

Spin FET



Jisun Baek

1. Introduction

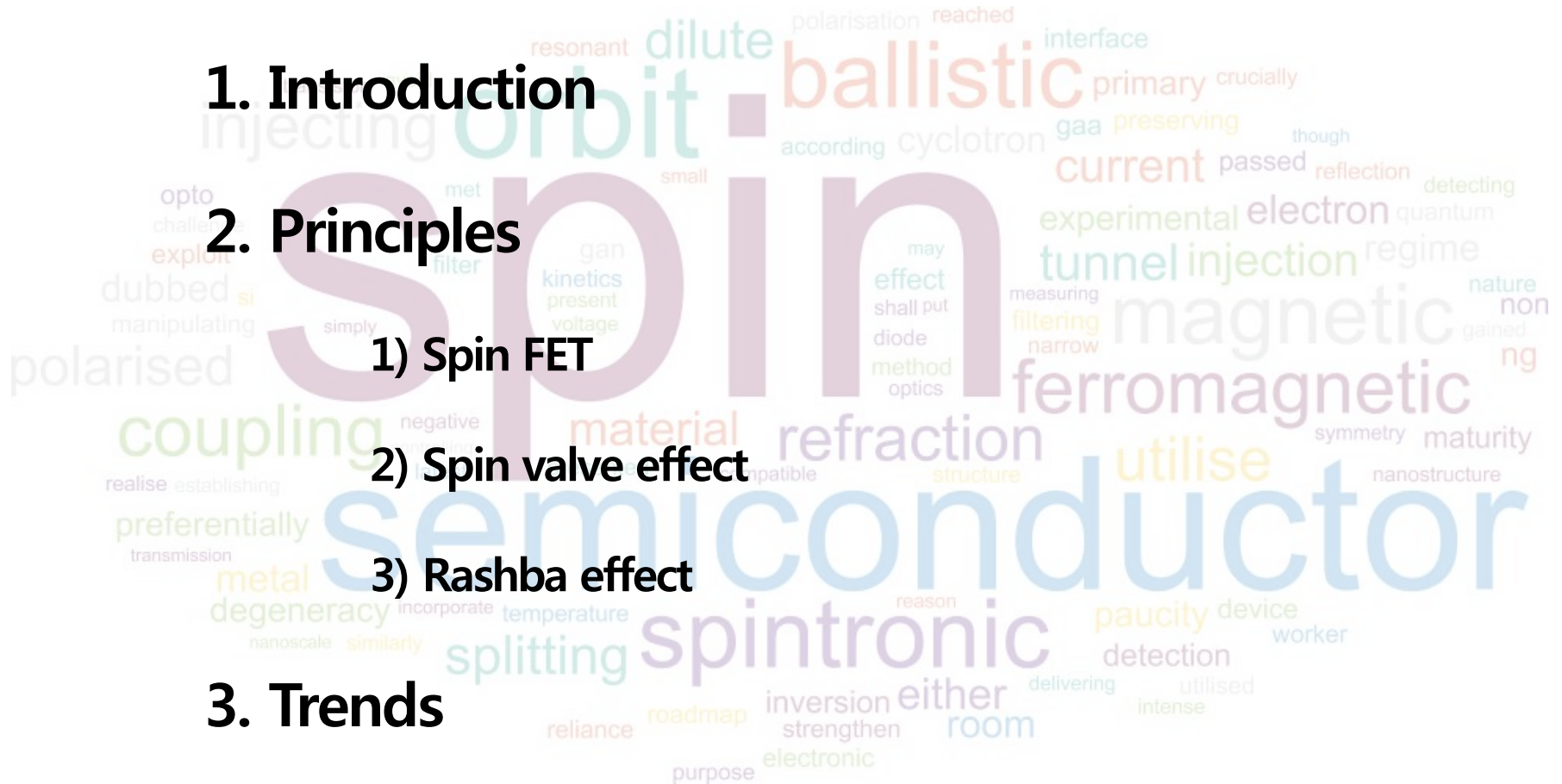
2. Principles

1) Spin FET

2) Spin valve effect

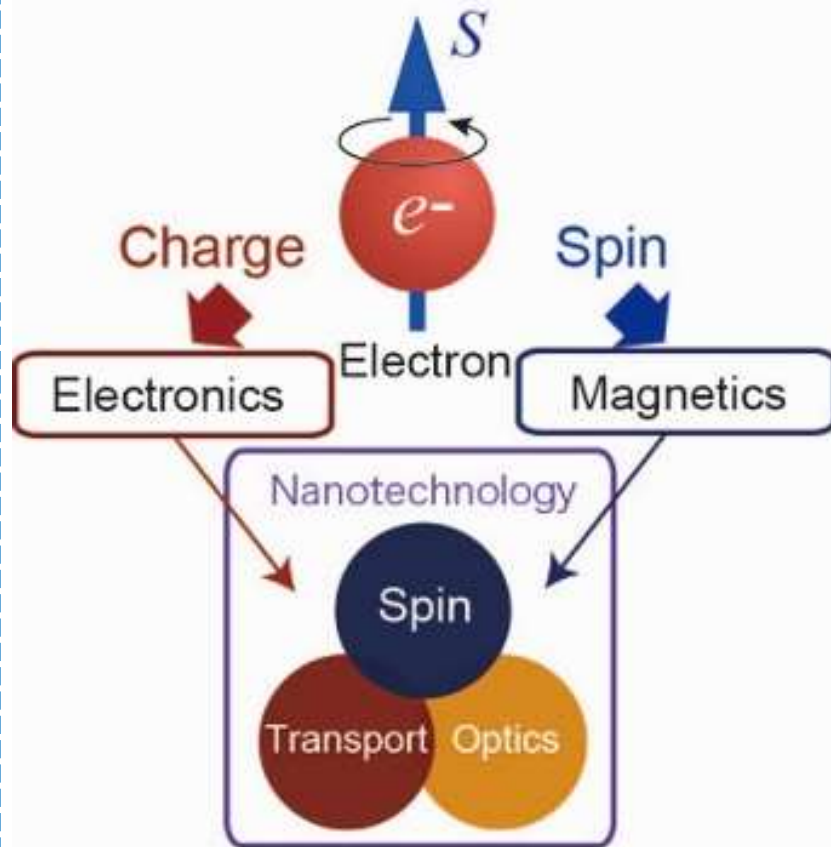
3) Rashba effect

3. Trends



Introduction

Spintronics



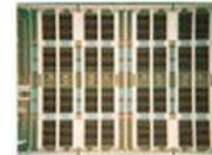
Applications

HDD (Hard Disc Drive)
