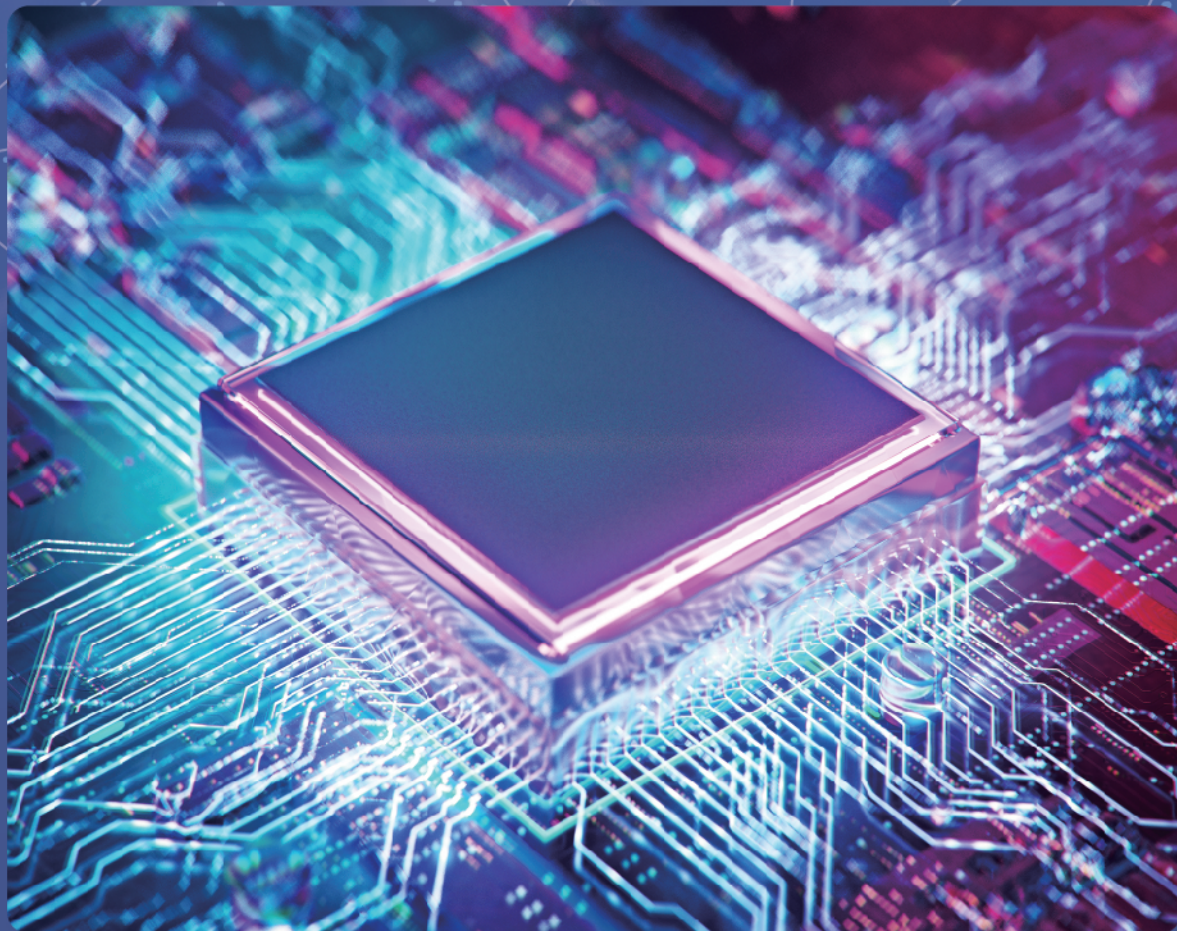


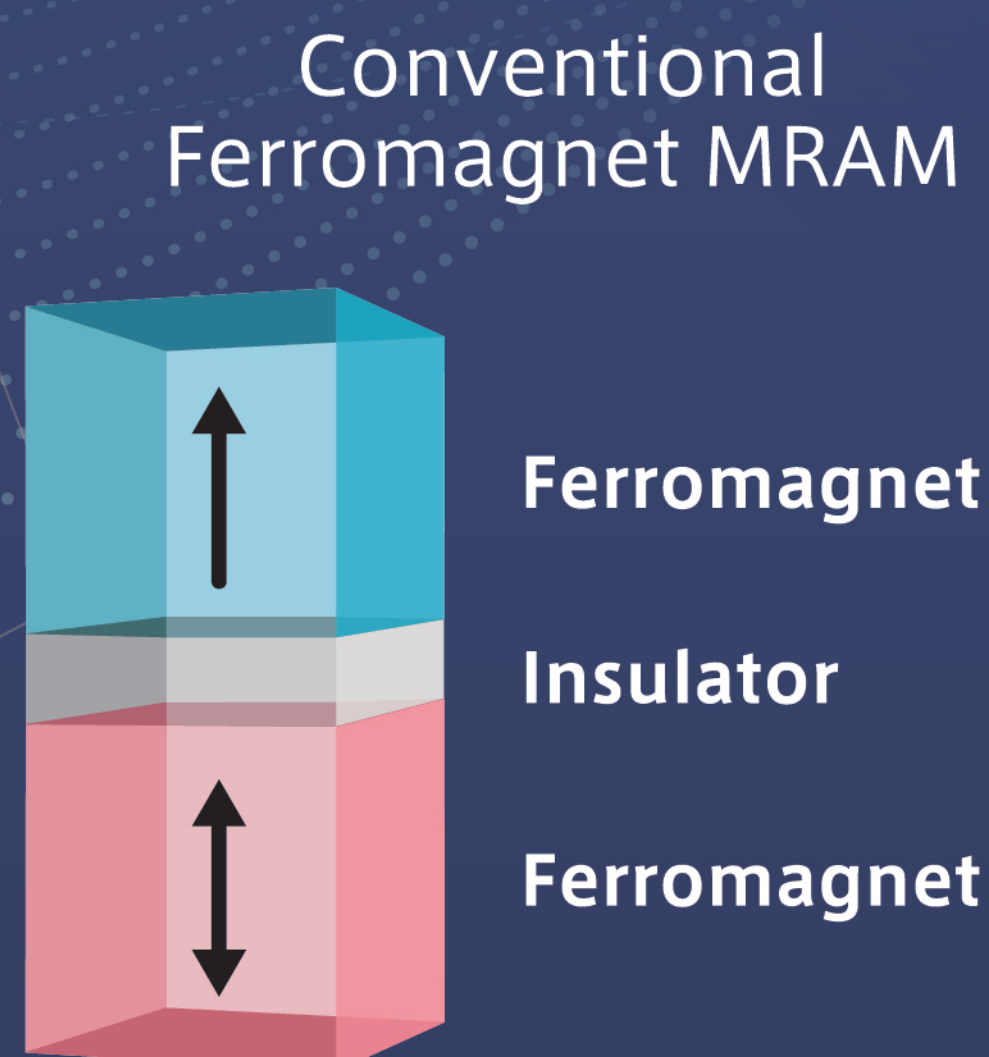
MRAM Materials

UTokyo and JSR have been conducting joint research related to **Topological Antiferromagnetic (AFM) MRAM**.

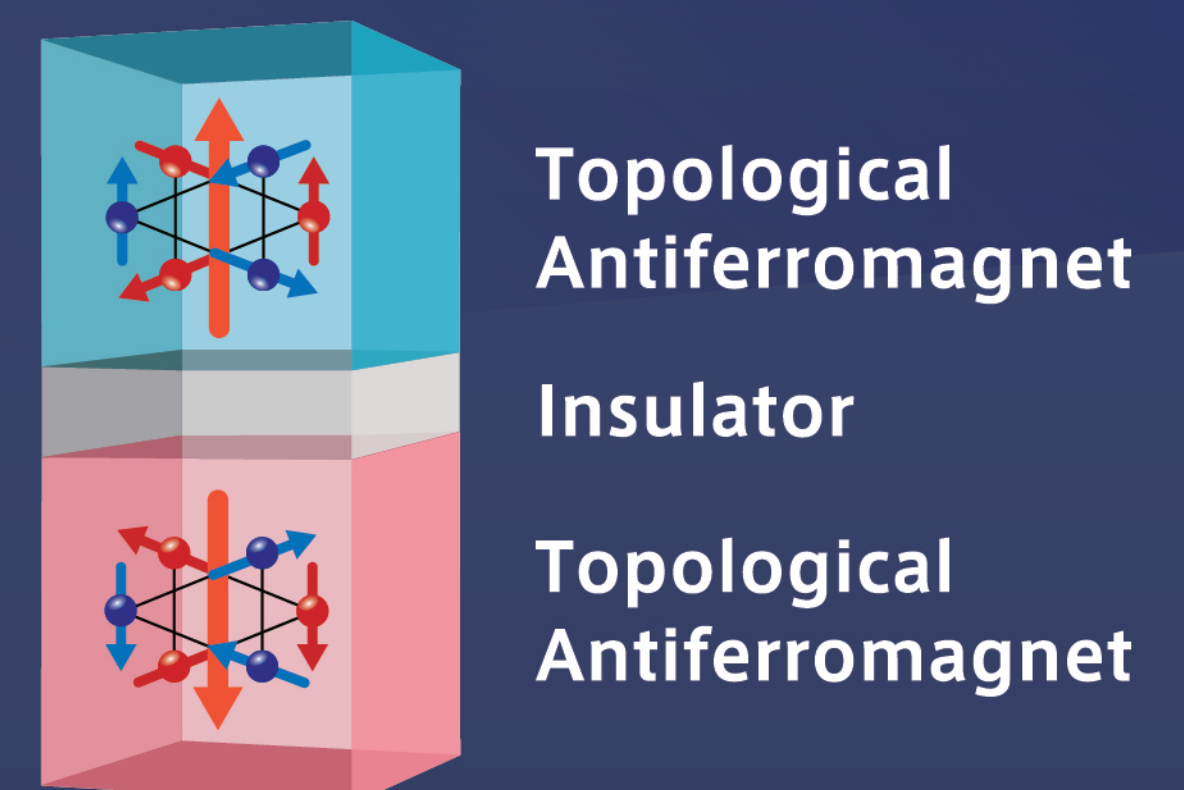
MRAM is a semiconductor memory which utilize up/down spin information or spin bit



