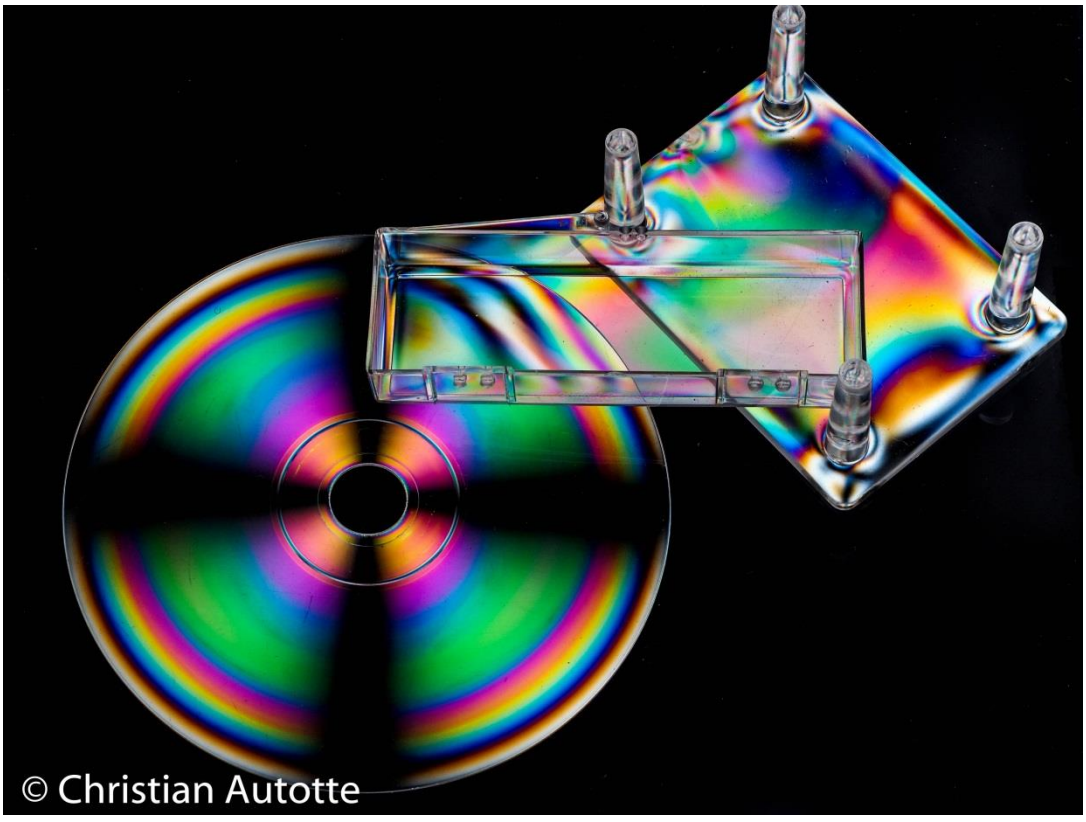
PLAYING WITH DIY WAVE PLATES

I have said it before on this site: I am not a scientist. I love science, but care not for mathematical formulas or theoretical mumbo-jumbo to explain in excruciating details the ways or whys of how things work. I only care about results. I am first and foremost a photographer and if the picture looks good I don't really want to know all the nitty-gritty behind it. Consider this a fair warning…

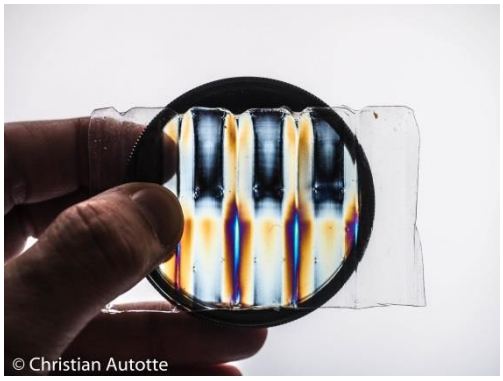
I recently discovered the fascinating principle of the wave plate. To give the short explanation, a wave plate is something placed between the two polarizing filters used when doing photography in polarized light. If we want to go into a little more details, light is polarized by the first filter, is slightly bent as it goes through the subject, and the result is seen through the second polarizer with all its interesting and colorful effects. When we add a wave plate, the light is further bent and modified by a clear plate placed above or below the subject, but necessarily between the two polarizers. For scientists, those wave plates can be quarter wave plate, half wave plate, or full wave plate, depending on the amount of bending it does to the wavelength. If you want to fill your mind with theories and formulas go to the following Wikipedia article: https://en.wikipedia.org/wiki/Waveplate.

