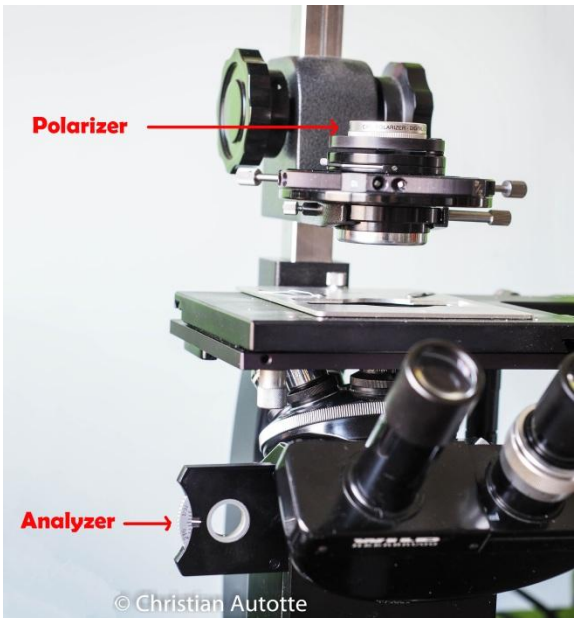
Play with those polarizers

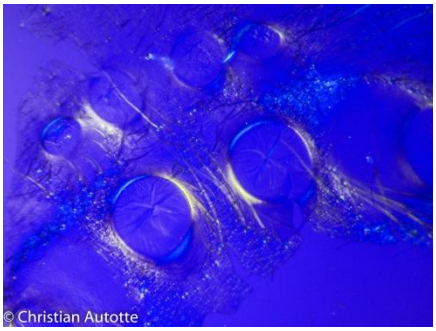
Chitin, the hard tegument of insects, spiders, and other arthropods, often takes on iridescent colors when placed between two polarizers. The reason behind these colors is linked with the birefringence of the subject, be it mineral, as in crystals, or biological. There is a whole lot of science behind it, but I'm not too interested in the scientific or optical reason behind the phenomenon; as a photographer I'm just interested in the aesthetic aspect of it.

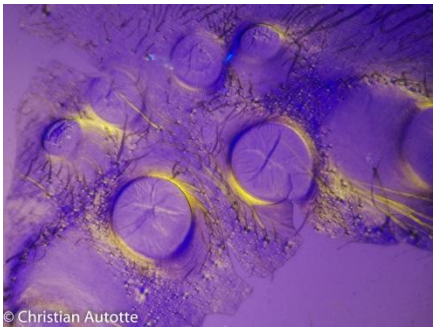
Most people who have observed with polarized microscopes will know that you normally turn one of the filters, usually the analyzer which is above the preparation, to change how the subject appears. For most amateurs it stops there, either the subject looks good or it doesn't. Specialized polarizing microscopes also offer the possibility of turning the stage, which changes the angle of the subject and result in varied and colorful effects.

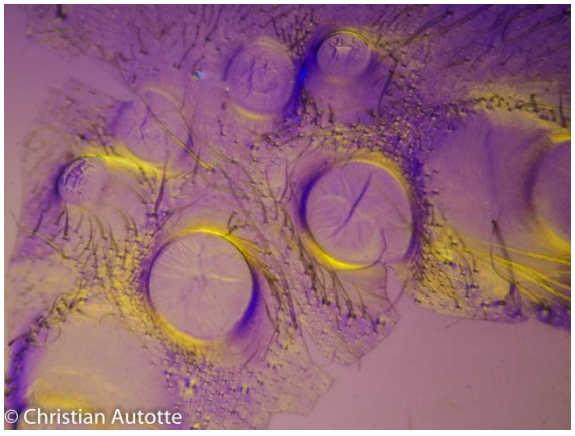
Another way of achieving the same result is to turn *both* filters at the same time. With some microscopes it may be a difficult proposition, as one of the polarizers may be locked and out of reach. But other microscopes design may make it very easy to control both filters at the same time. That's the case of my Wild M40 inverted microscope. While I'm turning the analyzer, which can slide in and out of position, it's very easy to also turn the second polarizer mounted on a filter holder above the microscope.



