The versatile Zeiss Phase Condenser

by

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Phase Contrast is rightly on many microscopists wish list. Its ability to allow us to discern fine detail in transparent protists is remarkable indeed.

If one is fortunate to own a finite (160mm Tube length) Zeiss microscope, then setting up a phase contrast system is a simple and straightforward endeavour.

There are a variety of phase condenser models - the simplest of which are not overly expensive and when combined with phase achromat objectives allow an economical start to phase contrast microscopy. Additional steps can be taken in time by upgrading from achromats to planachomats or neofluars and from there to planapochromats if desired.

The Zeiss Phase Contrast condensers come with either Ph1, Ph2 and Ph3 ports or as in the case of the Phase/DIC Condenser (3rd image in Fig. 1) just Ph2 and Ph3 ports. These designations are mirrored on the phase objectives, allowing one to match the objectives to the capabilities of the condenser. The range is:

Ph1: 10x;

Ph2: 16x, 25x and 40x (low NA);

Ph3: 40x (high NA), 63x and 100x.

Fig. 1. Three models of Zeiss Circular/Rotary Phase Contrast Condensers.
Phase Contrast Condenser 0.9 NA with swing out lens, II Z
Achromatic - Aplanatic, Brightfield - Darkfield - Phase Contrast Condenser, V Z
Achromatic - Aplanatic, Phase Contrast and Interference Contrast Condenser, 46 52 85

Why so Versatile

One could argue that the ease with which one can implement and change phase settings is versatile enough - however, the real versatility of these phase contrast condensers, lies in their ability to provide *Oblique, COL, Darkfield* and of course the default *Brightfield illumination* in addition to their stated function.

While it is true that most of these illumination techniques can be achieved by the use of stops or masks, it is the facility with which they can be accessed and thus implemented with these rotary phase condensers that makes them stand out.

This simple and efficient circular design - in which the phase ports, a brightfield port, a darkfield port (depending on the condenser model) and at least one empty port for experimenting, are sequentially rotated into position - facilitates these additional illumination techniques. See Fig. 2