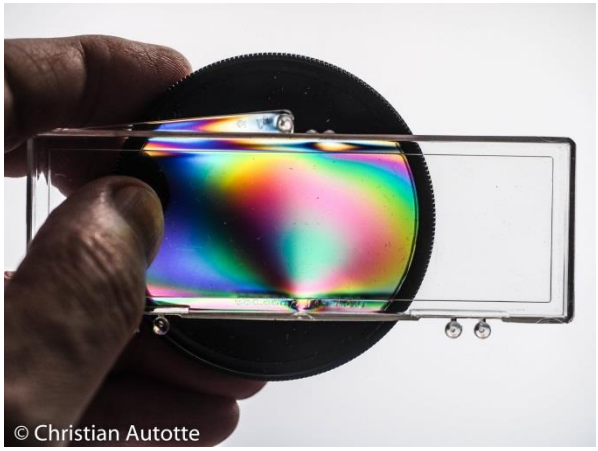
If, like me, you have no need of precise measurements or identifications of birefringent crystals but simply want to add diversity and color to your photography, a great many transparent plastic objects can be used as DIY wave plates. So I went about the house looking for anything what would produce interesting effects.



Different transparent plastic objects photographed on a sheet of polarizing material

One of first ones I tried was a piece cut from a food container that used to hold some mixed nuts. It resulted in a few interesting color changes, but tended to be too even in its coloring. Here and there, when moving the piece around, there were some varied color gradations. That's when I remembered some experiments I once made photographing plastics between two polarizers: stressed areas show up as a multitude of concentric colored areas spreading out from the point of stress. So I bent and applied pressure with the handle of a mounted needle to various points of the plastic sheet. The result was already more interesting, so I took a second look at that container: its sides were not flat but undulated. Looking at a cut piece between two polarizers I saw a lot more variations in colors. Studying more plastic held between polarizers showed a lot of potentials with a small plastic box and the transparent protector of a stack of blank DVDs; they quickly became my favorite wave plates. Cleared of their paint coat, the DVDs themselves proved disappointing, showing little or no color variations. I have also experimented with layers of clear tape on a piece of glass. While it does have an effect, the colors produced tend to be very uniform, contrary to my stressed plastics. Trying to stretch the tape to stress it had no effect. Another way to vary the effect, especially to view several color variations in the same field of view, is in the position of the DIY wave plate. The closer it is to the slide, the more chances there is of seeing more than one background color.





Going through a collection of mounted slides with a polarizing microscope can be time consuming. You first have to find that will look good in polarized light as not everything is birefringent and shows interesting colors. Once you find a suitable subject, starting to play with wave plates will slow you down some more, but the fun also increases accordingly! Talking about birefringence, if you want your ears to start smoking and you brain to swell and bleed, look at the mathematical formulas on that Wikipedia page on birefringence: https://en.wikipedia.org/wiki/Birefringence ... AARGH!

Spider Jaws, polarized light, 40x

Many arthropod parts are birefringent. These jaws and feet from a spider are interesting in polarized light, but even more so when a wave plate is added.

As can be seen in the foot pictures, the wave plates can have very varied effects depending on their nature and angle in the whole assembly.

