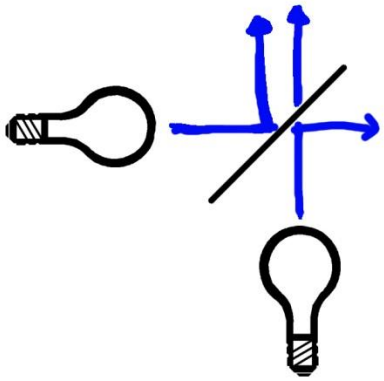
BEAM SPLITTERS, A SIMPLE IDEA

BY Christian Autotte, Montréal, Canada

One of the pleasures of playing with microscope is to look at whatever can be found living in “dirty” water, be it from a running brook or a beaver pond or even from a mere puddle in a city park. But being a photographer, I am not content with simply looking, so picture taking has to be part of the experience. The problem is that many of those little critters move way too fast to be photographed with the low power light generated by most microscope internal light bulb; the shutter speed one must use is just too slow to stop their motion, especially at higher magnifications.

Advanced research microscopes are often equipped with built in cameras and an electronic flash that can freeze the motion of just about anything that lives. For many years I have used the same principle with one of my microscopes: by removing the bottom plate that protected its light bulb, I was able to prop the whole thing on a home-made stand and shine a flash from below, right though that light bulb. It worked fine, even though the whole contraption looked kind of funny and unstable. But one day, the whole light assembly failed, the power supply fried and the light bulb burned. Unable to find the right replacement for a microscope long out of production, I had to improvise with LED light. Unfortunately, that new lighting system prevented me from shining a flash through it to stop fast moving subjects. I had to find a new solution.

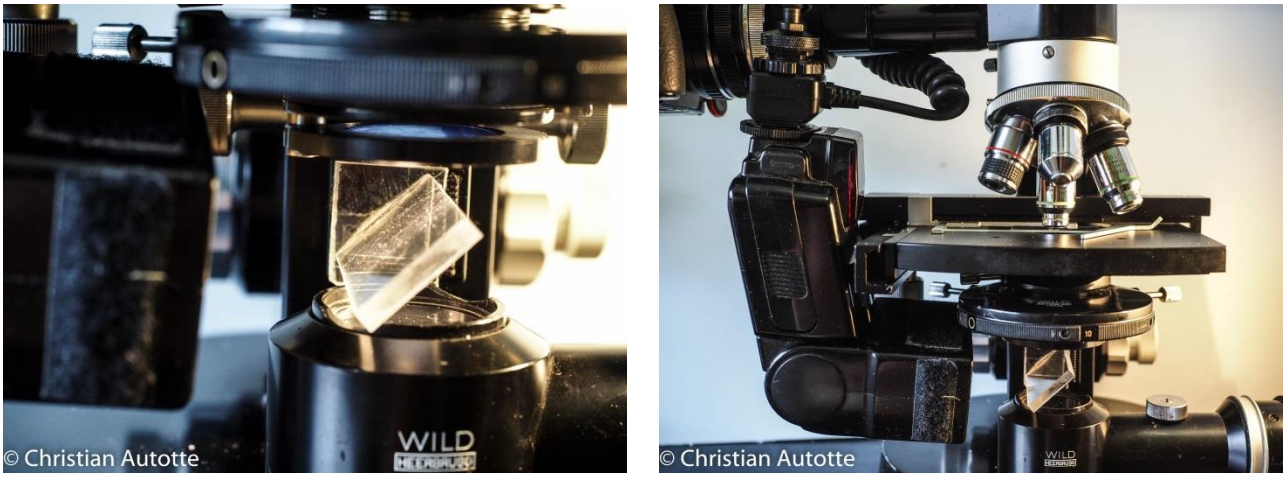
A few years back, Sony created a DSLR camera with a fixed, semi-transparent mirror. Most of the light shone through the mirror to expose the sensor; the rest was diverted to the focusing and exposure meter mechanism. That reminded me that clear glass held at a 45° angle will let part of the light pass through but could also reflect the light from a different source coming from a 90° angle to the first one.



So I went on from theory to experiment. My first prototype was made by taping a microscope slide on a piece of cardboard. Placed on top of the microscope light source it still allowed light to pass through. Placing a powerful flash to shine its light on the angled piece of glass, I was able to see some of that light reflected up to light the microscope slide, a fact that was confirmed by turning off the microscope built-in light.

Encouraged by this preliminary success, I went on to build a more permanent reflector, also one with a larger surface to increase the amount of light that might be reflected. This new unit was made with pieces of Plexiglas glued together. The first one (the support) is square; the reflector is glued from corner to corner, which guarantee an angle of 45°. In usage, there can be some variations in lighting due to the angle and distance between flash and reflector, so it’s important to find a way to precisely position the flash time after time. The next source of light variation is linked with the positioning of the reflector on top of the light source. If it moves slightly between shots the reflected light may not enter the condenser at right angle, resulting in an image that is slightly darker on one side. But these are minor problems, overall, the whole thing works like a charm.

