

Three week exposure of the sun with a pinhole camera using Ilford Multigrade IV RC Deluxe 8x10 black and white paper

Solarography

Revealing the Latent Image

Ted Kinsman

For several years I have been interested in taking images that show the passage of the sun through the seasons. The big problem was how to capture it all in one image? I thought of pinhole photography to limit the light on the film, but I needed some sort of high neutral density filter to get normal film into the correct exposure range.

Note: I have to use some sort of film technique here due to noise limitations of digital sensors—besides who wants to tie up a digital camera for a few months for one exposure? I remembered an old article on using the latent image of paper to create an image, but it was

very slow—this was exactly what I was looking for. An Internet search revealed that there is a technique to expose paper and use the latent image, but was it real? To test out the latent image technique I cut a 4x5 inch sheet of paper and exposed it in an old Graflex camera at 4.0 for one hour on a sunny day. I then tested out my scanner to see the fastest highest resolution that the scanner could do in one pass. If the scanner has to pause, then the light from the scanner will expose the paper and creates lines in the digital images as the paper becomes exposed. This technique works, but you can only scan the image once, and you had better get the image right on the first try.

Editor's Note on the term 'Latent Image' as used in this article: Photographic paper is coated with a light-sensitive emulsion. When it is exposed, a *latent image* is formed. This image is invisible to the naked eye. When photographic paper is exposed to light for an extended period of time, you are actually able to view an image on the paper. This image that you are able to see is not a *latent image* - it is an image caused by a chemical reaction of the emulsion to light over an extended period of time. In this article, the image is referred to as a *latent image*, even though technically, it is not. If you are interested in reading more about the reaction of light sensitive emulsions, books such as *Photographic Materials and Processes 3rd Edition* (focalpress.com) or *Imaging Processes and Materials: Neblette's* (wiley.com) are excellent sources.



Examples of a few of the pinhole cameras and setups

My first thought about the process was to determine if there is a way to fix the latent image. It turns out that to fix the image the rest of the silver would have to go through the development chemistry and this was not going to work. So this is what it is, a process free of wet chemistry. My paper turns out to have a sensitivity of about ISO 8.

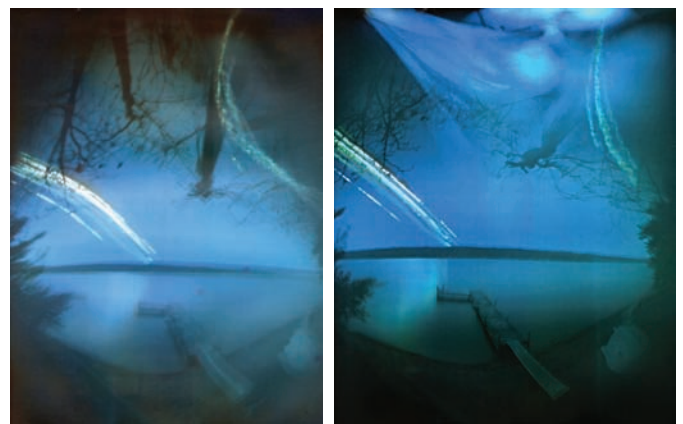
Note: There is an alternate way to record the image. The paper can be photographed under red light. Since the paper is not sensitive to red light the paper can be illuminated with a small LED, or even a safe light and photographed with a long exposure. The resulting photograph is converted to a black and white image. This image will not have the vivid colors as are captured in the scanning process.

To make the pinhole cameras I use an aluminum ice tea container and spray paint the inside black. The black insides help remove reflections on the inside of the container as the sunlight bounces around inside. I also paint the outside if I am going to hide the camera in a local park. This past summer I put four cameras in a local park, only to have two of them removed. The other two survived, but had other problems.

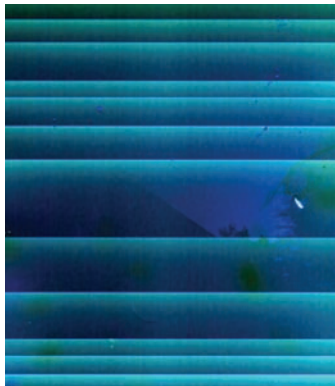
Once the can is painted I use a sewing pin to pop a hole right in the aluminum of the can. I slide a sheet of black and white paper into the can and tape the container closed. This process can be done in dim light, or a red safelight can be used. The can is mounted to a tree or other convenient mount in a location out of the way. Be sure to mount the can upside down. This makes for a much better waterproof camera. Any rain that gets in the pinhole has a good chance of draining out the tape at the bottom. My first two cameras had images artistically enhanced by filling up with water.



