Teaching Crystallography with a Laser, Two Lens and …Einstein's Tongue

Philippe Dumas[a], Vincent Cura,[b] [a]*IBMC, 15 rue René Descartes, Strasbourg.* [b]*IGBMC, 1 rue Laurent Fritz, Illkirch, France.* E-mail: p.dumas@ibmc.u-strasbg.fr

Teaching crystallography to students in Biology is a difficult task, particularly because many of them arrived there because '*there are no more Maths or Physics in Biology*'. After 10 years of practice, we have tried as much as possible to limit (not suppress !) the recourse to Mathematics and, also, to show really what diffraction means.

For that goal we make use of a classical optical bench requiring a LASER (λ=0.6328 µm), a pinhole as a beam expander and two lens. We use as crystals 24x36 B&W photographs of a 80×60 repeats of the well-known 'Eistein's tongue' (cell parameters a = 0.45 mm, b = 0.4 mm.). This allows to record a diffraction pattern on films mounted in the back focal plane of the second lens. The diffraction data extend to order 21 (more than 500 visible Bragg's spots), which correspond to 20 µm resolution.

In order to illustrate the principle of the MIR method, we have made 'heavy atom derivatives' by adding small dots on Einstein's face (one site per derivative), and we have 'collected new data'. Our hope is to go really all the way through with experimental data to 'solve the structure'. For now, this structure solution step is illustrated with calculated data. This shows very well how a recognizable picture is obtained after 'MIR phasing' with only 50 reflections, and what is the effect of experimental noise.

All programming was performed with *Mathematica* (Wolfram Research), which allowed to develop very rapidly the necessary code. This aspect will also be shown in the oral presentation.

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