Spider Foot, brightfield, stack of 5 pictures, 100x

Spider Jaws, polarized light and waveplate, 40x

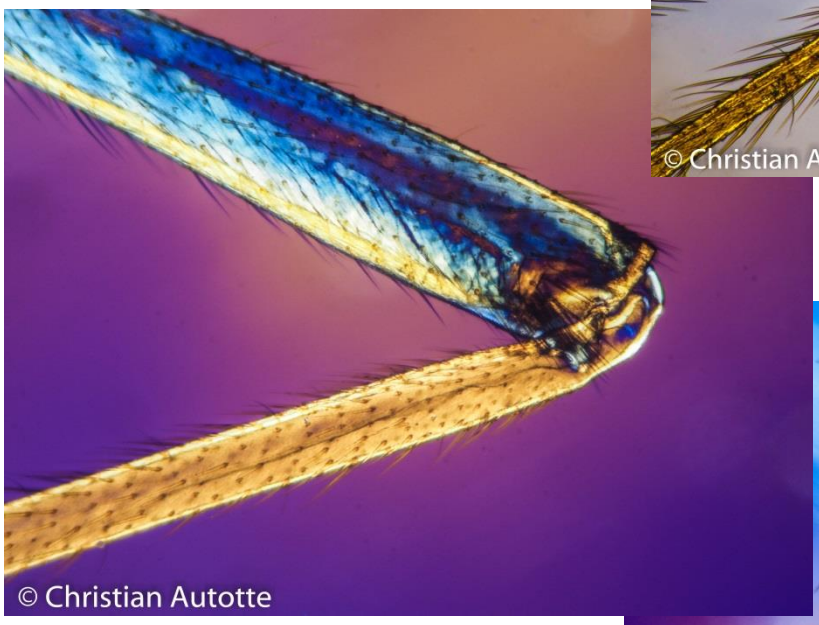
Spider Foot, polarized light and wave plate, 100x

Spider Foot, polarized light and wave plate, 100x

Common fly leg, polarized light and wave plate, 80x

Just like the spider parts, insect legs in polarized light maintain the colors induced by polarization but also gain an interesting background when a wave plate is added to the mix.

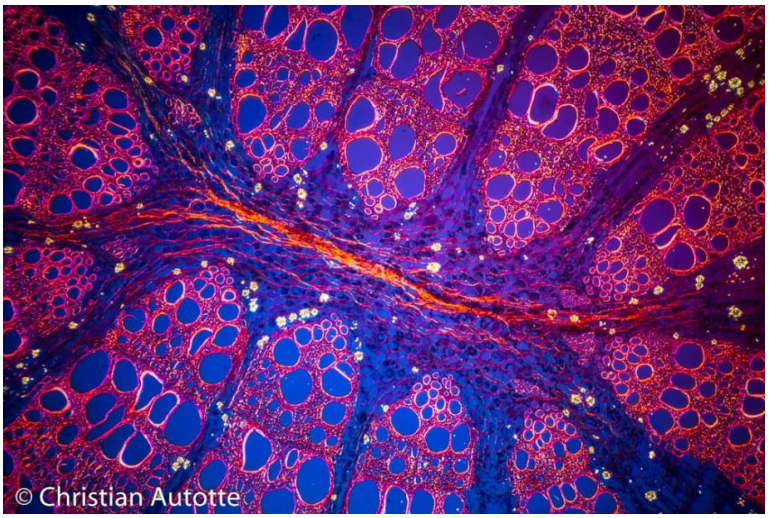
Cranefly legs, polarized light and wave plate, 80x



