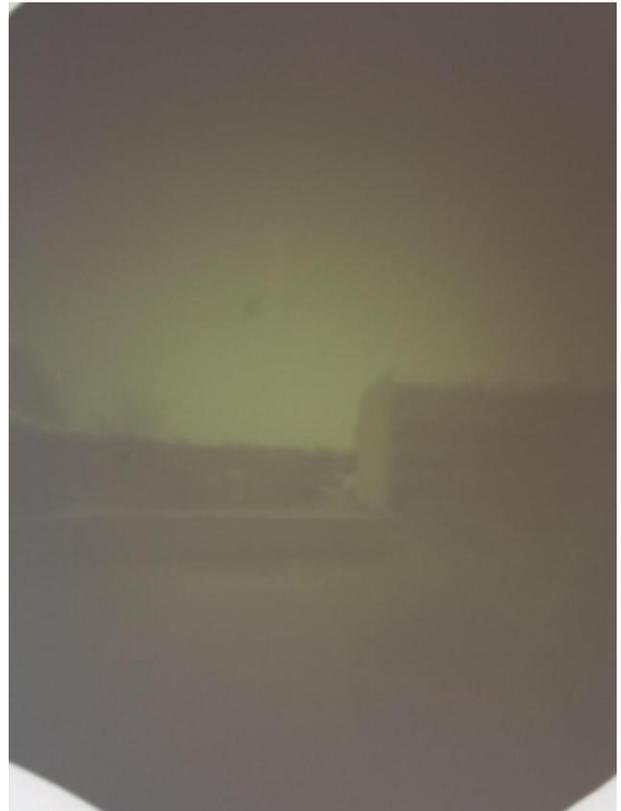
In the picture 10 are visible only very blurry outlines of the buildings, you need a big imagination to see there something specific.

Picture 12, in our opinion is also bad, but at least you can see the path of the sun during the day. We can see that the sun rises and sets in slightly different places, but the solar noon is still in the same place (direction).

Last photos look slightly better:



Pic. 12. The photo of paper after taking out from the can.

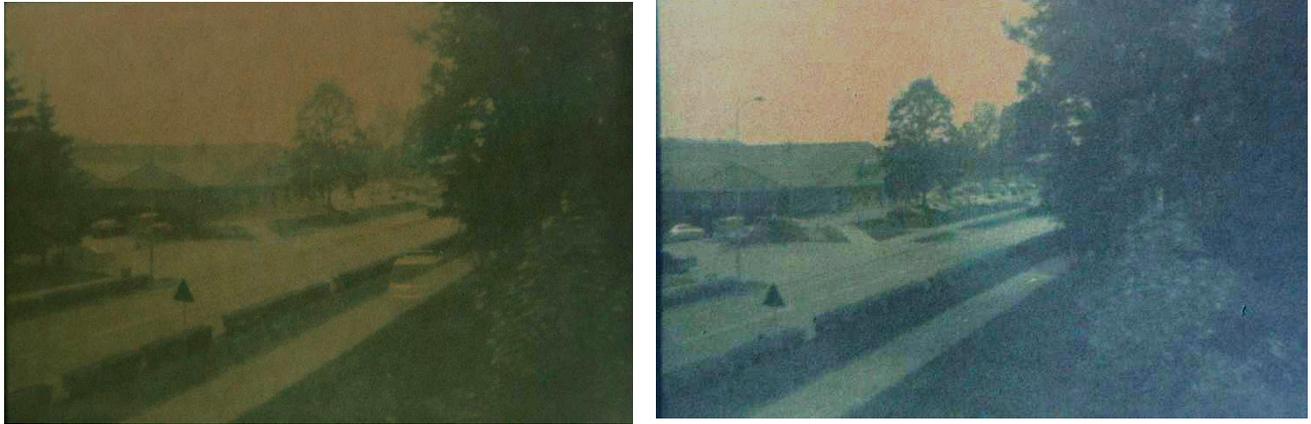


Pic.13. The picture in the reversed colors in Paint program, and reversed and processed using Microsoft Office Picture Manager.

