



## **Singapore-Hongkong Lightwave Workshop on Next Generation Optical Communication Technologies**

**Jointly Organized by:**  
**Network Technology Research Centre, NTU, Singapore**  
**IEEE LEOS Chapter, Singapore**

**And**

**Center for Advanced Research in Photonics,**  
**The Chinese University of Hong Kong**  
**IEEE LEOS and EDSSC Chapters (Hong Kong)**

**Date:** 29 November 2004  
(Monday)  
**Time:** 1.30am - 4.00pm  
**Venue:** Room 215, William Mong Man Wai Engineering  
Building, The Chinese University of Hong Kong

### **Workshop Objective:**

To present the latest research progress conducted in network technology research centre (NTRC) on next generation fiber-based optical communications. In this workshop, the design and analysis of novel tunable fiber ring laser, laser diodes, fiber Raman amplifiers, microstructured photonic-crystal fibers will be introduced. Also, the linear polarization effects, polarization mode dispersion and its applications in single-mode fibers will be presented. It serves as a platform to promote the research relationships and collaborations between two organizations.

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**\*\*\* ALL ARE WELCOME \*\*\***

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## **Program:**

**1:30 – 1:40pm**

**Welcome by Professor Chinlon Lin, Director, Center for Advanced Photonics Research, CUHK**

**1:40 – 2:00pm**

**“Lightwave Research in Network Technology Research Centre”**

**Speaker:** Dr Shum Ping, Director, Network Technology Research Centre, NTU



**2:00 – 2:20pm**

**“Design and Analysis of Laser Diodes for WDM system”**

**Speaker:** Dr Liu Hairong



**Abstract:** This presentation focus on our research work design and analysis of laser diodes for WDM system. During the presentation the proposal and analysis of the two dimensional VCSEL based wavelength converters will be presented. The new research works on the design and modeling of anti-resonant reflecting photonics crystal VCSEL will also be introduced.

**2:00 – 2:20pm**

**“Polarization mode dispersion and its applications”**

**Speaker:** Ning Guoxiang



**Abstract:** We present a new approach to determine the pulse broadening and power penalty due to first and second-order PMD as well as chromatic dispersion. A novel PMD emulator and two kinds of PMD compensators with Hi-Bi chirped grating will be introduced. Moreover, tunable microwave filter designs based on PMD applications will be discussed.

**2:20 – 2:40pm**

**“Theoretical analysis of microstructured air-silica fibers”**

**Speaker:** Yan Min



**Abstract:** Several numerical methods which are capable to analyze modal properties of complex-structured optical fiber will be briefly discussed. They include multipole (Rayleigh) method, finite-element method (FEM), finite-difference frequency-domain (FDFD) method. Several novel air-silica photonic bandgap (PBG) fiber designs will also introduced.

**2:40 – 3:00pm**

**“High Performance Fiber Raman Amplification For Optical Fiber Communications”**

**Speaker:** Tang Ming



**Abstract:** The advantages and impairments of fiber Raman amplification will be demonstrated based on the gain and noise performance as well as the fiber nonlinearity. Our proposed high performance double-pass discrete Raman amplifier will be introduced to enhance the Raman pump efficiency with affordable noise performances.

**3:00 – 3:20pm**

**“Design and Applications of Photonic Crystal Fiber”**

**Speaker:** Yu Xia



**Abstract:** Photonic Crystal Fiber (PCF, also known as Microstructured Optical Fiber) has attracted much of the attentions from researchers worldwide in the past few years. Flexible optical properties can be achieved by different microstructured fiber structures. The presentation will share with you some novel designs and potential applications of PCF.

**3:20 – 3:40pm**

**“Linear polarization effects in single-mode optical fibers”**

**Speaker:** Dr Dong Hui



**Abstract:** Basic polarization effects in single-mode fibers include birefringence and polarization dependent loss, which result in polarization mode dispersion in high-speed optical fiber communication system. In this presentation, a novel description of these polarization effects will be introduced based on the fixed-point theory and the differential geometry theory. Some new measurement methods on polarization vectors will also be proposed and demonstrated.

**3:40 – 4:00pm**

**“Tunable erbium-doped fiber lasers: modeling and experiment”**

**Speaker:** Dr Dong Xinyong



**Abstract:** The output power characteristics of a widely-tunable erbium-doped fiber ring laser (EDFRL) have been analyzed. The effects of emission wavelength, total intra-cavity loss, erbium ion clustering, output coupling ratio and active fiber length are investigated. A comprehensive theoretical model based on a two-level laser model with consideration of pair-induced quenching (PIQ) is proposed. To achieve good performance in an EDFRL, especially for a widely-tunable bandwidth of over 100 nm and high slope efficiency, numerical results, which are in good quantitative agreement with the experimental results, indicate that minimization of the intra-cavity loss as well as optimization of the active fiber length and the output coupling ratio are very important. It is found that the existence of erbium ion clusters in the active fiber can help an EDFL to emit at a longer wavelength, and hence may be favorable for achieving *L*-band laser although the output power is reduced and the power flatness is degraded significantly. These findings are useful for the design and optimization of erbium-doped fiber lasers, especially for tunable fiber lasers operating in the longer band or *L*-band.

**4:00 – 4:15pm**

Closing Remarks