A substantial amount of light is lost by the system; about 50% passes right through while the other 50% is reflected and used. Add to it the fact that many of those interesting subjects are to be photographed in phase contrast, which also reduces the light that will reach the sensor. Consequently, the flash to be used should be as powerful as possible and held very close to the beam splitter.

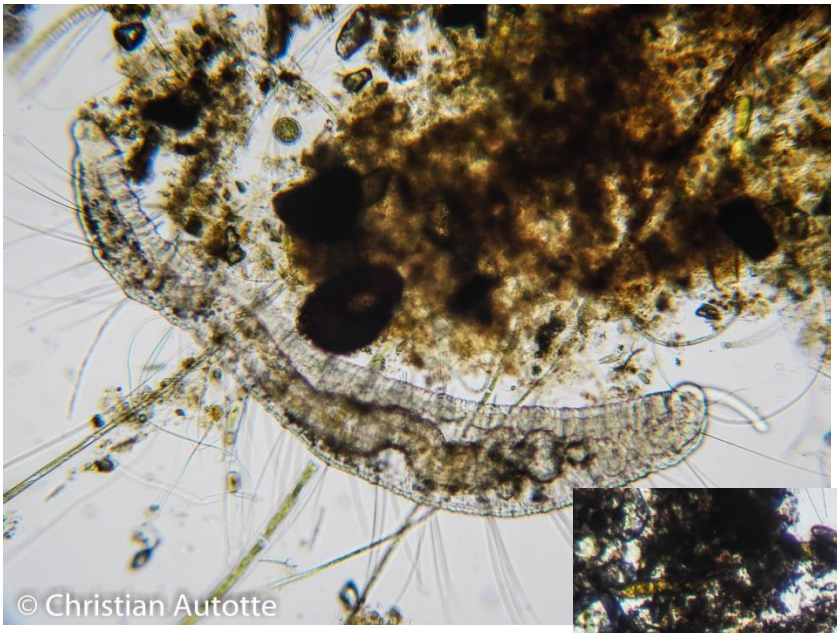


The beam splitter is made of two pieces of Plexiglas. The flash is maintained in place with a clamp, always at the same distance.

The Guide Number of my old Canon 550EX is 180 at ISO 100. That of my Olympus STF-8 Twin Flash is only 6 for one flash; that is enough when shooting regular macrophotography but if I use the Olympus with the beam splitter on the microscope I often need to push the ISO to 800 even with the flash at full power. By comparison, the power of my Canon flash can be reduced to ½ or ¼ and still provide enough light to use ISO 200. I still can use the Canon flash when choosing to work with my Olympus camera, but the flash must then be set to manual, which can slow me down when changing lighting techniques or magnifications. As a consequence, I have now ordered a more powerful flash for my Olympus system.

Eventually, two splitters were made, each adapted to a different microscope: my Zeiss Standard and the Wild M12 Phase Contrast. I did not invent anything; there are plenty of similar setups, many described in Micscape. My own version has the advantage of being simple, low cost, and efficient. As the saying goes: necessity is the mother of invention…

Colpidium, 400x, phase contrast

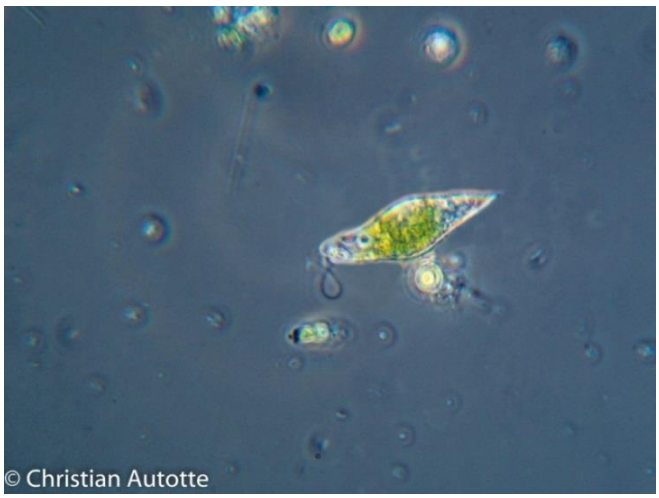


Worm, 100x

Spirostomum, 30x

Paramecium, about 300x

Look at the vacuole on the upper part of this Colpidium; this kind of changes must be recorded quickly with fast shutter speed. Colpidium, 400x, phase contrast.



Euglena, 400x, phase contrast

Stylonychia, 400x, phase contrast

Synura algae colony, 400x

Comments to the author Christian Autotte welcomed, email:
cautotte.9001 AT videotron DOT ca
Published in the April 2021 issue of Micscape magazine.
www.micscape.org