



# Spin Magneto-optical Modulator (20160103, Dr. Jian-Ping Wang)

**Technology ID**

20160103

**Category**Engineering & Physical  
Sciences/PhotonicsEngineering & Physical  
Sciences/Semiconductor**Optical modulator based on magneto-optical effect**

A new optical modulator, based on magneto-optic effect and spintronic technology, achieves optical modulation using pure spin current without net charge current. A significant advantage of this spin magneto-optical modulator is its low energy consumption. It uses spin polarized current as the input, and since spin current can be generated without any charge current, electrical power dissipation can be zero or very low. Furthermore, the device does not use an electric field applied on an insulating material for modulation. Instead, modulation of the phase of the optical signal is achieved through the non-reciprocal phase shift induced in magneto-optic material integrated on photonic waveguide.

**Consumes less power, operates at higher speeds**

Conventional optical modulators, based on electro-optical effect using electrical current or voltage as input, consume electrical energy due to capacitive and resistive dissipation. However, because the optical signal can be modulated without any charge current, this new technology consumes significantly less power and operates at much higher speeds than conventional devices. The operation speed is no longer limited by the RC response speed of the modulator because electrical charge does not need to be accumulated to achieve modulation.

**Phase of Development**

- Concept

**Benefits**

- Low energy consumption
- Operates at much higher speeds than conventional electrical interconnects or optical interconnects

**Features**

- Based on magneto-optic effect and spintronic technology
- Achieves optical modulation using pure spin current without net charge current

**Applications**

- Optical communication
- Interconnect for computation systems

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