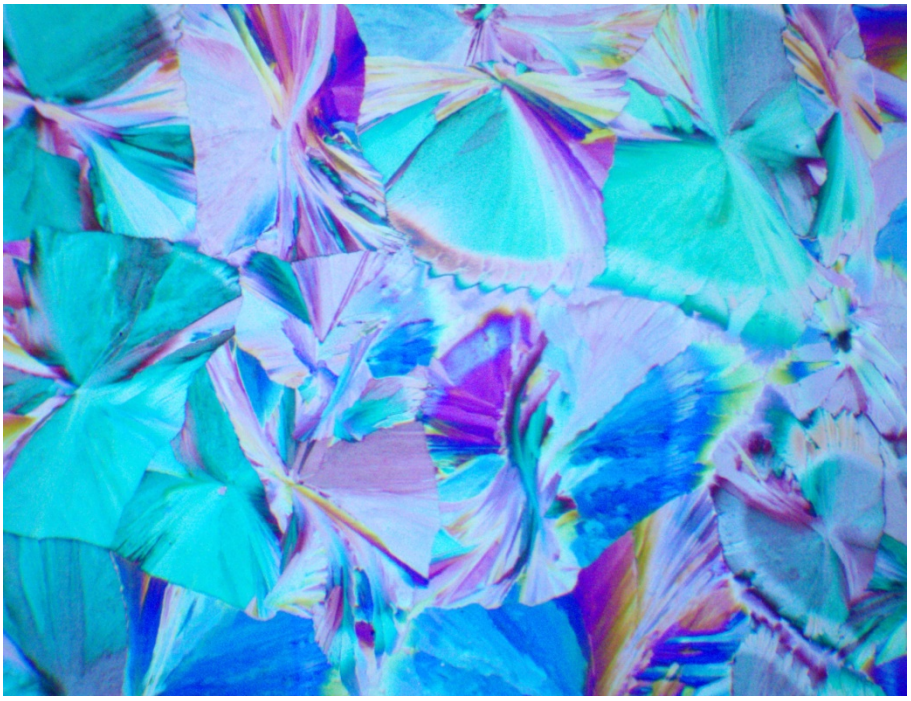
MICROSCOPICAL EXPLORATION

TWENTY SIX

A QUALITATIVE COMPARISON OF CIRCULAR AND LINEAR POLARISATION FOR THE MICROSCOPICAL OBSERVATION OF TARTARIC ACID CRYSTALS

In my previous microscopical explorations, where polarised light observations of various organic crystals were made, linear polarising filters were used as polariser and analyser in the accepted orthogonal orientation. The resulting images showed birefringent interference colours whose intensities varied with the orientation of the crystals relative to the polariser or the analyser. When the vibration direction of the crystals happened to be parallel with that of either the polariser or analyser the intensity of the interference colour was reduced to zero, rendering the crystal optically extinct and resulting in a dark patch in the image. This effect is illustrated in the first image of Tartaric acid crystals below:

If a sticky tape waveplate/retarder was introduced into the light path between polariser and sample, shifting the orientation of the linearly polarised light from the polariser, the dark patches in the image were eliminated and interference colours became visible where they had been, as shown in the next image.



This struck me...and got my two brain cells rubbing together causing me to **THINK!!!**

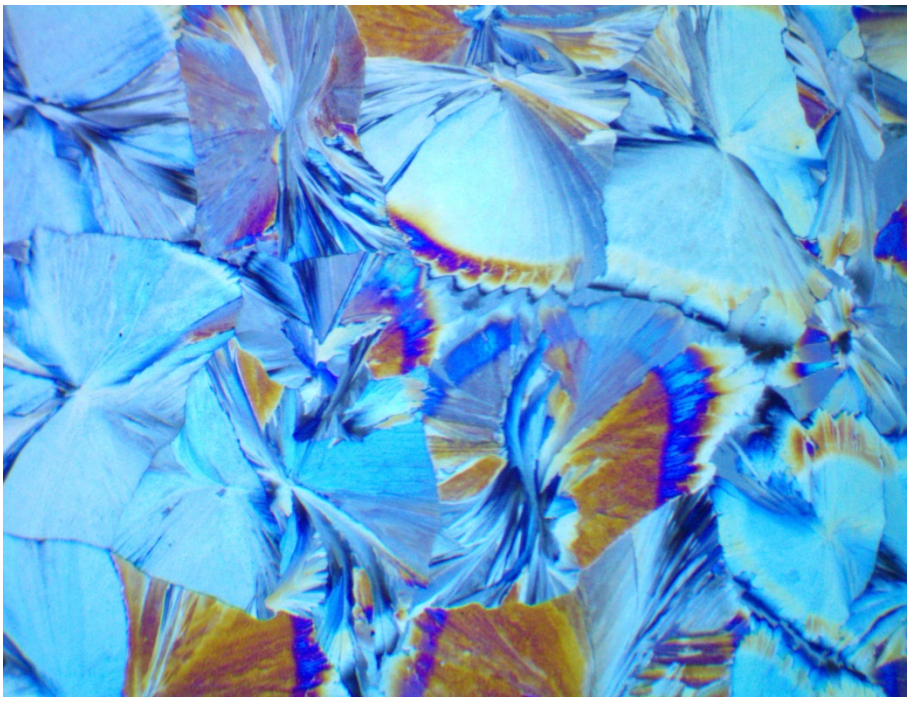
What would be the effect, I thought, if I removed the waveplate and replaced the linear polarising filter with a circular polariser, while leaving the analyser unchanged and unmoved?

