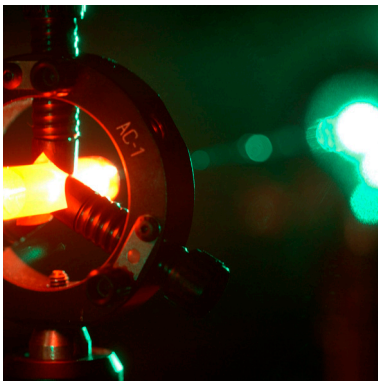
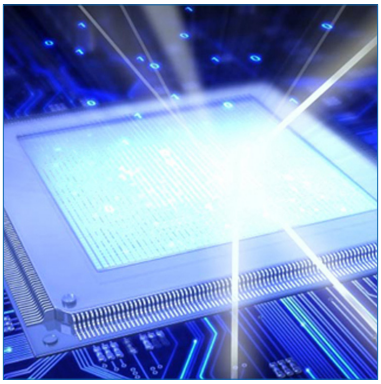
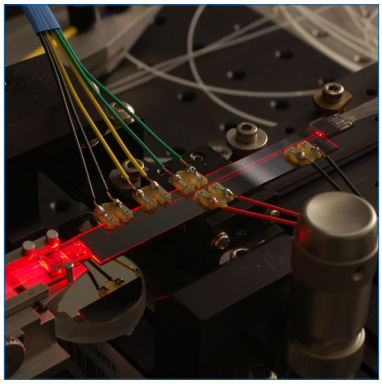
Poster

July 23, 2018

Laser Tech 2018







International Conference on

Laser, Optics and Photonics

August 23-24, 2018 | Paris, France

Optical telescope for micro satellite: Design and analysis

Ching Wei Chen and **Chia Ray Chen**
National Space Organization, Taiwan

Optical design of a reflecting telescope for use in a micro-satellite mission is reported in this study. A Cassegrain type telescope for earth observation techniques is adopted in this design. The primary and secondary mirror are circular clear apertures with 380mm and 144mm in diameter. The effective focal length is 2525mm operated at 561km altitude. A commercial 5120 × 5120 CMOS image sensor with a pixel size of 4.5μm × 4.5μm is applied, which capture a corresponding 5km × 5km swath area. The ground resolution is moderate to be 1m and 2m for PAN and MS applications. The MTF is expected to be about 0.3 at camera Nyquist frequency at 111lp/mm. The tolerance analysis is performed for further understanding on fabrication and assembly errors. The defocus and LOS equations are also evaluated in this study. These analytical results are the important reference in micro-satellite mission for self-reliant space technology development in Taiwan.

Speaker Biography

Ching Wei Chen has received his Ph.D. in electro-optical engineering from the National Chiao Tung University, Taiwan in 2008. He is currently an associate researcher with the National Space Organization (NSPO), Taiwan. His current research interests include optical design, optical testing, space technology, ultrafast optics and terahertz photonics.

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Droplet optofluidics as an application tool for biology and interface sciences

Zain Hayat, Bruno Le Pioufle and **Abdel el Abed**
Ecole Normale Superieure Paris-Saclay, France

Fluids in a controlled environment can perform operations that mimic the cellular and intra-cellular affairs. Such fluidic control at submicron scale is best provided by science of microfluidics where the platforms developed till date proved their significance in mimicking the organ structure. Often, manipulations of such tiny volumes of fluid are assisted by light and exploits their interaction to create "digital" micro-systems with highly significant scientific and technological interests in many areas such as single-cell studies, selected targeting, drug release and genetic sequencing. As greater aspect of technology design and application in biology, advancements of lab-on-chip technologies to artificially grow lung, heart and kidney models as well as insights on arteries and veins performance, that buildup those sophisticated organs had presented the potential of this science for diagnostics and drug delivery. Recent trends in the vary science are to understand what happens at cellular level when those diagnosis are performed and then observing those tests in real time. Biomimetic membranes standout as a remarkable tool to perform those tests in live feed while being a fragile structure often perish before the test completion. To tackle this issue a prospect is to develop lab-on-chip microfluidics droplet interface bilayer platform for stable biomimetic membrane generation. Soft lithography as a hardware realization tool is employed not only to develop a microdroplet generation accessory but also to interact those microdroplets by a multilayered geometry. This stability concern leads to successful imaging of membrane characteristics and opening new dimensions for modern medicine.