Cranefly leg, polarized light and wave plate, 80x

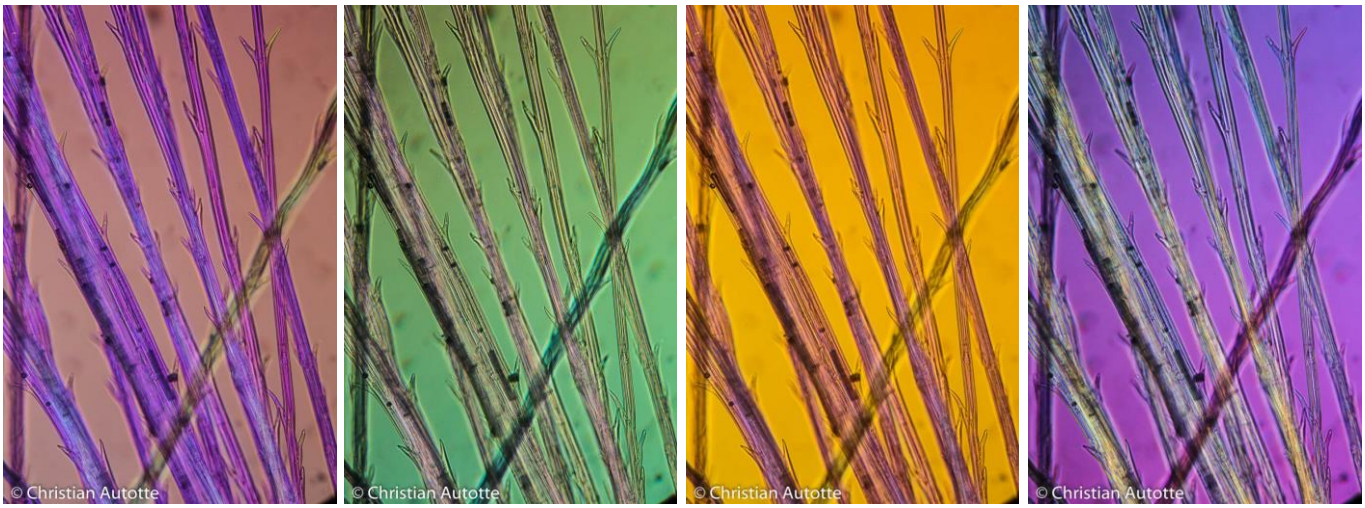
Asilid Fly foot, polarized light and wave plate, 80x

Many plants are also interesting when photographed with polarizers and wave plates, either treated with dies or photographed raw.



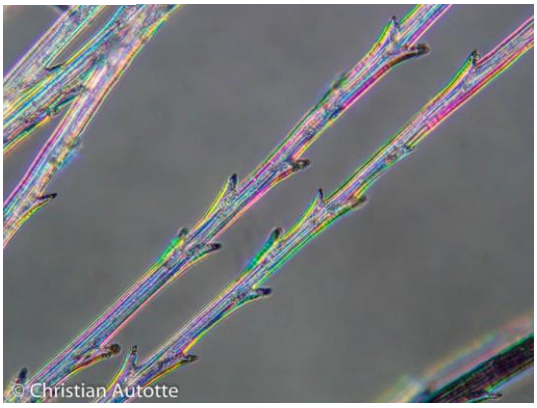
Aristolochia stem, polarized light with wave plate, 40x