Circular polarisers are widely used by photographers to reduce glare, and the physics of their operation is beyond the scope of this exploration, but suffice it to say that they comprise a linear polariser combined with a quarter-wave plate. For those interested in the physics, take a look here:

https://www.apioptics.com/about-api/api-blog/api-news/how-circular-polarization-works/

Now, where was I? Ah,Yes! The only way to find out would be to try it.

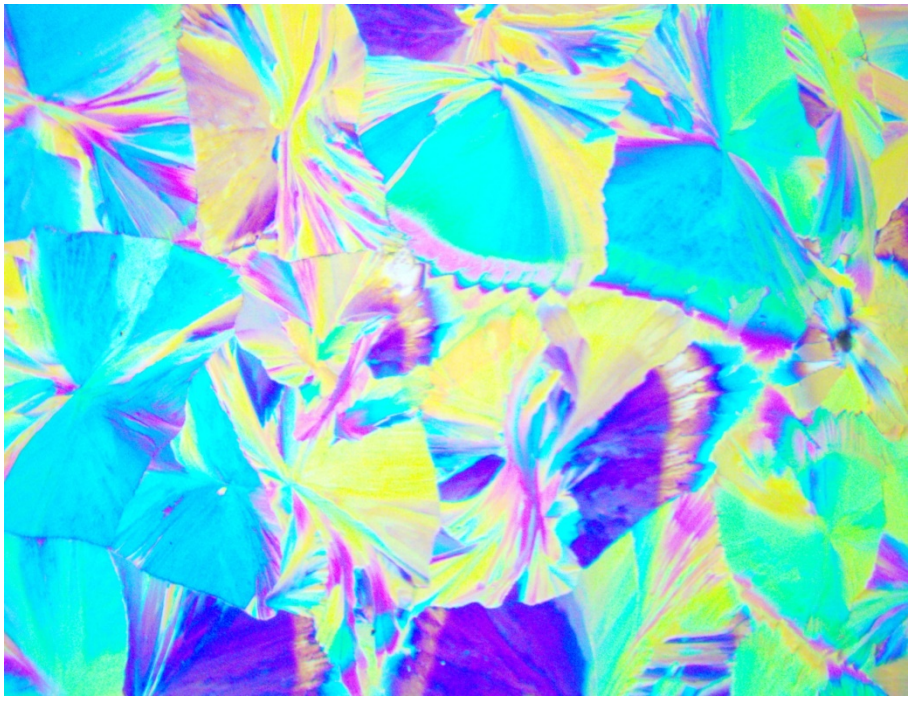
So, I removed the sticky tape waveplate, and also the linear polarising filter from below my microscope's condenser, and inserted a re-purposed photographic CPL polarising filter in place of the linear polariser. The next image shows the result:



As can be seen, there are also no optically extinct areas in this image, which I attribute to the presence of all polarisation orientations in the circularly polarised illumination.

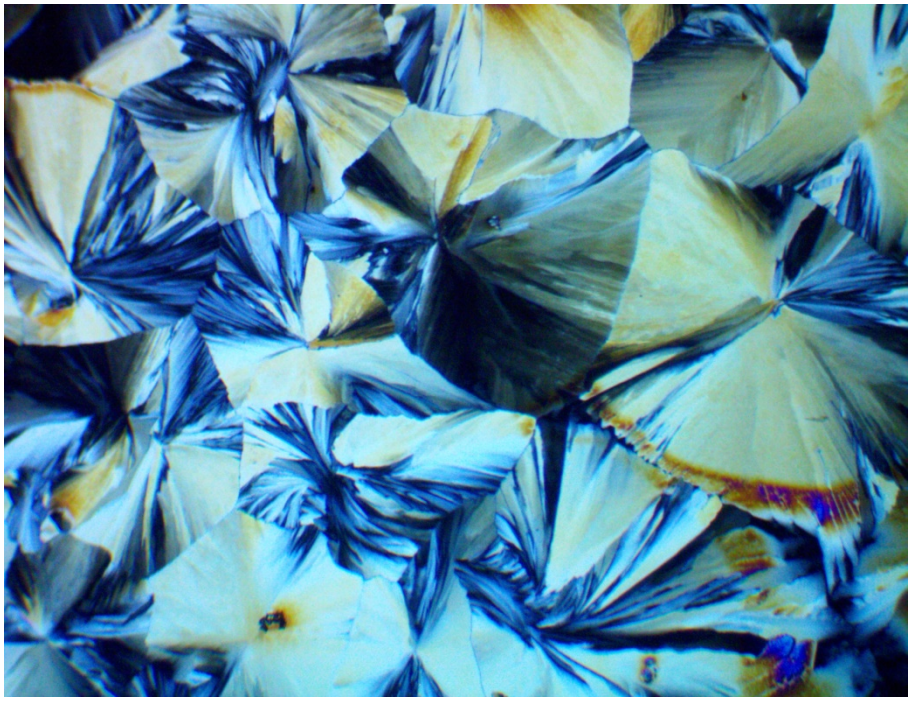
Only one more thing to try, as part of this brief exploration...what happens if I re-insert the sticky tape waveplate?