Read head



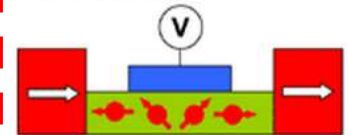
GMR

MRAM (Magnetic Random
Access Memory)



M. Johnson, *IEEE Spectrum* 37, 33
(2000).

Spin-FET (Spin - Field
Effect Transistor)



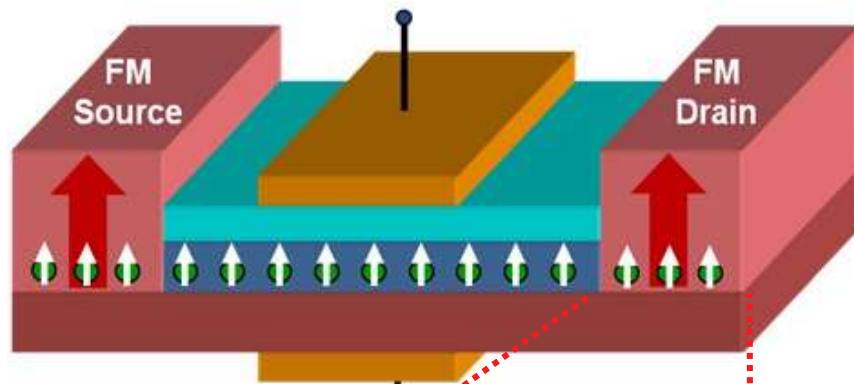
FM1 Semiconductor FM2
S. Datta and B. Das, *Appl. Phys. Lett.* 56,
665 (1990).

