USING A LASER POINTER TO DEMONSTRATE THE DECREASE IN THE WAVELENGTH OF LIGHT IN WATER

Stephen Hughes[a,b], Margaret Wegener[a], and Som Gurung[c]

Presenting Author: Stephen Hughes (stephen.hughes@uq.edu.au)
[a]School of Mathematics and Physics, University of Queensland, St. Lucia, QLD 4072, Australia
[b]UQ College Limited, St. Lucia, QLD 4072, Australia
[c]Paro College of Education, Royal University of Bhutan, Paro, Bhutan

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Globally, COVID-19 has had a profound impact on education. During the height of COVID-19 nearly all instruction was delivered online. Online delivery of education has continued as we enter the post-COVID-19 era, and a hybrid model has emerged in which teaching is delivered face-to-face and online simultaneously. In physics education there are many opportunities for small-scale experiments to be used in the hybrid model and for online students to do their own experiments at home. An example of this is using a laser pointer to demonstrate that the wavelength of light decreases when travelling from a lower to higher refractive index medium. The decrease in wavelength cannot be observed directly but can be observed indirectly through diffraction.

One such experiment is to reflect a violet laser off a CD (Hughes et al., 2022). The number of possible diffraction orders is given by the track spacing divided by wavelength. In water, with a refractive index of 1.33, the wavelength of 405 nm (violet) light is $= 405/1.33 = 305$ nm. In air, $1600/405 = 3$ diffraction orders are observed, but in water $1600/305 = 5$, as shown in figure 1. Dilute tonic water can be used to enable the diffracted beams to be seen in low light since violet light causes quinine in tonic water to fluoresce. Students can use a mobile phone camera to take a photo of the diffraction orders, as seen in the figure, taken with an iPhone 12, and use a freely available image analysis program such as *ImageJ* (https://imagej.nih.gov/ij/) to measure the angle of the diffraction orders and compare with theory. The experiment is very cheap. The laser used to take the photo in figure 1 cost 4 AUD.

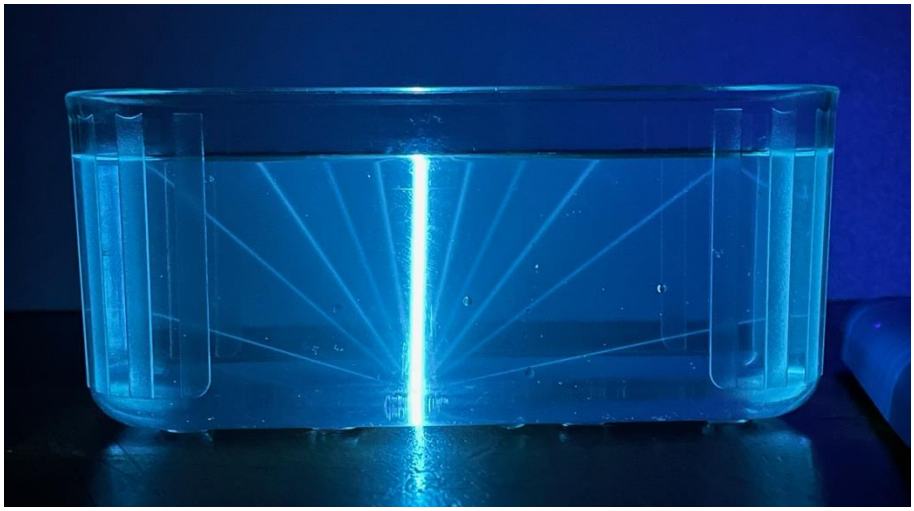

Figure 1.

REFERENCE

Hughes, S. Gurung, S, & Wegener, M. (2022). Shrinking violet. *Physics Education, 57*, 055016. https://doi.org/10.1088/1361-6552/ac7934

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