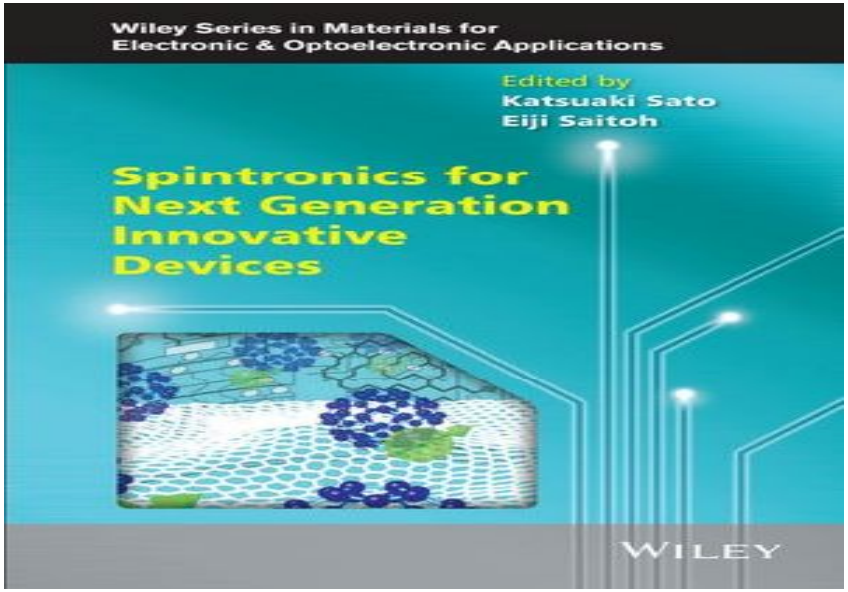
SPICTRONICS DEVICES

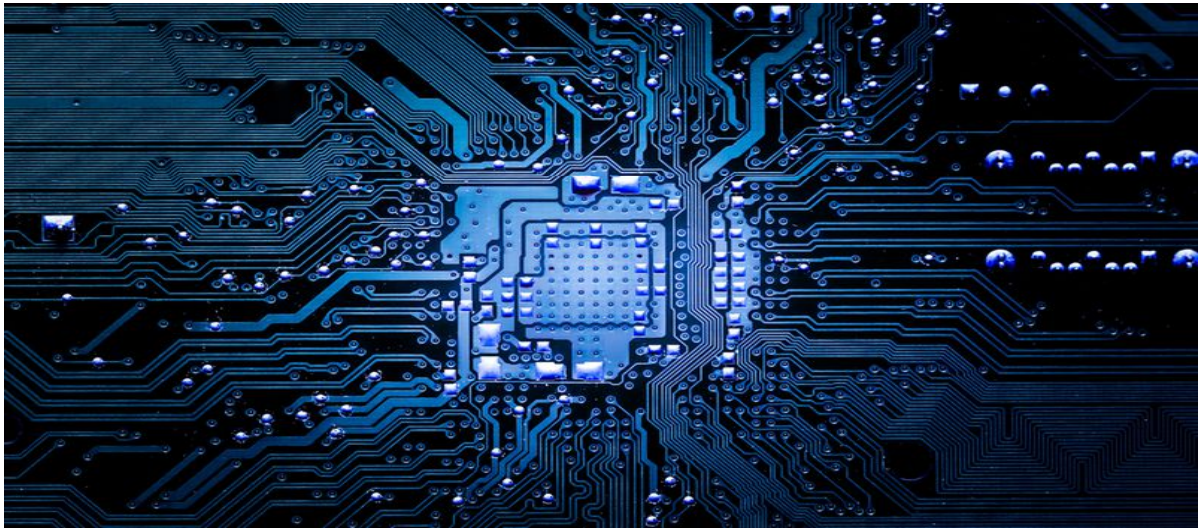
INTRODUCTION



- Spintronics is "Spin based electronics". The idea is to use the electron's spin, as well as it's charge. Electrons can spin in two directions
- There are many possible usages of Spintronics. One of the obvious ones is memory. MRAM is based on Spintronics, and it promises to be a fast, small and non-volatile memory.
- In the future we might see Spintronics based transistors, which will allow us to replace electronics circuit boards with Spintronics ones.