Merits

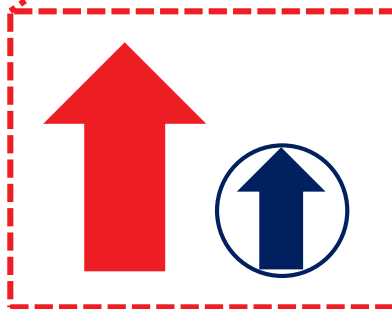
- non-volatility
- ultra-low power
- ultra-high speed
- new concept of a logic circuit

Principles

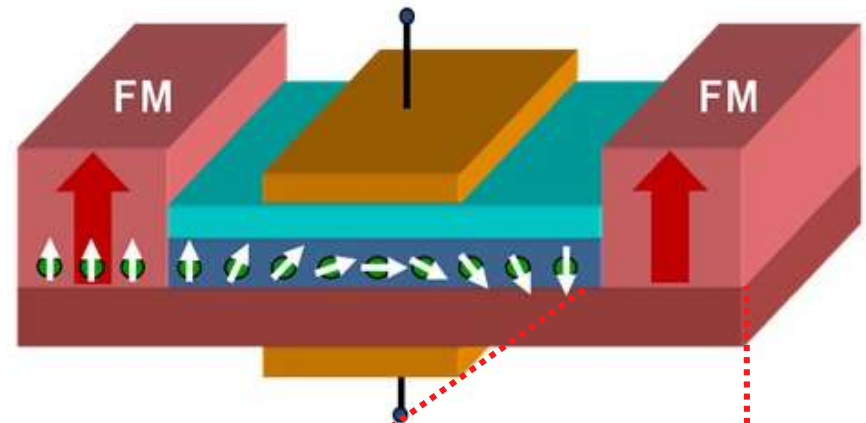
1. Spin-FET



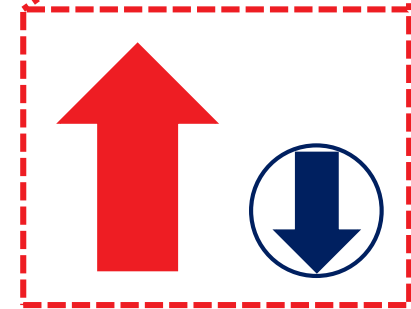
ON



Parallel



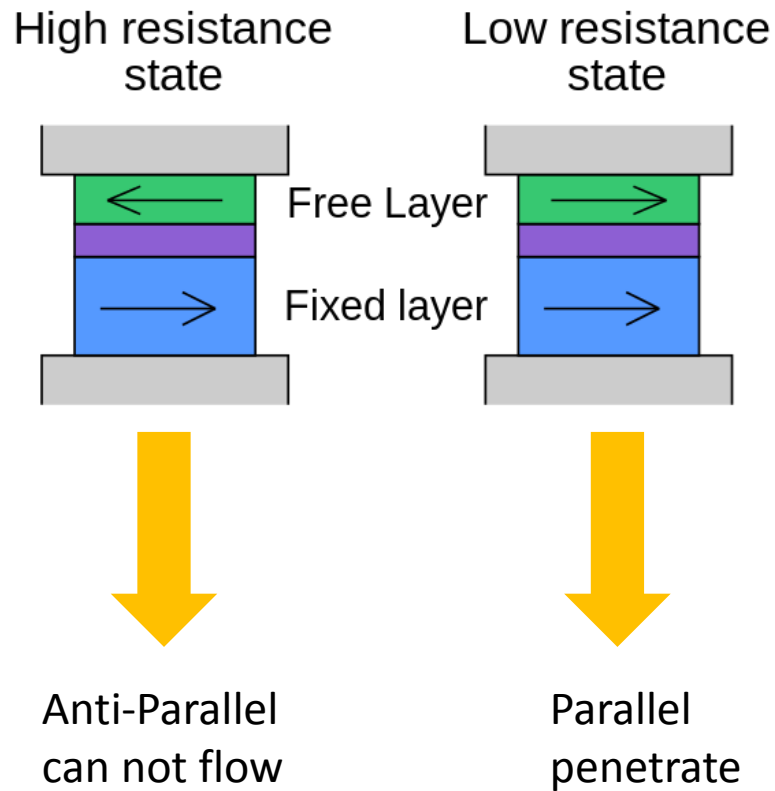
OFF



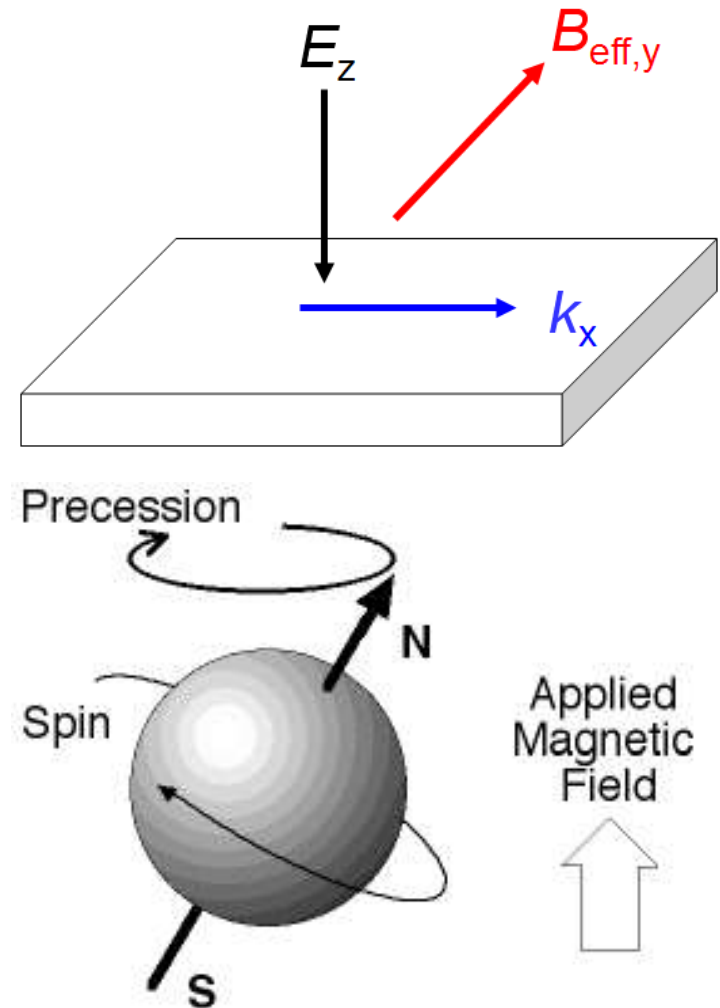
Anti-Parallel

Principles

2. Spin Valve effect

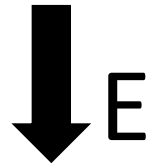


3. Rashba effect

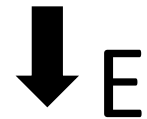


Principles

Low Resistance



High Resistance



