

STSM REPORT

STSM Application number: COST-STSM-BM1205-25212

STSM Grantee: Ilona Kuzmina

STSM title: In vivo skin cancer detection using diffuse reflectance spectroscopy

Home Institution: Institute of Atomic Physics and Spectroscopy, University of Latvia

Host Institution: Institute of Electronics, Bulgarian Academy of Sciences

STSM period: 15.03.2015.-29.03.2015.

STSM purpose: In vivo study of different skin pathologies using equipment for diffuse reflectance developed in the host institution.

Description of the work carried out during the STSM:

During this STSM in vivo diffuse reflectance measurements were performed in the University Hospital “Tsaritsa Ioanna-ISUL” with collaboration with Institute of Electronics in Sofia. All ethical issues and approvals for measurements were received from the ethical committee of the hospital. 20 patients were inspected and 31 lesions such as seborrheic keratosis, dermal and dysplastic nevi, basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and melanoma were measured. Seborrheic keratosis and dermal nevi are considered benign skin malformations, while BCC, SCC and melanoma are malignant lesions, dysplastic nevi are unusual benign moles which have a tendency to develop into melanoma more often than ordinary moles.

For this study equipment (Ocean Optics Inc.) from the Institute of Electronics was used. Tungsten halogen lamp was used as a light source; spectra were measured by USB4000 spectrometer and fibre optic cable of 7 fibres: one was used for illumination and the other six – for signal detection. Before each measurement white and dark references were obtained. During measurements reflectance spectra of lesion and healthy skin were taken from each patient. Obtained spectra were normalized and converted to CIE XYZ coordinates. From these coordinates CIE xyY and L*a*b* colour parameters were calculated. Spectra and colour parameters were compared to find diagnostic criteria.

Description of the main results obtained:

Differences among reflectance spectra of different skin lesions and healthy skin were identified. Calculated colour parameters of benign and malignant lesions were compared and some differentiation features were specified.

Fig.1 shows example of obtained reflectance spectra from patient with melanoma. Spectra were taken from three places of the same melanoma and healthy skin. As it was expected melanoma has lower reflectance and less notable haemoglobin peaks in the region 500-600nm due to higher melanin absorption.

Colour parameters (a*b*) of melanoma, basal cell carcinoma, dysplastic and dermal nevi are shown in Fig.2. Lesions are grouped in different regions of graph; however some parameters of dermal nevi are located in the region of BCC. Colour parameters of seborrheic keratosis and SCC also occupy the same region as BCC (not shown in the figure). Melanoma and dysplastic nevi are separated in different quadrants of the coordinate plane though confident conclusions about separation of these lesions are not possible, because we have data only from one melanoma (spectra were taken from three places of lesion) and two dysplastic nevi (from one patient). Lightness parameter L* didn't show any diagnostic potential.

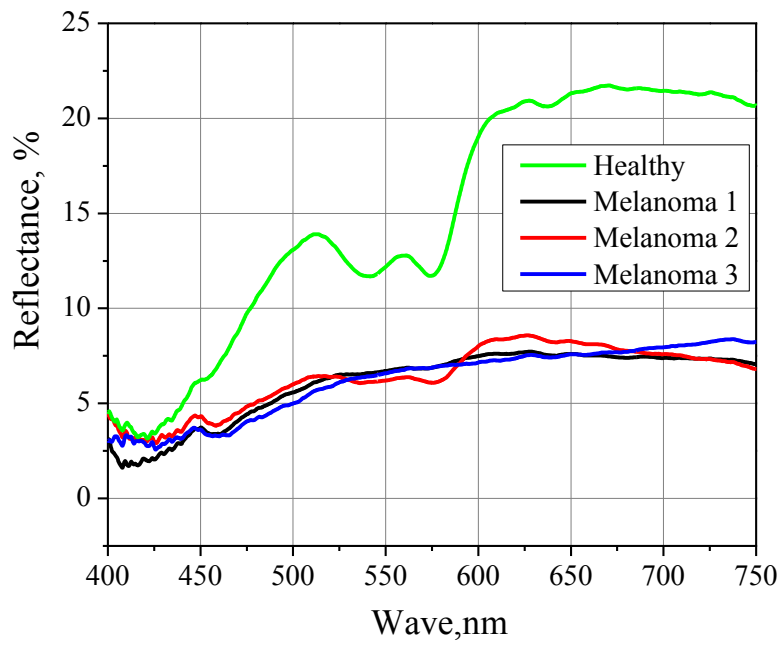


Fig.1. Reflectance spectra of melanoma and healthy skin of one particular patient