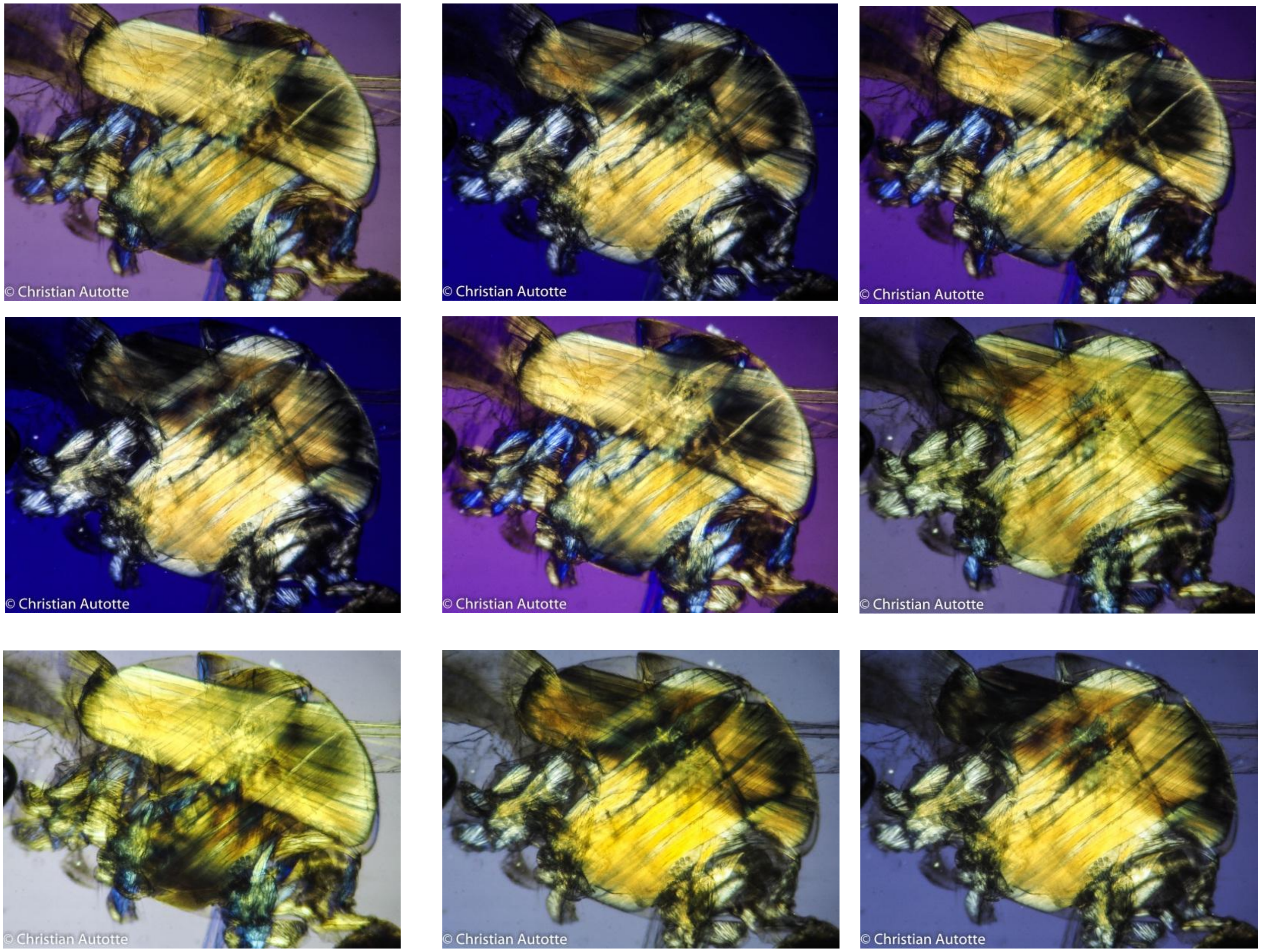
Top part of the Wild M40 inverted microscope. The analyzer is pulled out on this picture; you push it in and turn its wheel to vary the polarizing angle.