Graphene Spin-FET

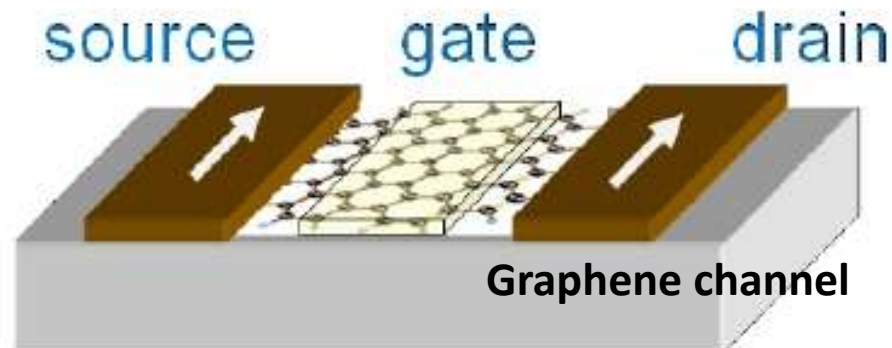


Illustration of the structure of a spinFET (top).
Operating principle of the spinFET (bottom).

Reference

1. 이우영, 이경일, 테마기획: 자성반도체, 전기전자재료 18권 11호, 2005
2. Won Young Choi et. al. (2015), *Electrical detection of coherent spin precession using the ballistic intrinsic spin Hall effect*, *Nature Nanotechnology*
3. *Magnetoelectric Spin-FET for Memory, Logic, and Amplifier Applications*
4. S. G. Tan,¹ M. B. A. Jalil,² Thomas Liew,¹ K. L. Teo,² G. H. Lai,¹ and T. C. Chong¹

Thank You