

Science Program presents

All-Optical Switches, Unidirectional Flow, and Logic Gates with Discrete Solitons in Waveguide Arrays

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Thursday, April 16 , 2015

12-1 PM

LH 143

We propose a mechanism by which a number of useful all-optical operations, such as switches, diodes, and logic gates, can be performed with a single device. An effective potential well is obtained by modulating the coupling between the waveguides through their separations. Depending on the power of a control soliton injected through the potential well, an incoming soliton will either completely transmit or reflect forming a controllable switch. We show that two such switches can work as AND, OR, NAND, and NOR logic gates. Furthermore, the same device may also function as a perfect soliton diode with adjustable polarity. We discuss the feasibility of realizing such devices with current experimental setups.



Dr. Usama have obtained my Ph.D. from the Niels Bohr Institute at Copenhagen University/Denmark in 1999. He spent 3 years afterwards in the University Utrecht/Netherlands as a postdoctoral researcher. Then he has joined the United Arab Emirates University in 2002 till presently. His main topic of research started with Bose-Einstein condensation during my Ph.D. and postdoctoral periods. He continued this subject in UAEU but gradually extended to nonlinear physics, solitons, and integrability.

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