



# XII Reunión Nacional de Óptica

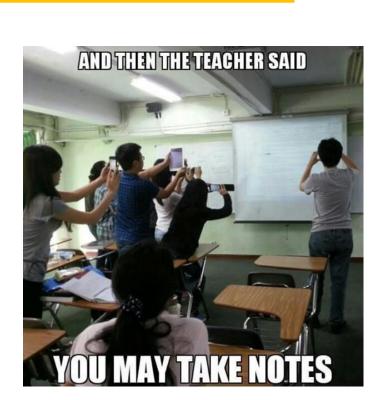
<sup>1</sup> Department d'Òptica i d'Optometria i Ciències de la Visió, Universitat de València, 46100 Burjassot, SPAIN 50 Aniversario SEDOPTICA <sup>2</sup> Departamento de Ciencia de Materiales, Óptica y Tecnología Electrónica, Universidad Miguel Hernández, 03202 Elche, SPAIN <sup>3</sup> Instituto de Bioingeniería, Universidad Miguel Hernández, 03202 Elche, SPAIN <sup>4</sup> Departament d'Òptica, Farmacologia i Anatomia. Universitat d'Alacant. 03690 Alicante, SPAIN

#### **ABSTRACT**

**Networking** means to **interconnect people sharing** an interest in the success of a particular enterprise. We present our Innovative Education Networking which develop learning tools for Optics and Photonics. The network is composed by University of Alicante, the University of Miguel Hernández in Elche and the University of Valencia. The academic networking staff is expert in Optics and Photonics teaching. Other student demands multimedia applications, in that sense we are developing several online materials based on video-tutorials of laboratory experiences, also different activities to enhance students creativity and interest in Optics and Photonic. That will result in **interesting educational synergies** between universities and promote student autonomy for learning Optics.

#### MOTIVATION

This picture summarized very well our motivation. Students are demanding changes in the way of teaching. Now due to Higher Education European program, academic methodology focuses o the student autonomous learning rather than in the role of mere information receptors



#### **1. INTRODUCTION**

Bologna process has transformed teaching methods and structures in **Spanish Higher Education** in the last seven years. In that sense, students need many new tools and teaching material to accomplish such autonomous learning process, because there is some evidences that traditional approaches are **ineffective in teaching physics concepts**, including light and optics concepts. Electronic Learning or e-learning is a type of technology-supported education learning using computer technology such as online classrooms, however one of the main drawbacks is the lack of social interaction. In that sense, blended learning (b-learning) combines both technology and regular teaching methods (face to face lessons, lab sessions, guidance and coaching).

A "network" according to the meaning here is a **web of interconnected** people sharing an interest in the success of a particular enterprise. Photonics educators can benefit from being better connected to each other, not just to information. In that sense, the department of Policy Training and Educational Quality of the University of Valencia, in Spain, has bet on innovative education networking. The requirements to apply for that kind of innovative project is to be minimum ten teachers and three universities from Spanish **territory**. The aim of our network is to develop b-learning tools for Optics and the network is composed by University of Alicante, the University of Miguel Hernández in Elche and the University of Valencia. We are a consolidated network and the University has granted with innovation projects since last 4 (UV-SFPIE DOCE14-222505, UV-SFPIE GER15-314280, years UV-SFPIE\_GER16-418575 and UV-SFPIE\_GER17-589019). In Fig. 1 we show our hoe web page where all those learning tools are linked together.

