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Upper secondary students face optic diffraction using simple experiments and on-line measurements

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The phenomenon of optical diffraction is crucial in order to recognize the wave behavior of light [1]. It limits the resolving power of optical instruments, including the human eye. Therefore it is of fundamental importance not only for practical applications, for example as in microscopy, but also in ability of our eye to distinguish two objects, as well as in our perception of one colors next to another, aspect exploited for example by Pointillists painters.[2]

The exploration of the optical diffraction in didactic laboratory with on-line sensors offers a unique opportunity to high school students to have experience of this important phenomenological context. Activities of computer modeling allow to pass from phenomenology to its interpretation. [3-5]

A research-based path was developed for upper secondary school approaching the optical diffraction through the experimental exploration of the diffraction pattern produced by a laser beam incident on a single slit. Students first analyze the diffraction pattern qualitatively, recognizing the global properties, then measuring with on-line sensors the light intensity vs position, constructing empirical relations between order and position of minimum, order and position of maximum, position and intensity of maximum. A computer modeling, based on Huygens' principle, is used to fit experimental data, showing the empirical relations, characterizing the experimental distribution and that obtained with the model. [3, 6]

Experiments in school was performed with 85 students, using IBL tutorial worksheets e pre-test, post-test. Positive learning paths of students emerged concerning the role of diffraction in everyday situations, activated by the qualitative analysis of the global properties of the diffraction pattern. The characteristic properties of the diffraction pattern, explored with on-line sensors, combined with the modeling activities aided students to move from a geometric point of view, based on rectilinear rays, to a physical one, based on an interference / intensity analysis.

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