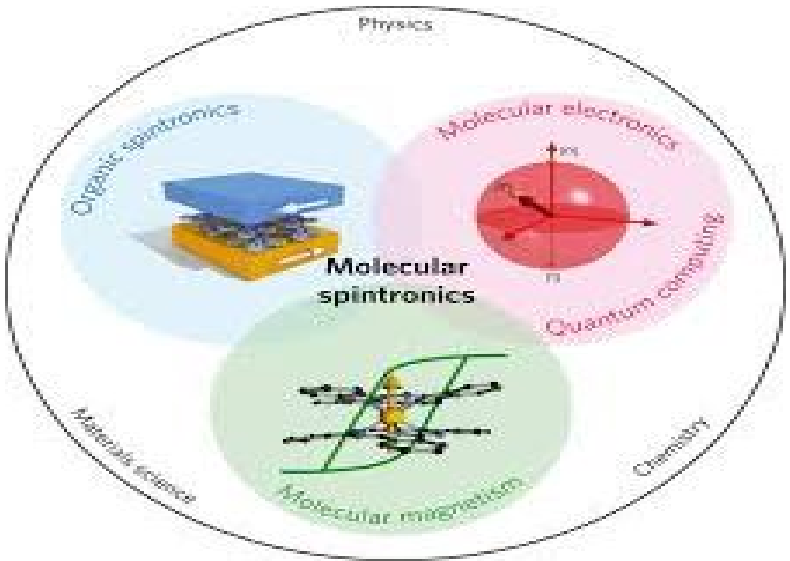
ELECTONIC &SPINTRONIC DEVICES

- Electronic and spintronic devices are devices that use the properties of electrons to transmit, process and store information.
- devices use the electrical charge of an electron to encode data.
- Spintronic devices instead use another fundamental property known as spin, which is the intrinsic angular momentum of the electron.

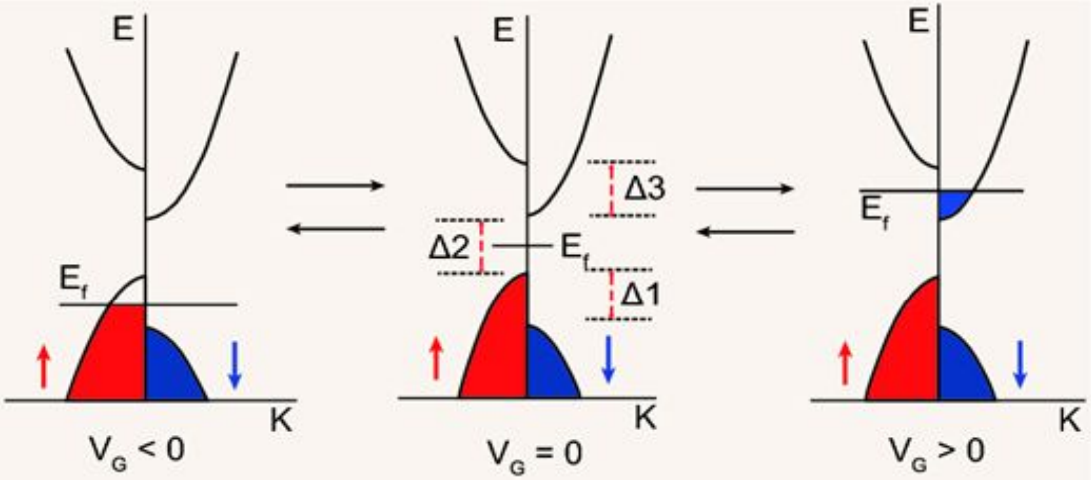


SPICTRONICS MATERIALS

- Magnetic tunnel junctions (MTJs) are prototypical spintronic devices . They consist of three layers: a ferromagnetic metal, an insulator, and another ferromagnetic metal.
- When the magnetizations of the ferromagnetic layers are aligned, the tunneling current is large and the device resistance is low. When the magnetizations of the ferromagnetic layers are anti-aligned, the tunneling current is small and the device resistance is large.



BIPOLAR MAGNETIC SMICONDUCTORS



- The proposal of BMS is aimed to realize electrical control of carriers' spin orientation, since electric field can be easily applied locally, in contrast to magnetic field. In BMS, completely spin-polarized currents with reversible spin polarization can be created and controlled simply by applying a gate voltage .
- Under zero gate voltage ($V_G = 0$), BMS exhibits intrinsic semiconducting behavior. Under an appropriate negative gate voltage ($V_G < 0$), when the Fermi level is shifted down into the spin-flip gap Δ1, BMS possesses half-metallic conduction with the carriers fully spin polarized in the spin-up direction. While the Fermi level shifts up into the spin-flip gap Δ3 under an appropriate positive gate voltage ($V_G > 0$), BMS also possesses half-metallic conduction but with the carriers fully spin polarized in the spin-down direction. Through this way, the carrier's spin orientation in BMS can be easily reversed just by altering the sign of the applied gate voltage. BMS can also be used to detect and separate entangled electrons from superconductors, which is very attractive in quantum information processing

APPLICATIONS OF SPICTRONICS

THANK

YOU