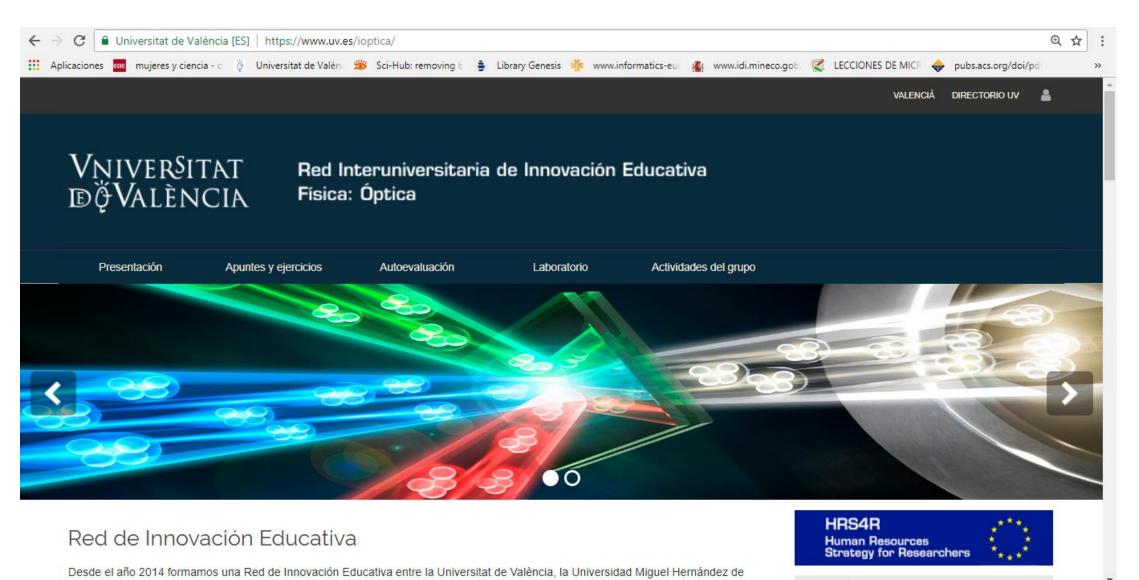


Figure 1: Snapshot of the Innovative Education Group home page (www.uv.es/ioptica)

# **RED INTERUNIVERSITARIA DE INNOVACIÓN DOCENTE EN LA** ENSEÑANZA DE LA ÓPTICA Y LA FOTÓNICA

# P. García-Martínez<sup>1</sup>, I. Moreno<sup>2</sup>, M. M. Sánchez-López<sup>3</sup>, I. Fernández<sup>1</sup>, C. J. Zapata-Rodríguez<sup>1</sup>, M. Nasenpour<sup>1</sup>, J. Espinosa<sup>4</sup>, D. Mas<sup>4</sup> and J. J. Miret<sup>4</sup>

# **2. VIDEO-TUTORIALS FOR SELF ASSESMENTS**

The video format is familiar to students, contains a wealth of spatial and temporal data, and provides a bridge between direct observations and abstract representations of physical phenomena. Video-tutorials enhance and speed up the learning process due to the visually easy followed procedures step by step. In fact, we started to work on video-tutorials due to the **insistent student** demands. Laboratory experiences related to the image formation through optical systems is fundamental to understand the subject properly. Solving the problems in the laboratory should help you explain many of student daily experiences with the concept of light rays that travel from sources or illuminated objects in straight lines and suffer refraction through prism, parallel plates, lenses, etc

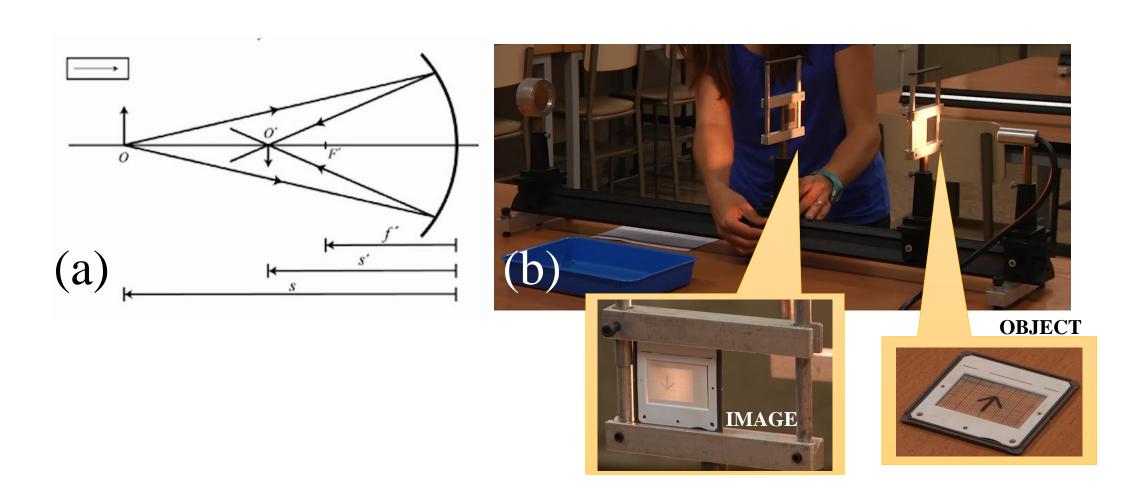


Figure 2: Different snapshots of Geometrical Optics Lab video-tutorials

Video-tutorials have a duration of **ten minutes** approximately. At the beginning of the video-tutorial we review the theory and we clarify the objective of the practice. Then, we show the different optical components that are needed and we implement the experiment putting special attention in recording the relevant parts of the experiment.