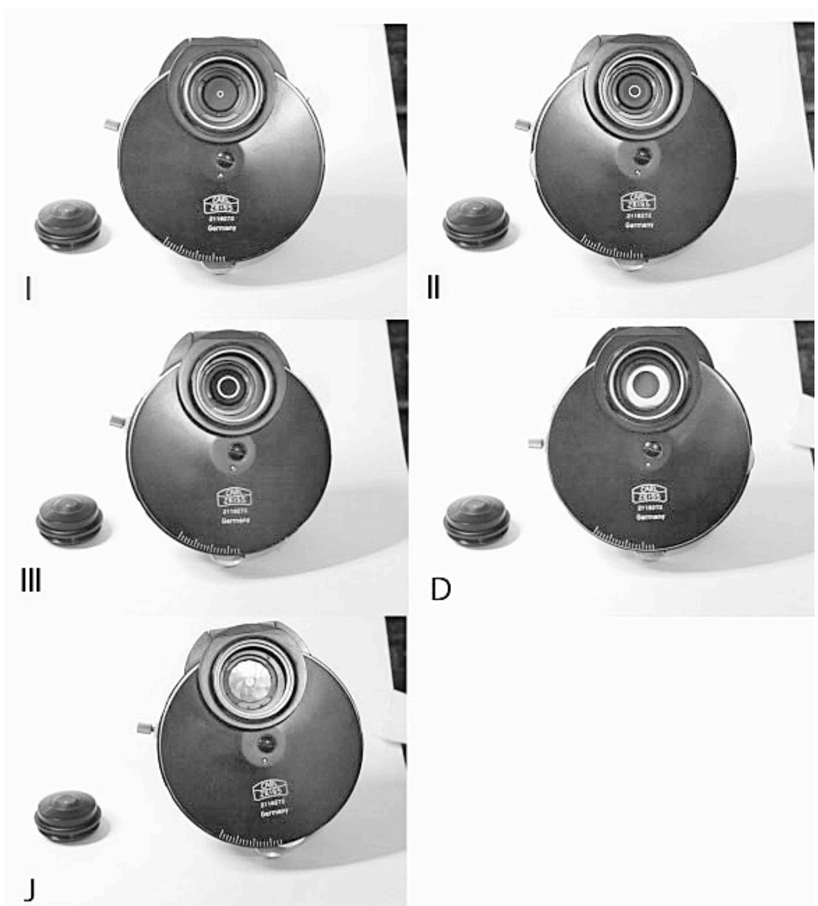

Fig. 2 Zeiss Condenser showing Ph1, Ph2 and Ph3 Ports with respective annuli as well as Ports D (Darkfield) and J (Brightfield - showing diaphragm)

Oblique can be quite simply achieved after first setting up Köhler (the prerequisite of all observations) and gradually offsetting the brightfield port either clockwise or anti clockwise, the variation changing the side from which it is shaded and therefore the effect, while adjusting the diaphragm opening. The addition of a rotary stage enhances the use of this technique.

COL, which stands for Circular Oblique Lighting, is a technique that is particularly effective with diatoms and can work quite well with transparent protists. See 3rd image in Fig. 3 The technique requires the use of a non phase objective and an annulus with a diameter just a little smaller than that of the field of view. See link for an article on the subject:
http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artdec02/pjcol.html

Darkfield is obtained in the lower magnification objectives by placing the Phase I, II or III ports and their respective annuli (which function as stops) in place. Some experimentation will quickly indicate the correct annulus for each objective. The higher the objective magnification the larger the annulus required. In order to achieve darkfield with the highest magnification objectives a phase condenser with the position D is needed. See Fig. 2
The condenser must then be oiled to the slide.

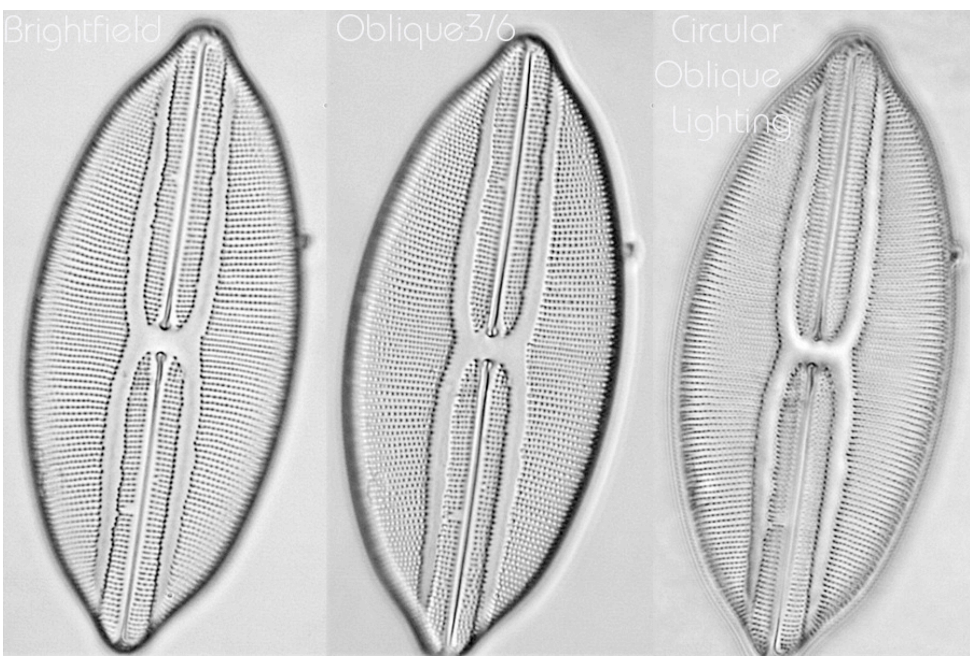

Fig. 3

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