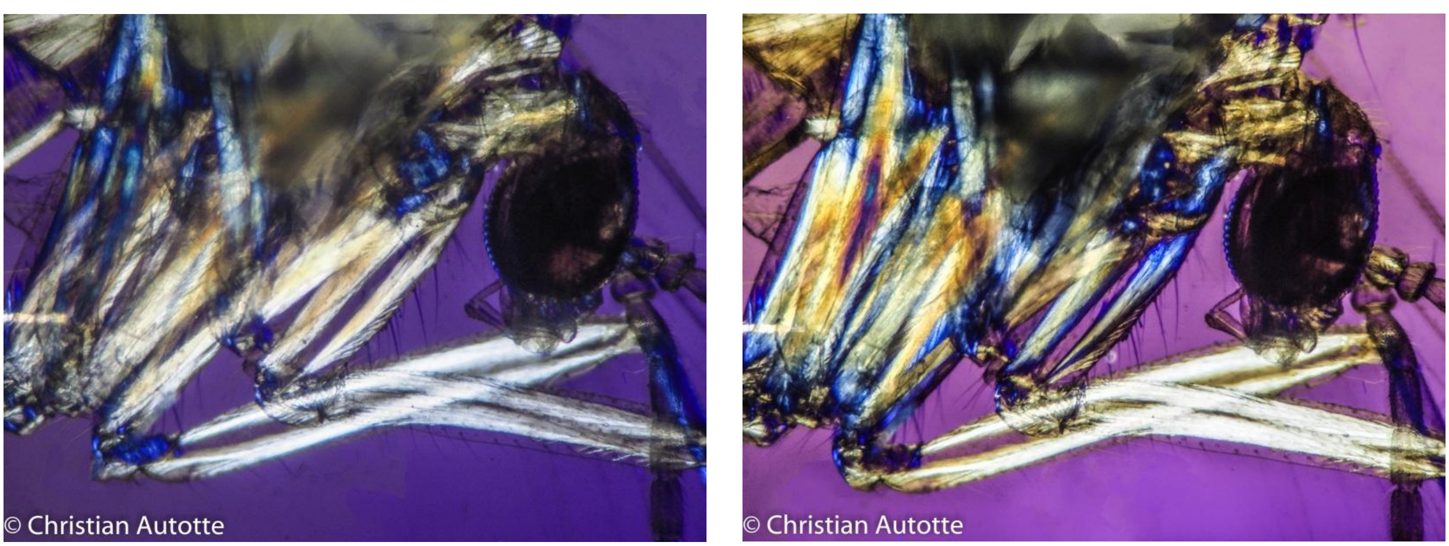


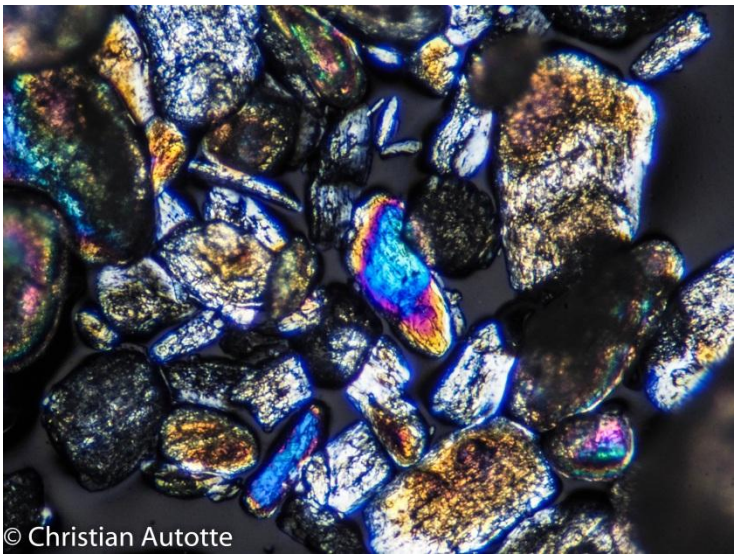


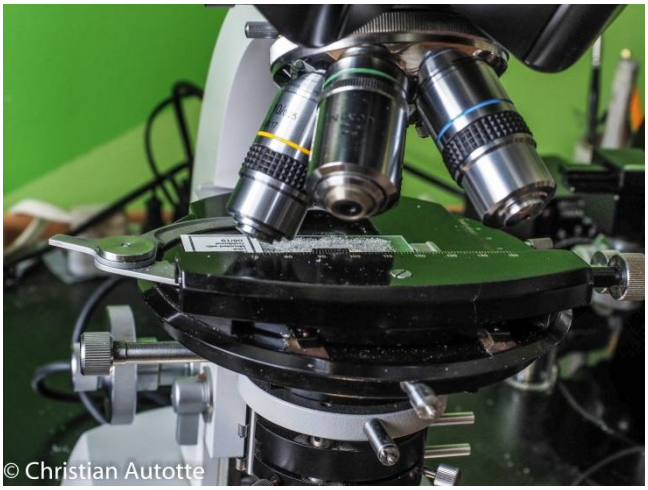
This is the eyes on the empty molt of a wolf spider. As you can see, the look imparted to the image can vary a lot depending on the various angle of polarization. Shot at 40x.

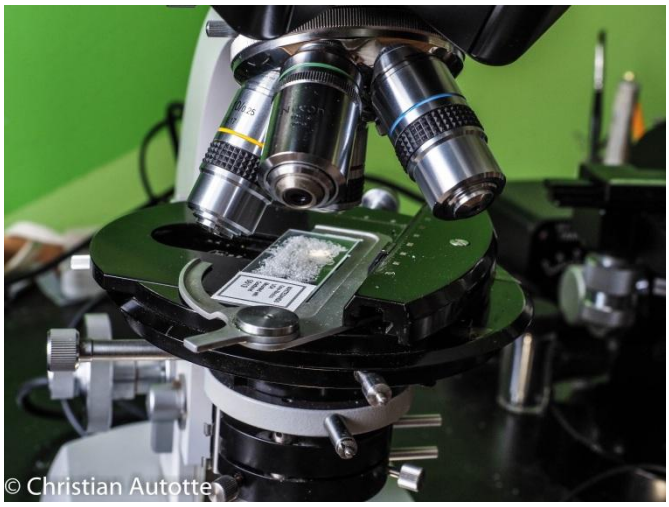