Speaker Biography

Zain Hayat is currently pursuing PhD at the Ecole Normale Superieure Paris-Saclay, France. His research focuses on the design of new optofluidic systems for droplet content analysis. Currently he is developing a highly sensitive optofluidic platform to study the dynamics and electro-optical properties of droplets interfaces and droplet-interface-bilayers (DIBs).

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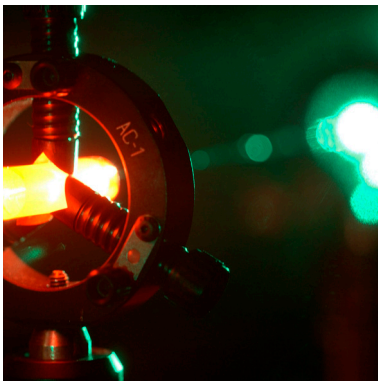


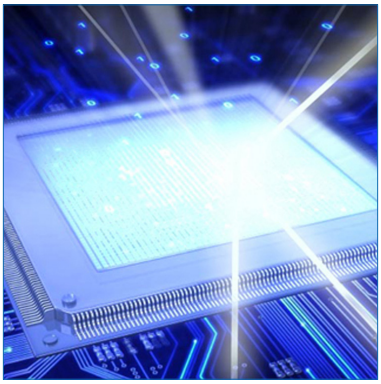
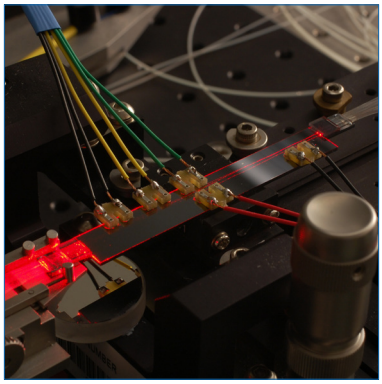

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Ten conclusions after ten years experience in radical endovenous laser therapy of lower extremity varicose veins

Ivan Maly, S Julinek and **D Klein**
General and Vascular Out-patient Surgery Centre, Czech Republic

The paper is aimed to show our experience with endovenous surgical treatment of superficial venous insufficiency of the lower limbs. We have been performing the radical endovenous laser therapy in the treatment of the chronic venous insufficiency of the great and the small saphenous veins with the device Cerelas D15/Biolitec Inc./ since 2004. The 980nm wavelength was used until the end 2007, and the 1470nm wavelength has been used from 2008 to date. All patients underwent the procedure under the conditions of the aseptic operation theatre, the length of their hospitalisation ranged from a few hours to 24 hours. In total, we treated 835 patients, 65.5% of them were females, the great saphenous veins were closed in 724 cases, the small saphenous veins in 103 cases, bilateral procedure was performed in 102 cases and the accesory veins in 77 cases. The power of the laser beam decreased from 12W in the groin to 2W in the ankle. The amount of energy released per unit length oscilated around 80J/cm. We always sought to treat simultaneously all varices on the extremities during the initial endolaser therapy. All dilated branches of the main veins were closed either by laser, or instrumentally with combined approach, or by sclerotisations.

Speaker Biography

Ivan Maly born in Prague March 16th, 1944. He has been graduated on Charles University in Prague, Czech Republic in 1967. From 1967 he worked as a general surgeon and after time with the vascular specialisation, in Central Military Hospital in Prague till 2003. He has been, from 2004, the private surgeon in General and Vascular outpatient centre and at present, he is interested in the endovenous laser surgery of the lower limbs.

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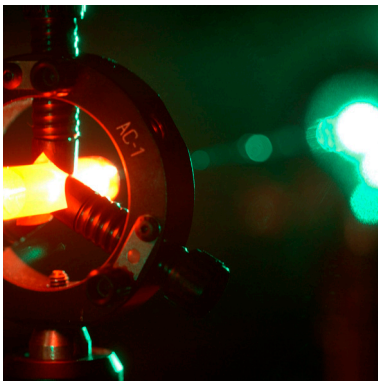


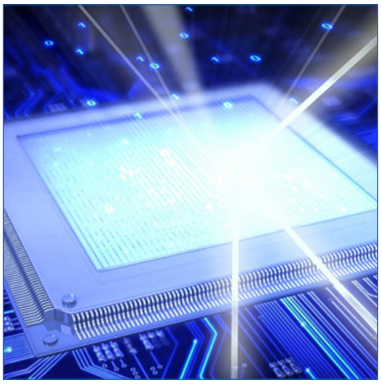
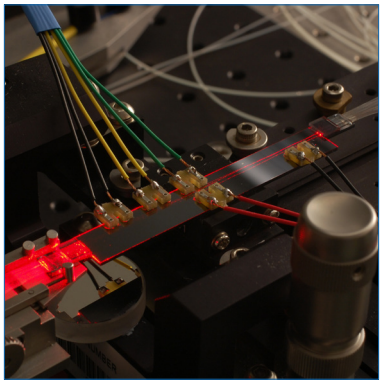