Here’s what:

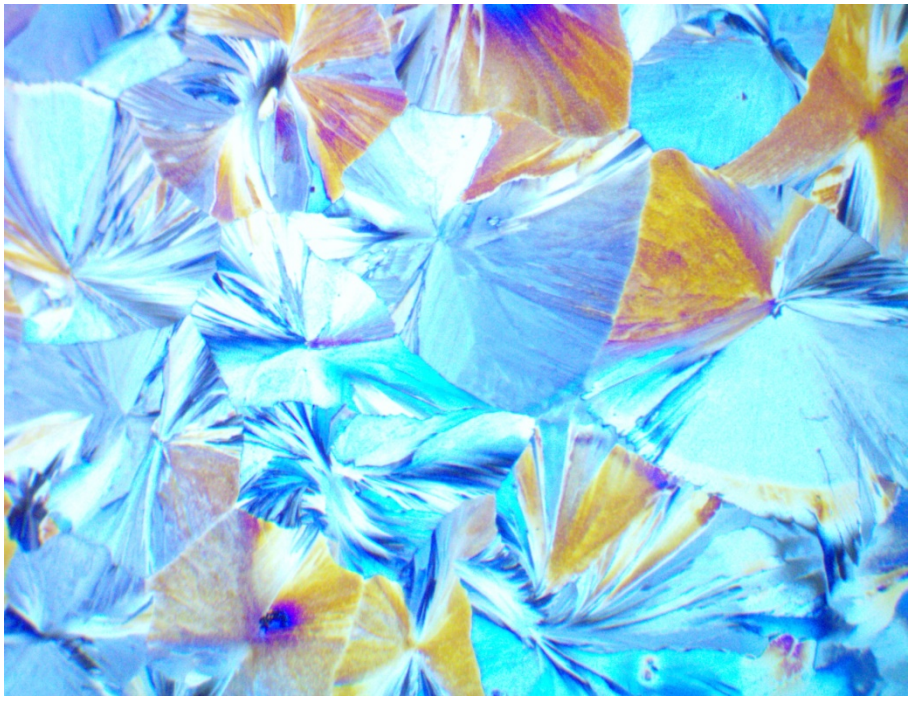


Below are some further comparisons, taken from a different area of the same specimen slide of Tartaric acid.

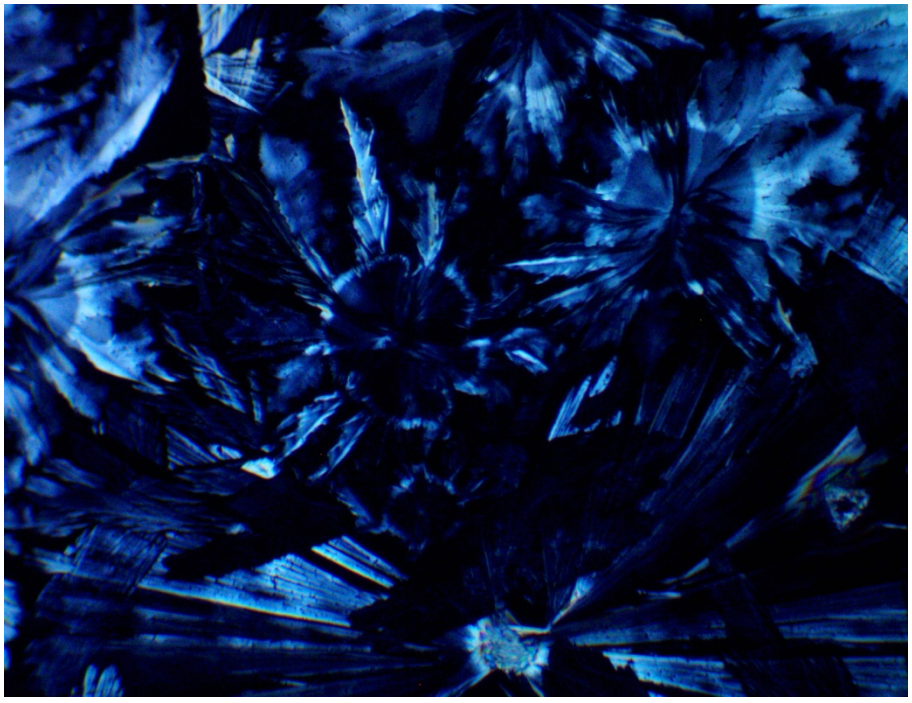
Linear polarisation



Circular polarisation



Linear polarisation



Circular polarisation

As we say here in Cumbria:

‘Ave a go yersel’!

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