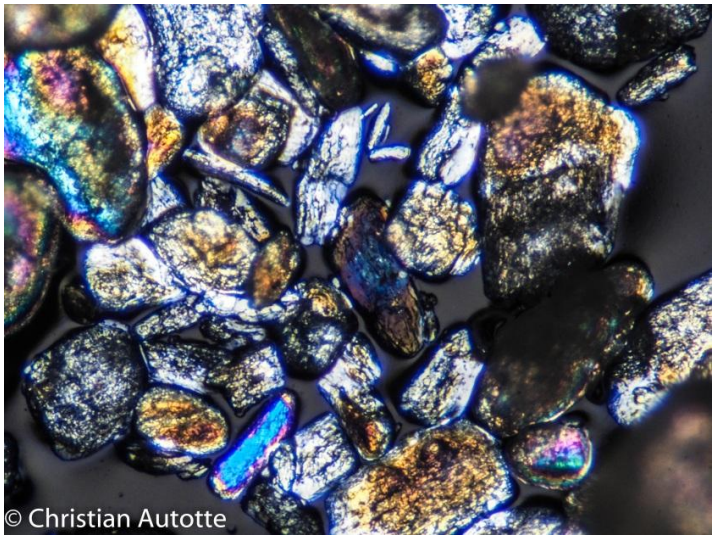
The thorax of a small midge reveals its muscles in polarized light. Depending on the polarization, I was able to isolate one set of muscles or the other. My favorite image remains the one in the center (the head is at lower right). Shot at 40x. Below, another midge shows some similar effects in its legs.



