



## **MASTER IN PHOTONICS – PHOTONICS BCN EUROPHOTONICS-POESII MASTER COURSE**

### **PROPOSAL FOR A MASTER THESIS**

**Dates: 2020**

**Laboratory: Center for Sensors, Instruments and Systems Development (CD6)**

**Institution: Universitat Politècnica de Catalunya**

**City, Country: Terrassa**

**Title of the master thesis:** Improvement of a system to measure the tear film stability. **Name of the master thesis supervisors:**

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#### **Summary of the subject:**

The tear film is the first surface of the eye which is in contact with the air. When its normal function is altered dry eye appears, a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. Dry-eye has high prevalence, up to 30%, and which is expected to increase due to the use of contact lenses, LASIK and all sorts of displays.

There are several tests in clinical practice for dry eye diagnosis. Despite the wide use of those techniques in clinical practice, there is general agreement of their limitations as being subjective and invasive. In this sense in the last years a big effort has been made to develop objective and non-invasive methods for dry eye diagnosis based in new technologies. However, up to date no gold-standard exists for the diagnosis of dry eye, and some of the methods based in new technologies are unfeasible in clinical environment as cannot be adopted to daily clinical practice, where inexpensive and easy-to use tools are needed.

In the last years our research group has proposed a new method for tear film evaluation by means of corneal reflex image degradation analysis, a simple technique based on

photonics. When the tear film is in good condition the image of coherent light reflected on the cornea, is regular and of good quality. However, when the tear film breaks up, the corneal reflex degrades. By means of the corneal reflex image degradation, our method evaluates the tear film and could be used on dry eye diagnosis. Up to date, our research group has done basic research on the field, developed the method, built a pre-prototype and carried out measurements in laboratory and clinical conditions. Fruits of this labor, we have done international communications of the scientific progresses, published a paper on an international journal and patented the method. However, the technique presents a main limitation on the measured area. Due to the optical design, only an area of 2mm diameter of cornea are measured, while 8mm are required in the clinical practice.

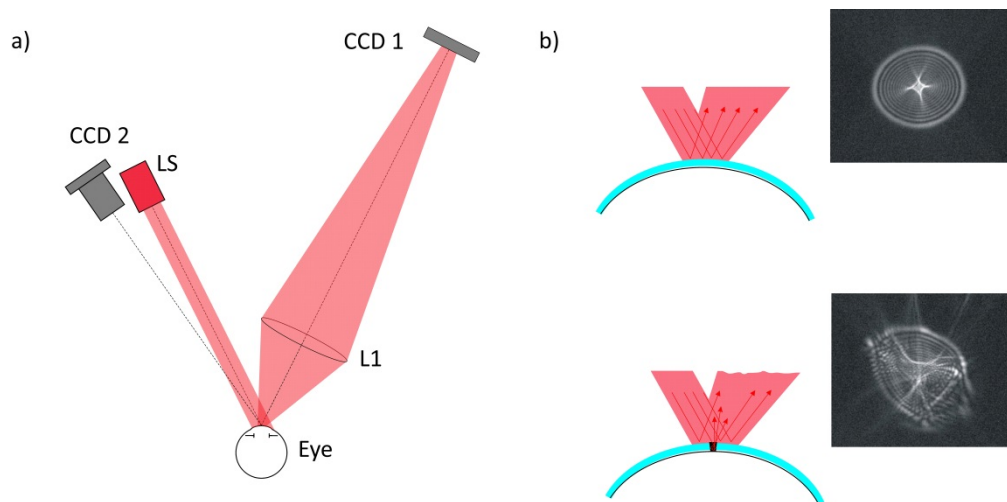


Fig. 1. a) Schematic diagram of the setup. LS: light source, L1: lens, CCD 1 and CCD 2: CCD cameras. b) Representation of light reflections on tear films and images recorded from (upper) a smooth and regular tear film and (lower) a broken up tear film with a break up.

Your master thesis project will consist of the proposal of a new optical design in order to increase the measured up to 8mm, the construction of a setup with the new design and its validation.

**Keywords:** tear film, dry eye, biomedical photonics.

**Additional information :**

\* Required skills: Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.