### **3. INTERACTIVE LEARNING MULTIMEDIA EXERCISES**

The student is offered a set of 24 exercises solved using only graphical tools for optical ray tracing. The approach of each exercise is based on a **multiple-answer** operative scheme, which can only be answered correctly after the graphic resolution of the problem. Prior to the approach of every problem, a brief theoretical introduction is advanced, which contextualizes such problem

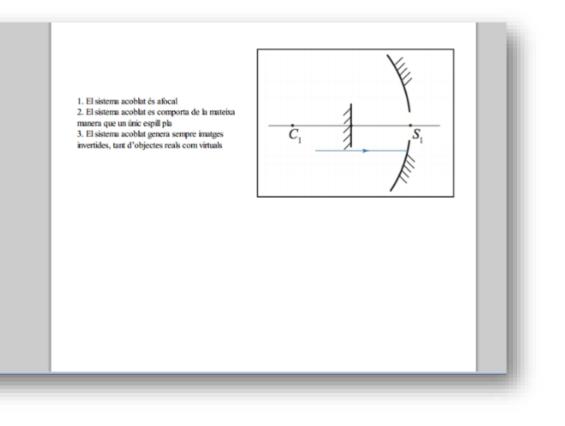
	Manual d' Òptica Geomèl per al traçat gràfic de raig	l d'Optica Geometrica			Imprimir Total: 1 hoja de papel	
	3.2. Doblet de lents esfèriques				Imprimi	
nual d'Optica Geométrica per- açoit gràfic de naiga ex	Un doblet de lents primes enfiriques resulta de la combinació altre acoblament de dos elements, podera trobar tres espais ben amb l'espai objecte de la primera lent L1, 2) l'espai imarge de L1 l'espai internedi comparatri per l'espais unstre de L1 i l'espai d	diferenciats: 1) l'espai objecte del sistema o doblet que va a coincidir amb l'espai imatg	optic que aci coincideix	Destino	EPSON Stylus DX8400 S Cambiar	
atucció at de problemes afracció i roficeto	Commercem resultent un problema que está basat en una versió simplóficada de la ullera de Galileo Problema 16 Considereu l'acoblament de les dos lents esfériques primes de la figura adjunta. La lent L1 per la que incideix la llum en primer lloc és convergent i té el seu pun focal objecte F1 i puns focal imatge F1 representats a llarg de l'eix òptic. La seguna leur	Páginas	Todo			
rmació d'inatges amb mes simples rmació d'imatgas amb	en pranter noc es contrengent i ter el seu pom nocar ordecte e e t pom nocar ordecte e e termange e e nordecte que e e entre que e e entre de la pomició de E2: Es col·loca un punt objecte O davant de la primera lent. Trobes la insarge O' formada pel dobles de lents primes. A més, trit una de les seguetas opcians:			Caniar	p. ej. 1-5, 8, 11-13	
rises conferiques. Lorits confériques. Deserted providents				Copias	Vertical	
Elements cardinals Formació d'invatges usant s principals i focals Sistemes plocals	<ol> <li>Existeix inversió de la imatge, la qual és real.</li> </ol>	Q.			Horizontal	
Sistemes catóptica.i dióptica L'espill equivalent	<ol> <li>Excistrix inversió de la imatge, la qual és virtual</li> <li>No exosteix inversió de la imatge, seut aquesta virtual.</li> </ol>	$F_1$ $F'_2$	$F_1'F_2$	Color	<ul> <li>Color</li> <li>Blanco y negro</li> </ul>	
logula				Márgenes	Predeterminado 👻	
	Mostra Roalimentáció		_	Configuración	<ul> <li>Encabezado y pie de página</li> <li>Doble cara</li> </ul>	
				Imprimir utilizan (Ctrl=Shift=P)	do el cuadro de diálogo del sistema	

Figure 3: Different snapshots of Interactive Learning exercise

The interactive tool that we developed has the additional objective of impact very directly on **non-attendance and independent study of a student**. For this reason, this tool is mainly based on problem solving specifically designed for self-study. The material incorporates the necessary elements that allow students to know the degree of success in solving the proposed problems