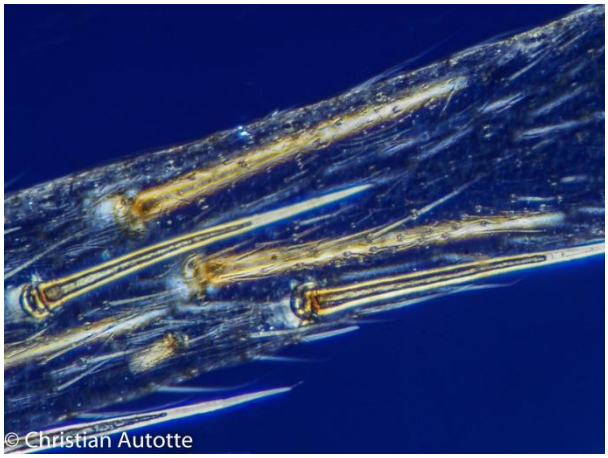




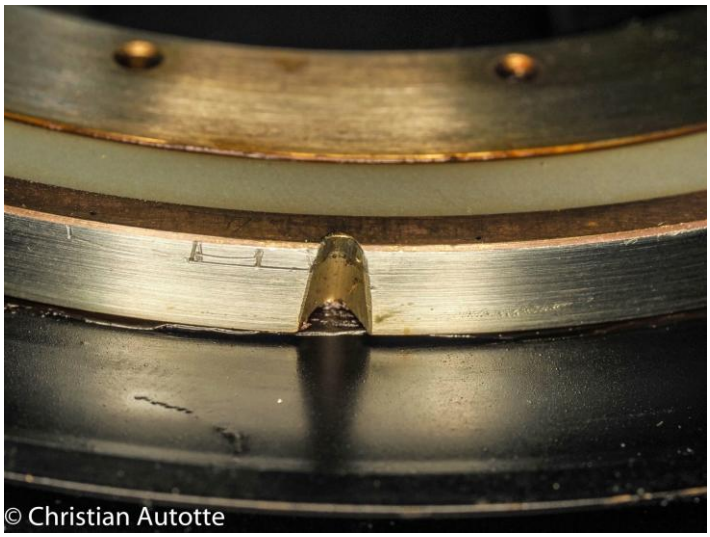




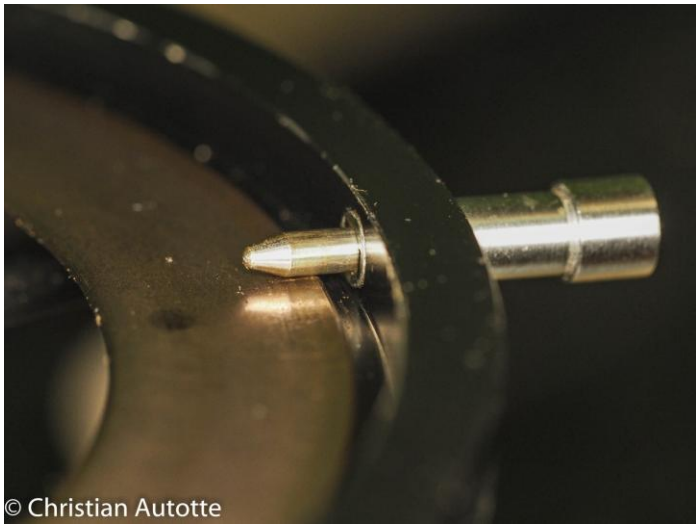
My Zeiss Standard was the result of several separate purchases: the base, the nose piece, the trinocular head, and the various lenses. While the head I found on EBay was not intended for polarizing work, I was able to include a small filter between the head and its base, as explained in a previous article (*Polarization revisited* in the May 2019 Micscape issue). In this position, that filter is out of reach and must remain fixed. However, the round pivoting stage can be useful when shooting polarized pictures. My camera adapter is in two sections. As the stage is being rotated, it is fairly easy to keep the same composition by rotating the camera. Above, a sample of White Sands, New-Mexico, shows varied birefringent effect while turning the stage. The camera was pivoted on its adapter in order to maintain composition. The two shots of a hairy spider leg seen below were also made on the rotating stage with partial polarization.



The only difficulty in working with a rotating stage is keeping it properly centered. Two screws on the back of the stage are used to center the stage assembly so that when it pivots the subject remains in the center and does not fly off to one side or another. At first, I was having problems with my Zeiss, until I realized that not only were the centering screws poorly adjusted, but the spring loaded pin in the front of the stage was also out of its groove. Once the problem was identified, it was easy to make everything work the way it was supposed to.



The groove. On the left side you can see the marks left by the pin (at right) which was out of its position when I first tried to center the stage.



Those interested in the science behind polarization can read the following:

https://www.microscopyu.com/techniques/polarized-light/polarized-light-microscopy

It is full of charts and cute animations, plenty of examples and lots of fancy words like isotropic and anisotropic, vibrational plane, refractive indices, dichroic medium, and vibration azimuth. After reading too much of it I tend to get cross-eyed and develop a splitting headache… Guess I'll stick to the visual side of it all…

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