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Optical frequency comb generation utilizing Mach-Zehnder modulator and multi-laser sources

Driss EL Idrissi and **Abdella Battou**
National Institute of Standards and Technology, USA

We investigate a wideband optical frequency comb generator based on multi-laser sources and a single-stage Mach-Zehnder modulator. The generated comb lines were successfully increased as compared with a single laser. In this paper, we propose a new technique to increase the generated comb lines by using multi-laser sources injected simultaneously into an MZM. We also provide a simple equation to correctly define the wavelength of each laser source needed to duplicate the comb signal without a gap. The preliminary results show the multiplicative growth of the generated comb lines as a function of the number of launched laser sources. A new technique for generating a wideband optical frequency comb based on multi-laser sources and a single MZM has been proposed and simulated. As more and more laser sources are launched simultaneously using a WDM multiplexing system, more OFCG signal bandwidth achieved accordingly.

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Robust and optimal quantum control for some classes of linear quantum systems

Aline I Maalouf
University of New South Wales, Australia

As experimental quantum technology continues to improve, the idea of manipulating microscale quantum processes rather than just observing them is rapidly gaining ground. In particular, the manipulation of quantum systems using continuous measurement and feedback control has generated increasing interest in the last few years due to its potential applications in metrology, communications and other quantum technologies. Also, the area of quantum control is of theoretical interest, since it connects the well-developed field of classical optimal control theory to fundamental questions regarding the structure of information and disturbances in quantum mechanics. Therefore, significant interest has emerged in the area of quantum feedback control systems. Extending classical control theory to the quantum domain; i.e., to physical systems whose behaviour is not governed by classical physics but dominated by quantum effects, has become an important area of research. It is also an essential prerequisite for the development of novel technologies such as quantum information processing, as well as new applications in quantum optics, quantum electronics and quantum chemistry. The most effective strategies in classical control applications involve feedback control. However, the implementation of classical feedback control for quantum systems poses severe challenges since quantum measurements tend to destroy the state of the system (wave-packet reduction). Nevertheless, the possibility of continuous monitoring and manipulation on a natural time-scale has recently become realistic for some quantum systems. This may be viewed as a first step in the direction of closing the gap between quantum feedback control and classical control theory. In this talk, I will define robust and optimal quantum control which are at the core of feedback control from an engineering perspective and go through my own contributions in that domain.

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Electronic ICs supporting high-speed optical transceivers for short-reach applications

Peter Ossieur[1], G Coudyzer[1], H Ramon[1], J Lambrecht[1], M Vanhoecke[1], L Breyne[1], S Zhou[2], S Facchin[2], P D Townsend[2], G Torfs[1], X Yin[1], and **J Bauwelinck[1]**

[1]Ghent University, Belgium

[2]Tyndall National Institute and University College Cork, Ireland

We present progress on high-speed driver and receiver integrated circuits intended for high-capacity short-reach links inside data centres. Optical transceivers for these applications need to provide high baud rates, while being highly energy efficient (<<10pJ/bit) and occupy small physical footprints. Realization of such electronics in a CMOS process offers the advantage of monolithic integration with large-scale digital chips. The low (<1V) breakdown voltage of the transistors in deep sub-micron CMOS limits the achievable drive voltage, which may limit the optical modulation amplitude. At the receiver side, it can be difficult to achieve low-noise, high gain and wideband amplification. Integration into a large-scale digital chip will require consideration of crosstalk due to logic switching activity. In case analog performance is important then SiGe BiCMOS processes can be considered. Driver circuits need to generate sufficient current or voltage swing into or across the electrical load presented by the optical modulator, possibly overcoming breakdown limitations of the used CMOS or SiGe BiCMOS processes. Examples developed for VCSELs (vertical cavity surface emitting lasers), Silicon Photonic microring resonators, electro-absorption modulators, lumped Silicon Photonic and Indium Phosphide travelling wave Mach-Zehnder modulators using deep sub-micron CMOS and SiGe BiCMOS technologies are given.