The heart of MRAM is the 3-layer structure



Topological AFM-MRAM



Innovating Ultra-Fast, Low-Power Memory

Topological AFMs work as a cell of non-volatile memory:

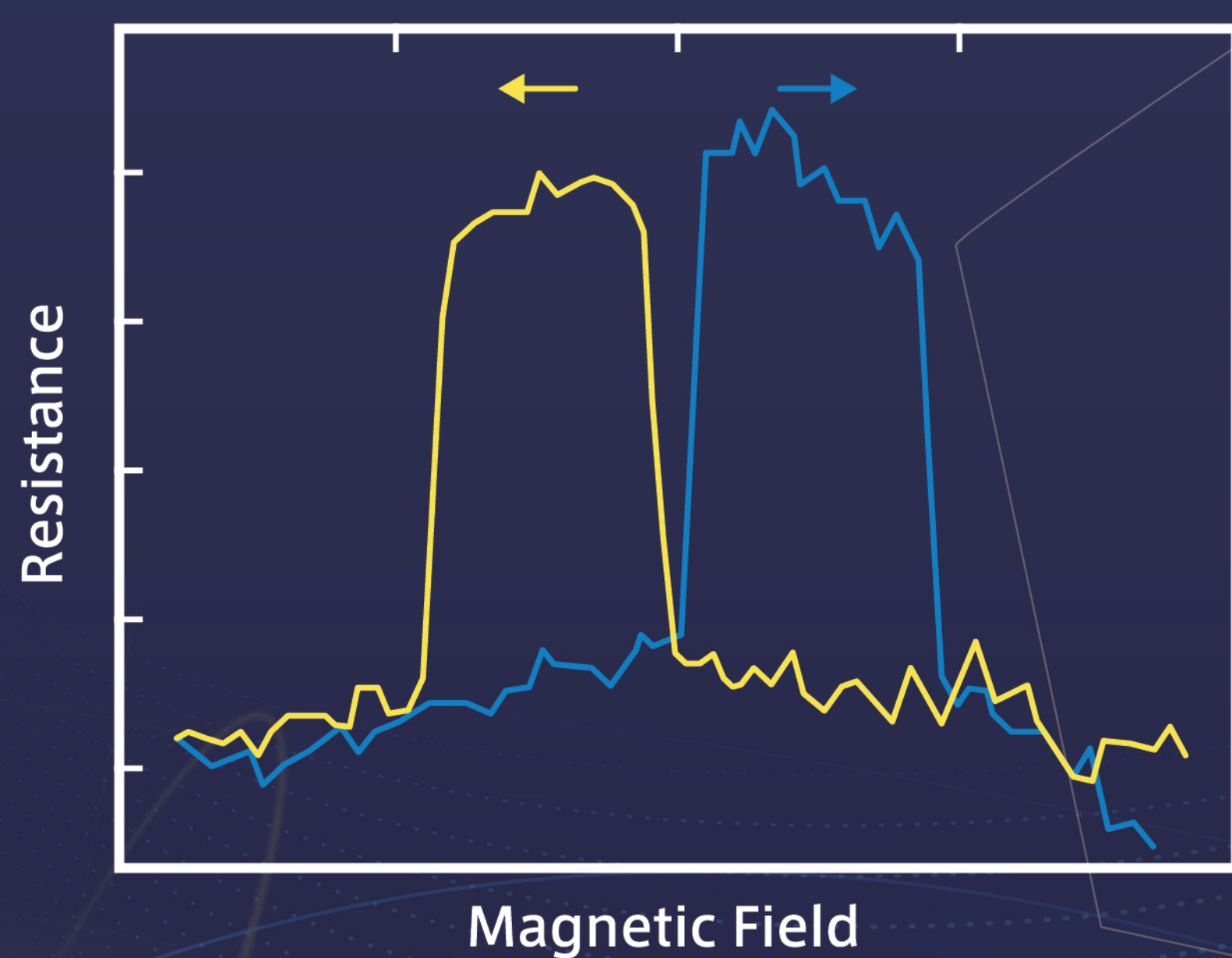
"current-control" → Write
"voltage-detect" → Read

Source: Arm, IBM, Samsung, Sony, TSMC (at IEDM, VLSI, IMW, FMS, and other conferences)

	Topological AFM-MRAM (Predicted)	SRAM	Ferromagnet -MRAM
Writing speed	1 ~ 10 ps	0.5 ~ 1.5 ns	1 ~ 10 ns
Reading speed	1 ~ 10 ps	0.5 ~ 1.5 ns	1 ~ 10 ns
Volatility	Non-volatile	Volatile	Non-volatile
Power consumption	10 fj/bit	100 fj/bit	100 fj/bit

Experiment

Clear TMR signals



Simulation

High TMR ratio predicted

