



## A PROPOSAL FOR A TEACHING CD APPARATUS

The feeling I do have is that people are usually not trained at high schools or at universities about polarization spectroscopy. The idea is to sort out if an educational CD apparatus would have some request.

As we all know current CD spectropolarimeters are all based on the idea of Grosjean and Legrand<sup>1</sup>, i.e. on the use of electro-optic retardation modulator. The approach gives very good sensitivity, but it's expensive.

Alternative ways to measure CD were widely used in the past, and some of them could be reconsidered in the design of a less expensive apparatus devoted to educational purposes.

For example in the sixties Applied Physics Corporation introduced the Model 1401 accessory for their Cary 14 double beam spectrophotometer.

CD is by definition the difference in absorption coefficient of a sample using left and right circularly polarized light, while a normal spectrophotometer is designed to measure the difference in absorbance between a sample in the sample beam and its blank in the reference beam.

If sample and reference beams are feed with left and right circularly polarized light, the normal spectrophotometer will be able to measure CD.

The Cary 1401 achieved this target putting in the two compartments a polarizer and a Fresnel prism oriented to give right circularly polarized light in the sample compartment and left circularly polarized light in the reference one.

So CD spectra were possible putting same sample in both beams after the Fresnel prisms.

The designed allowed to measure additionally also LD (Linear Dichroism) simply putting sample in both beams but in between respective polarizer and Fresnel prism.

The approach is very simple, but it didn't achieve any real commercial success since technique requires very good optical components and is not free from artefacts.

However if we limit the wavelength range to the visible only, a relatively inexpensive device could be built (as from figure in the next page), the unit would have the facility to measure:

-CD

-LD on oriented samples

-regular absorption on non-oriented samples

and the artefacts/limitations would be very welcome since unit is designed for educational purposes.

If range is limited to the Vis range a simple single monochromator with halogen lamp is enough (with manual or automatic scanning ..... this too cost money), a cube polarizer would be enough to generate two linearly polarized beams to feed glass rombs etc. Detection can be done with simple Si diode and electronics should allow to measure independently the SAM and REF signal or their absorbance difference, this too for better educational purposes.

Other educational experiments would be possible:

- evaluation of polarization properties of grating monochromator

- energy distribution of a pseudo black body source (the halogen lamp) as measured via chromatic optics (the monochromator and the detector)

- .....

*Purpose of this report:*

*to sort out (between qualified experts as you are) if a certain interest for such an educational tool is existing, if so we may proceed building up a prototype.*

*Question:*

*are polarimetric (or ORD) facilities felt important or can we skip?*

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<sup>1</sup> Grosjean M., Legrand M., *Compt. Rend. Acad. Sci.* (Paris) 251, 2150 (1960)

## Lay-out of a possible CD/LD educational apparatus