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Wave scattering by many small impedance particles and creating materials with a desired refraction coefficient

Alexander G Ramm
Kansas State University, USA

The theory of acoustic and electromagnetic (EM) wave scattering by one and many small impedance particles of arbitrary shapes is developed. The basic assumptions are: $a << d << \lambda$, where a is the characteristic size of particles, d is the smallest distance between the neighbouring particles, λ is the wavelength. This theory allows one to give a recipe for creating materials with a desired refraction coefficient. One can create material with negative refraction: the group velocity in this material is directed opposite to the phase velocity. One can create a material with a desired wave focusing property. Equation is derived for the EM field in the medium in which many small impedance particles are embedded. Similar results are obtained for heat transfer in the media in which many small particles are distributed.

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Overcooled gas flow assisted quantum computing

Konstantin Lyakhov

Jeju National University, South Korea

This paper is addressed to possibility of implementation of quantum computations by resonant excitation of target isotopologues in overcooled gas flow. The phenomena of quantum states population control by the sequence of laser pulses is proposed to employ. For optimal control of excitation laser pulses should be specifically shaped to selective excite target isotoplogue. Moreover, their periodicity also plays essential role. Supersonically overcooled and rarefied gas flow can be thought as a quantum Turing machine, because molecular spectra are well resolved and have rather long lifetime. Therefore, better control over them by laser field can be implemented. Decoherence level in this ensemble of molecules and clusters, representing gas flow, can be controlled by its rarefaction degree and extension. Evolution of quantum states population is guided by the sequence of femtosecond lasers installed along the gas flow direction. Each laser emits laser pulse of predesigned shape, which is related to some command written for the quantum computer (unitary transformation). Thus, the quantum state in the end of gas flow is the result of calculation. If gas flow transition time is not long enough to complete all sequence of required commands, received final state (intermediate solution) is recorded and translated into laser pulse shape, assigned for initialization. Otherwise, initialization laser pulse is step-like with intensity just high enough to excite all isotopologues to the same quantum state. Final quantum state of the gas flow is read by the classical computer by finalizing measurement, which is implemented as following: Once irradiated gas flow feeds spectrometer, where electrons, corresponding to resulting quantum state, are ejected by applied ionizing laser pulse. Obtained electron energy spectra, bearing information of original optical spectrum, are recorded by the network of surrounding electrodes, and then amplified. By analog-digital convertor electrical currents induced on electrodes are transformed into digital format for further processing on the classical computer.

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Hybrid structured photonic crystal fiber for terahertz applications

KM Samaun Reza
FZI Research Centre Computer Science, Germany

Electromagnetic wave lying in between that of millimetre wave and Infrared ray in the frequency region of 0.1THz to 10THz has attracted the researchers for their wide spread application in the fields of sensing, biotechnology, imaging, security, pharmaceutical drug testing, spectroscopy and communication. But the biggest hindrance of its widespread development and commercialization material loss and propagation loss plays a vital role. Therefore, much research is conducted in this field for the development of ultra-low material loss Optical Fibers. In this letter a Kagome structured photonic crystal fiber for low-loss terahertz (THz) wave guiding has been designed and analyzed. A perfectly matched layer (PML) which is of 9% of the radius of the fiber has been used in the boundary to investigate the transmission characteristics. Most of the attention is given to the geometries of the fiber to increase the fraction of power transmitted through core air. The proposed fiber at the diameter of 420μm and porosity of 80% has shown ultra-low material loss of 0.0326 at relatively high frequency of 1.25THz. Properties like: Power fraction of the core air holes with respect to frequency and core diameter, responses of the effective material loss with respect to core diameter and frequency, confinement loss, dispersion have been reported and well discussed. The design can be fabricated following the existing fabrication technology. Due to the favorable wave-guiding properties of the proposed fiber, it can be anticipated that the proposed PCF can be applicable in polarized THz filters, sensors and multichannel communication.