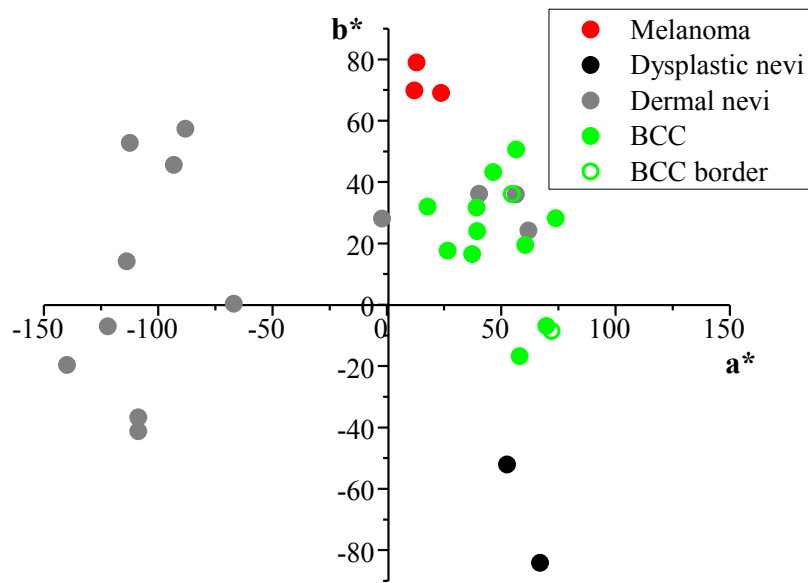


Fig.2. Colour parameters (a^* , b^*) of different skin lesions

One of the patients had both dysplastic and dermal nevi. Obtained colour parameters of these moles (Fig.3) are separated in opposite quadrants that indicate good potential for diagnostic.

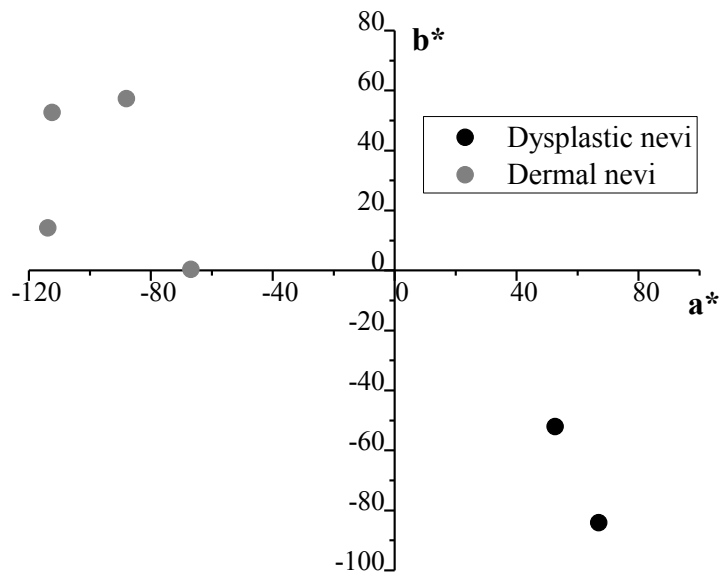


Fig.3. Comparison of colour parameters of dysplastic and dermal nevi from one particular patient.

Mutual benefits for the Home and Host institutions:

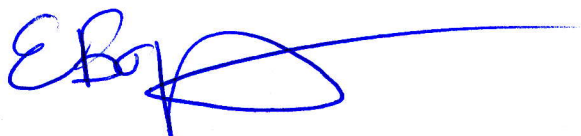
Cooperation between laboratories, mutual exchange of knowledge and experience

Foreseen journal publications or conference presentations expected to result from the STSM (if applicable): Eventually possible after more detailed analysis of spectra and colour parameters.

Confirmation

Herewith I would like to confirm the completion of the STSM applied by Ilona Kuzmina. She worked in this Project from 15th to 29th March 2015 and fulfilled the objectives of the STSM work plan in the Institute of Electronics, Bulgarian Academy of Sciences.

Assoc. Prof. Dr. Ekaterina Borisova
Bulgarian Academy of Sciences
Sofia, Bulgaria

A handwritten signature in blue ink, consisting of stylized initials 'EB' followed by a long horizontal stroke that loops back under the initials.

STSM outcome form

STSM application number	Home institution & country	Host institution & country	BM1205 WG	Objective of the collaboration	Results of the collaboration
COST-STSM-BM1205-25212	Institute of Atomic Physics and Spectroscopy, University of Latvia, Latvia	Institute of Electronics, Bulgarian Academy of Sciences, Bulgaria	WG4	In vivo skin cancer detection using diffuse reflectance spectroscopy	Diffuse reflectance spectra and colour parameters of different skin lesions were obtained and compared.