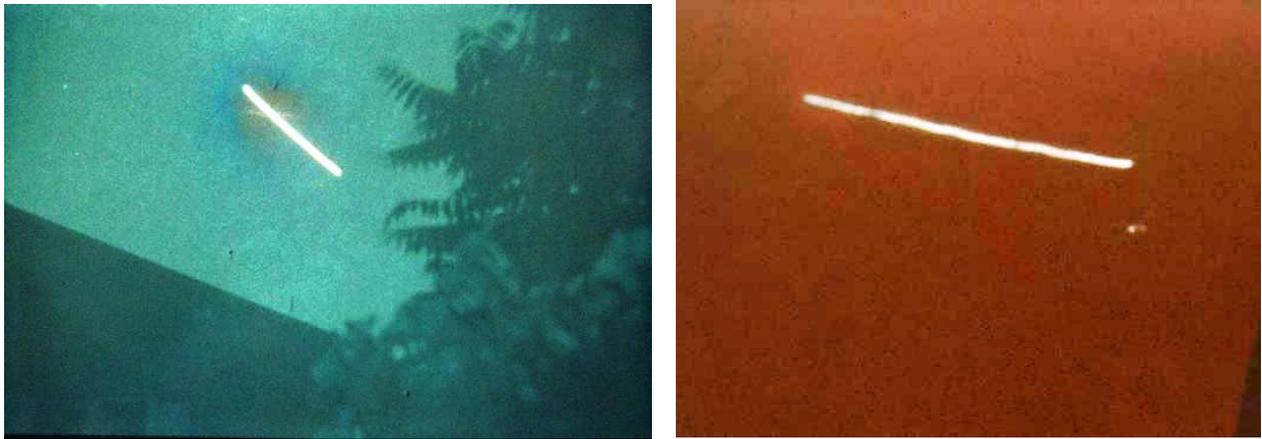
This photo paper "hung" for a relatively short time, but exposure is much better and much more details are noticeable. For us, this is just the beginning of a fascinating adventure, but the results are already promising. Now we are hanging another cans that will hang for around half a year.

## 7. Breaking news

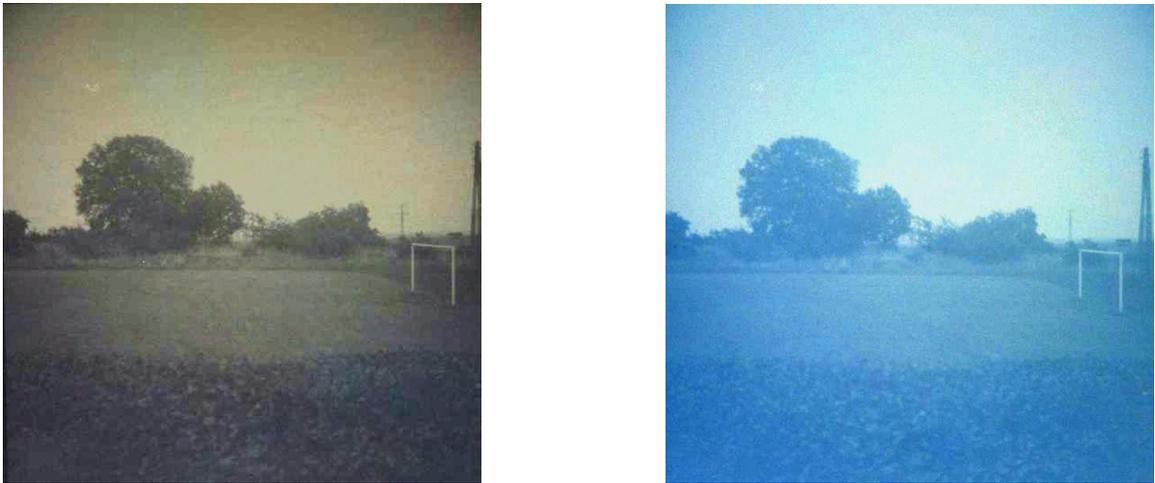
Below are some pictures taken a slightly different technique. We wondered what effect can be achieved when put the photographic paper directly in the old camera instead of film. We borrowed the camera from our friends, Smiena 8 and Polish Start. Effects exceeded our expectations.



Pic. 13. Pictures of landscape made using the Smiena 8 camera.



Pic. 14. Pictures of the Sun (dash) and Venus (point) made using the Smiena 8 camera.



Pic. 15. Pictures of landscape made using the Start camera.

As you can see solargraphy made by this method brings much better and faster results (Exposure time was about 2 hours).