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Multi - MW laser for new applications

Victor Victorovich Apollonov
GPI RAS, Russia

The analysis of the results achieved in the area of creation and practical use of the laser technology, rockets and space crafts, systems of flight control, and materials allows to develop a very wide complex of experimental, technical and technological works on the space vehicle prototype creation, able to be launched by laser propulsion mechanism and the laser system for launching as itself. The innovative project of such a works has received the name Impulsar Cooperation, which was not so long ago formed, includes many organizations of the rocket industry of Russia. Project of multi-module pulse-periodic CO_2 GDL system for launching with parameters: Specific energy value- 20-40kJ/kg, temperature of the gas-1800K and pressure- 4,0Mpa will be presented. Optical system of laser pulsed energy chain delivery and optical matrix of laser engine receiver will be discussed as well. In the report the basic characteristics of the engine will be compared with theoretical predictions and important stages of further technology implementation will be observed. Relying on the gigantic in its scale cooperation of different branches of science and industry organizations, first of all on the powerful experimental and production base, it is very possible to use the accumulated potential for full scale setup creation and for launching of such a Nano and Micro vehicles during the upcoming 3 years. Another very important task for such a laser is the orbital scale conductive channel in air and even vacuum development. Solar battery and ionospheric energy transmission from the space is the most valuable application for high repetition rate P-P GDL.

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Laser action in rare earth doped Borosilicate glasses in visible and NIR Region

Yogesh Kumar Sharma, Priyanka Goyal and **Neha Arora**
Kumaun University, India

The rare earth doped Borosilicate glasses have been prepared by standard techniques. The prepared glass samples have been characterized by XRD, SEM, EDAX, FTIR and TEM. FTIR gives the information about the borate network which lies in the wavelength region 650 - 1700 cm^{-1} and further verified by the TEM image. The fluorescence spectra were recorded in visible and NIR region. Laser parameters have been computed with help of absorption and fluorescence spectra. CIE Chromaticity diagram have been given in this paper for measuring the colour of vision that the human eye perceives and verifies the results of fluorescence spectrum. Pr^{3+} ion gives emission in the blue region and most probable transition for Pr^{3+} doped glasses are $^3P_o \rightarrow {}^3H_4$. Three laser transitions are observed for Nd^{3+} ion viz $^4F_{3/2} \rightarrow {}^4I_{9/2,\ 11/2,\ 13/2}$ among which the strongest laser transition is $^4F_{3/2} \rightarrow {}^4I_{11/2}$. Nd^{3+} ion gives red colour emission and lies in the red region of the chromaticity diagram. Sm^{3+} ion gives orange red emission and lies in the orange red region of Chromaticity diagram. The $^4G_{5/2} \rightarrow {}^6H_{7/2}$ transition is suitable for reddish – orange laser transition for Sm^{3+} ion. Er^{3+} ion gives green colour emission which is used for photonic applications. The suitable laser transition for Er^{3+} is $^4S_{3/2} \rightarrow {}^4I_{15/2}$ and this transition is perfect for green lasers.

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Passive Q-switched pulse Erbium doped fiber laser Antimony Telluride (Sb_2Te_3) as saturable absorber

Noor Azura Awang[1], N Zalkepali[1], Y R Yuzaile[1], Z Zakaria[1] and **A A Latif[2]**

[1]University of Tun Hussein Onn Malaysia, Malaysia

[2]University of Putra Malaysia, Malaysia

This paper demonstrates the passively Q-switched pulse Erbium doped fiber laser (EDFL) using thin film Antimony Telluride (Sb_2Te_3) as saturable absorber (SA) for the first time. The modulation depth of the Sb_2Te_3 is measured as 28.01% with input intensity 0.02MJ/cm^2 at 63.8mW pump power that operated at 980-nm laser source. Handmade mode-locked fiber laser is utilized for measuring modulation depth by using twin detector method with period 59.52ns and repetition rate 16.8MHz. The simple design is fabricated to generate passively Q-switched pulse fiber laser with maximum pump power at 69.5mW with an operating wavelength at 1560nm for this experimental setup. The repetition rate and pulse width are 30.21kHz and 0.54µs respectively. The Q-switched pulse energy is 29.43nJ and the optical signal to noise ratio is 63.82dB for this study.

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Two-sided half-reflective light dot plate is valid for all wavelengths, according to multiple angles

MHD Saeed Maroof
Damascus University, Syria

The semi-reflective plates of light are important visual elements used in optical experiments, optical electronic devices, and laser devices. But its work is limited to a single wavelength and must be placed according to a specific angle of direction, which is 45°, but if we have to use the length of another wave, a half-reflective plate should be used for another wavelength, and the plate should be adjusted at 45° angles to divide the incoming light. Two packets are quite equal in optical intensity. So, I worked in this research to design a semi-reflective light plate that works for any wave length in the visible and near red fields. The light can also be divided into two equal bands of optical intensity, even if the angle of direction of the plate is not 45° for several angles. Here lies the importance of this research. I hope this search serves many visual applications.

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