

## **All-optical transistor/logic gates and active matrix laser display application based on anisotropic nonlinear responsive liquid crystal**

Tsung-Hsien Lin\*

Department of Photonics, National Sun Yat-sen University, Kaohsiung, 804, Taiwan

\*E-mail: [jameslin@faculty.nsysu.edu.tw](mailto:jameslin@faculty.nsysu.edu.tw)

Anisotropic photosensitive nematic liquid crystals made by incorporating anisotropic absorbing dyes are promising candidates for constructing all-optical elements by virtue of the extraordinarily large optical nonlinearity of the nematic host. In this presentation, I will demonstrate several room-temperature all-optical devices such as optical diode, optical transistor, primary logic gate operations and active matrix laser display applications based on such LC optical transistors. Owing to the anisotropic absorption property and the optical activity of the twist alignment nematic cell, spatially non-reciprocal transmission response can be obtained within a sizeable optical isolation region. Exploiting the same mechanisms, a tri-terminal configuration as an all-optical analogue of a bipolar junction transistor is fabricated. Its ability to be switched by an optical field enables us to realize an all-optical transistor and demonstrate cascability, signal fan-out, logic restoration, and various logical gate operations such as OR, AND and NOT. The demonstrated capabilities of these devices have shown great potential in all-optical control system, active matrix laser display and photonic integrated circuits.

**Speaker Biography**

[Tsung-Hsien Lin](#) received B.S./M.S. degree in Physics and Ph.D. degree in Electro-Optics from National Cheng Kung University (Taiwan) in 2002/2004 and 2006, respectively. Prof. Lin is currently a professor in the Department of Photonics and division director in Office of Research & Development, National Sun Yat-Sen University. He received Ta-You Wu Memorial Award (MOST), Excellent Young Scholar Award (Taiwan Comprehensive University System), Exploration Research Award (Pan Wen Yuan Foundation), Academia-Industry Collaboration Award and Distinguished Young Scholar from National Sun Yat-Sen University. The current research interests are photonic liquid crystal devices and advanced liquid crystal display. Prof. Lin has published over 60 scientific papers in international journals including *Advanced Materials*, *Advanced Optical Materials*, *ACS Photonics*, and *Scientific Reports*.