A five-month exposure - ending on December 21, 2011. There are often odd effects with this technique. The light was so bright on the white photo paper that the reflection can clearly be seen on the right hand side of the picture.

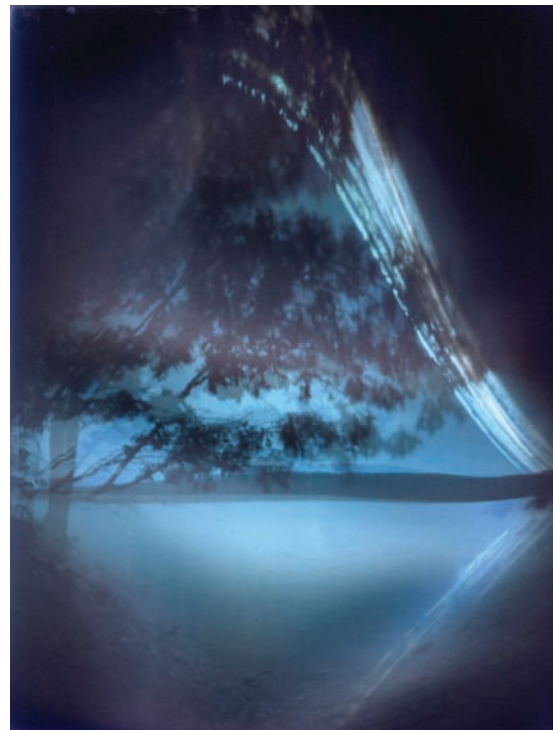


Two Cameras exposed side by side. The more cameras used the better chance that one of the images will turn out good. Two week exposure made the last two weeks of August 2011, taken on Keuka Lake in the Fingerlakes region of New York State. The camera is pointing west. The image on the right shows a large light leak and the image of the sun is mirrored by its own image reflected off the paper. The better image on the right has had more level adjustment than the image on the left.



Here is an image that was scanned at too high a resolution where the light from the scanner created lines as it paused to transfer data to the computer.

This test can be done with an unexposed sheet of photographic paper and should be done before scanning your first exposure.



All Images © Ted Kinsman

The left image is the raw scanned image while the right image has been inverted and had levels adjusted. This is a two month exposure that spans the summer solstice. The sun crosses the same part of the exposure as it moves towards and away from the solstice. The paper also slipped in the camera during the exposure. Taken from June 1 to August 1, 2011 in the Finger Lakes Region of New York State. The image on the right was also warped in Photoshop to try and level out the horizon.

The mount should also be secure. If the paper or the container moves during the long exposure the image will have a double exposure. I like to glue the aluminum cans to blocks of wood and then screw the wood into a tree to fix it into place for the exposure. My shortest exposures with this technique are two weeks, this gives the sun a chance to move in the sky, and see the results of clouds blocking the sun. The two-week exposure also gives enough light to expose structures in the foreground to make the image interesting.

Keep in mind that the most interesting part of the images is the motion of the sun through the sky. The sun moves the fastest in the fall and spring. An exposure made from December 1 to January 30 will have the sun trace out the path twice, since the sun will reverse the relative motion after the winter solstice. The same problem happens at the summer solstice.

Once the exposure has been made and the paper has been scanned, the image is moved to an image editing program and inverted. The paper exposure is still a negative and most often is a light tan color to a deep brown where the sun has hit the paper. By inverting the image, the sun will appear lighter than the rest

of the image. Levels can be adjusted to show the foreground as desired.

As a technique, this is a very interesting way to record the motion of the sun relative to the earth. It is also fun to revisit some of the hands on experimentation that comes from building your own camera and taking a two-week exposure. I hope that you give this simple technique a try and see what you can do.



Ted Kinsman is one of the few active high-speed photographers able to photograph at times less than 1/1,000,000th of a second. That is faster than a speeding bullet. Recently, Kinsman's work has expanded to the x-ray region of the spectrum where he continues to explore imagery for books and magazines.

His work has appeared on The Discovery Channel, Crime Scene Investigations (CSI), The X-Files, South Park, The Tyra Banks Show, ABC, NBC, PBS, CBS and the BBC. Recently, he did work on The Frozen Planet series, and contributed to James Cameron's Avatar movie where he supplied time-lapse images of blooming flowers that were used in the creation and timing of animation sequences.

He teaches Macro photography in the Biomedical Photographic Communications Dept. at RIT. He also teaches Advanced Placement physics at Brighton High School located in Rochester, NY. See more of his work at sciencephotography.com