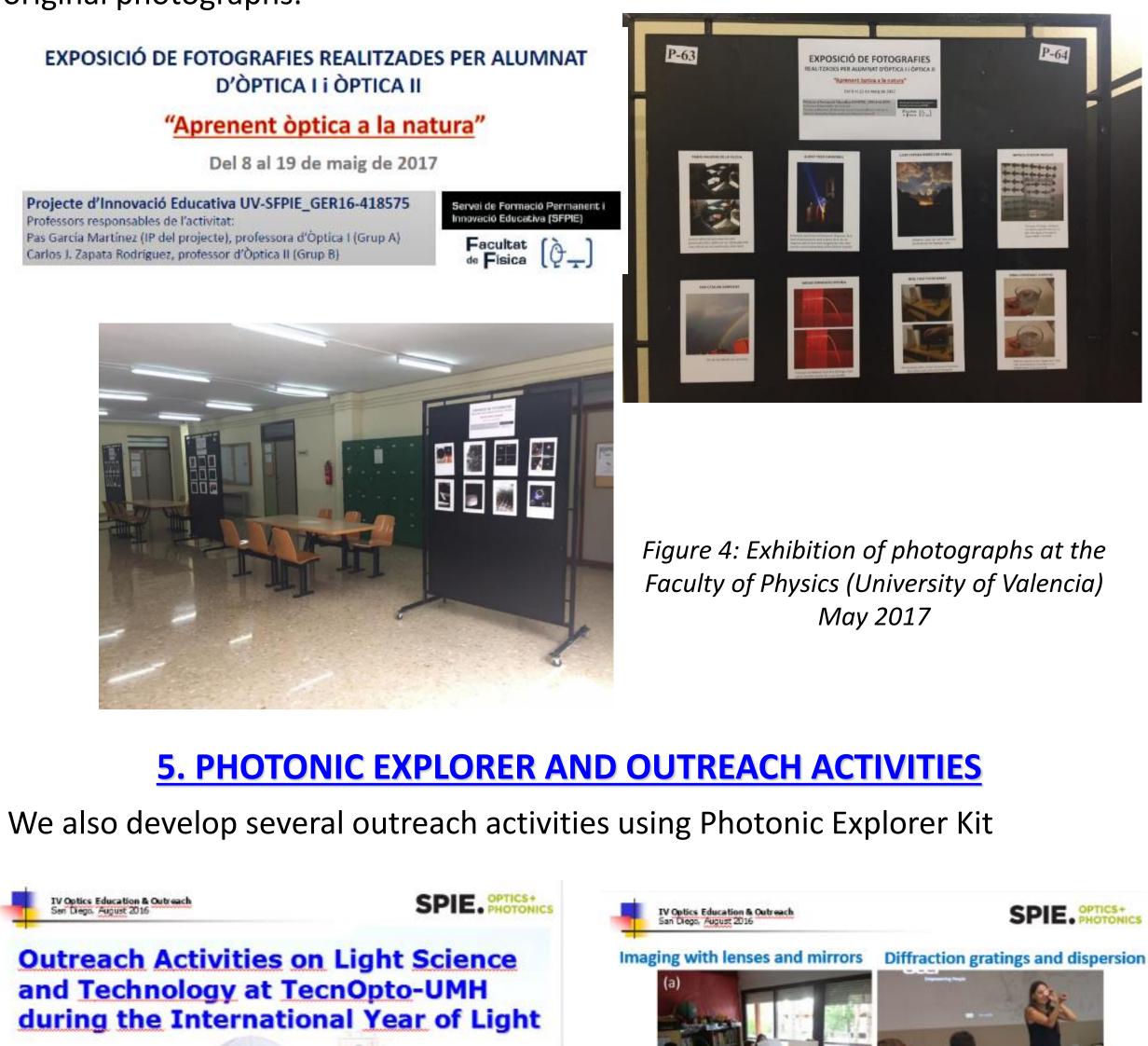
Universitat d'Alacant Universidad de Alicante



# **4. LEARNING OPTICS IN NATURE AND DOMESTIC EXPERIMENTS**

The students perform photographs made by themselves with scientific content and illustrating physical phenomena learned in class of Optics. This makes students much more involved in learning by transferring the theoretical contents to their domestic and everyday environment.

We organized at the faculty, a picture competition and we gave three different awards, depending on the optics theoretical content, as well as visual and original photographs.





## **6. CONCLUSIONS**

- University of Valencia
- facilities for **improve teaching** around Optics.

#### **REFERENCES**

Photonics: ETOP 2015, 97930L

#### **Acknowledgements:**

This work was supported by the Vicerectorat de Polítiques de Formació i Qualitat Educativa de la Universitat de València (Project UV-SFPIE\_GER17-589019).







Servei de Formació Permanent i Innovació Educativa (SFPIE)

• An **innovative education networking** involving academic staff from three Spanish universities linked together around **Optics and Photonics** has created thanks to the department of Policy Training and Educational Quality of the

• This possibility is a real synergies between universities to share materials and

[1] García-Martínez, P., Zapata-Rodríguez C. J., Ferreira, C., Fernández, I., Pastor, D., Nasenpour, M., Moreno, I., Sánchez-López, M. M., Espinosa, J., Mas, D., and Miret, J. J. (2015) Proc. SPIE 9793, Education and Training in Optics and