Chara (algae) in polarized light with wave plate, 100x

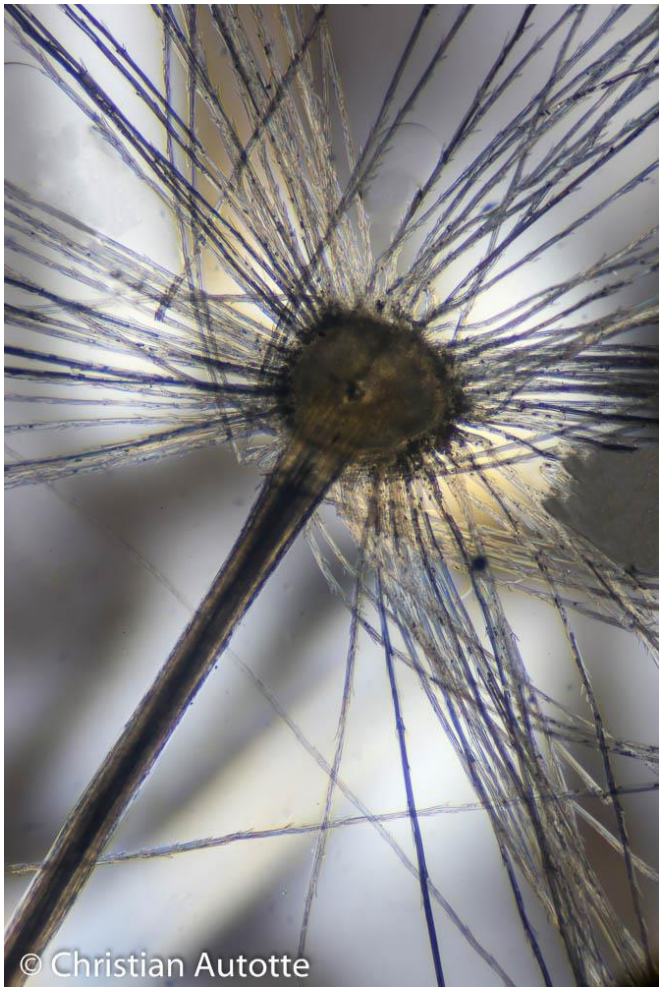


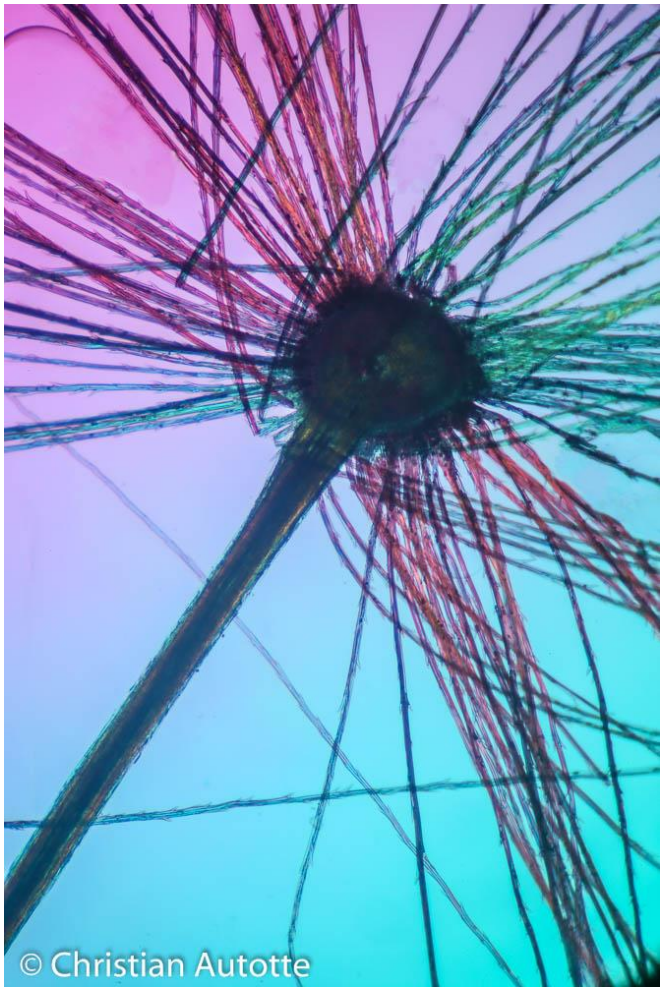
Dandelion seed, 200x in polarized light with wave plate

The same subject can produce a variety of results with the simple rotation of the wave plate. By comparison, a picture without wave plate can be a bit duller, with a background often either black or dark grey.



Dandelion seed, 200x, polarized light





A dandelion seed at 40x. The one on the left was shot with a wave plate cut in a recyclable plastic food container placed directly under the slide. The one on the left is with my small plastic box held just above the microscope light source.

There is still plenty of experimenting to be done with DIY wave plates and the results can be very interesting for the visually inclined, regardless of the science involved. Those who wish to read more about wave plates can do a quick search in Micscape archives; they will fine pages after pages of examples and articles on the use and theory behind these bits of plastic that can change the way we use polarizers.

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