The Future of Storing Bits

Nanotechnology's Impact on Digital Memory

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Will Nanotechnology Enable a Universal Memory?

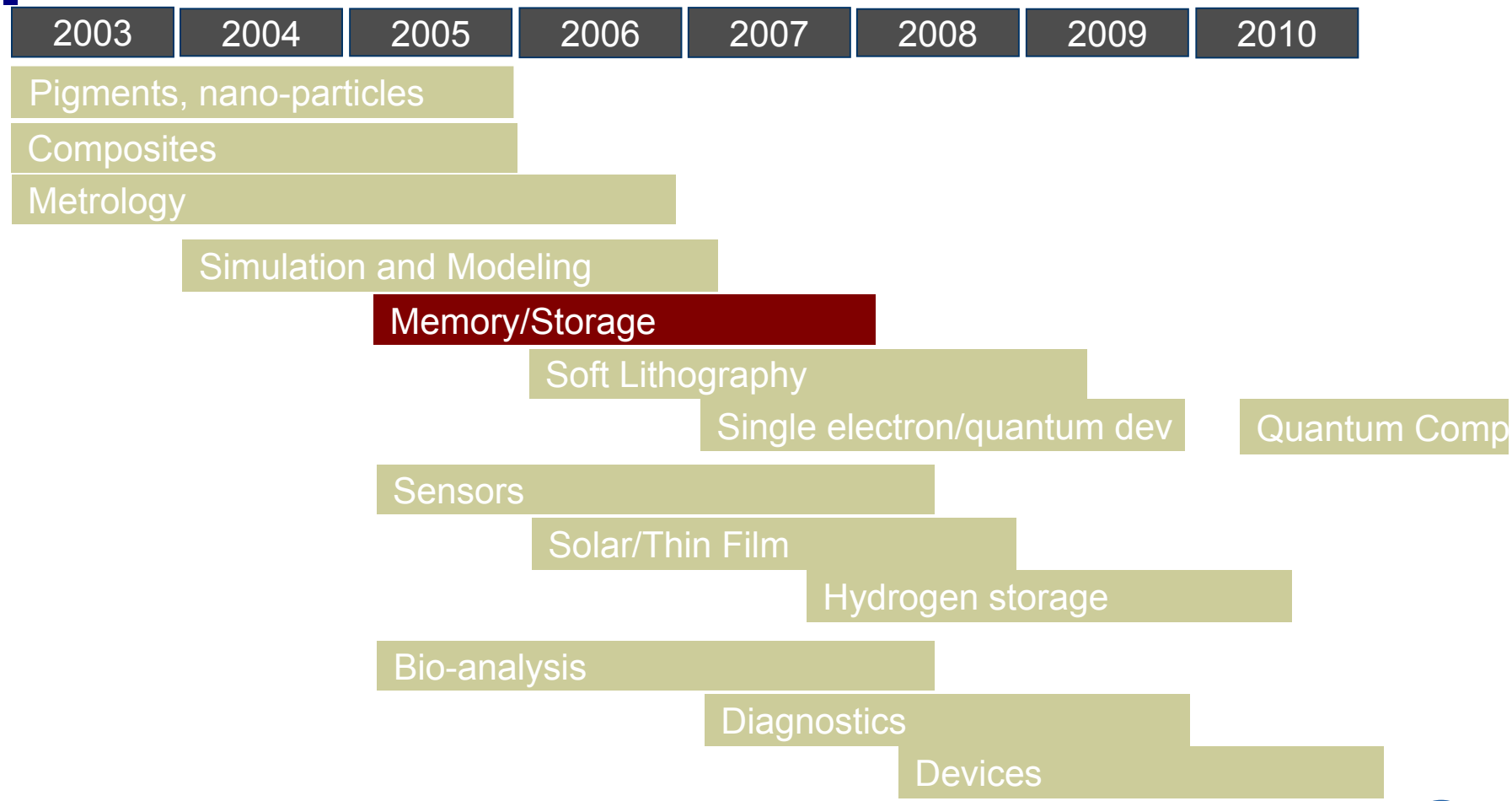
	SRAM	DRAM	EEPROM	FLASH	Universal?
Vol/Non	Volatile	Volatile	Non-Vol	Non-Vol	**Non-Vol**
Bit Cell	6T	1T/1C	2T	1T	**0T**
Read (ns)	12ns	70ns	200ns	70ns	**Fast**
Write (ns)	12ns	70ns	5,000ns	100,000ns	**Fast**
Endurance	Infinite	Infinite	10^5	10^5	**Infinite**
Density	Low	High	Medium	High	**HDD**
Cost	High (10,000x)	Low (100x)	Medium	Low (100x)	**HDD (1x)**

Source:Adapted from "Emerging Memories", B. Prince; PriceGrabber.com; Integrated Circuit Engineering Corp.

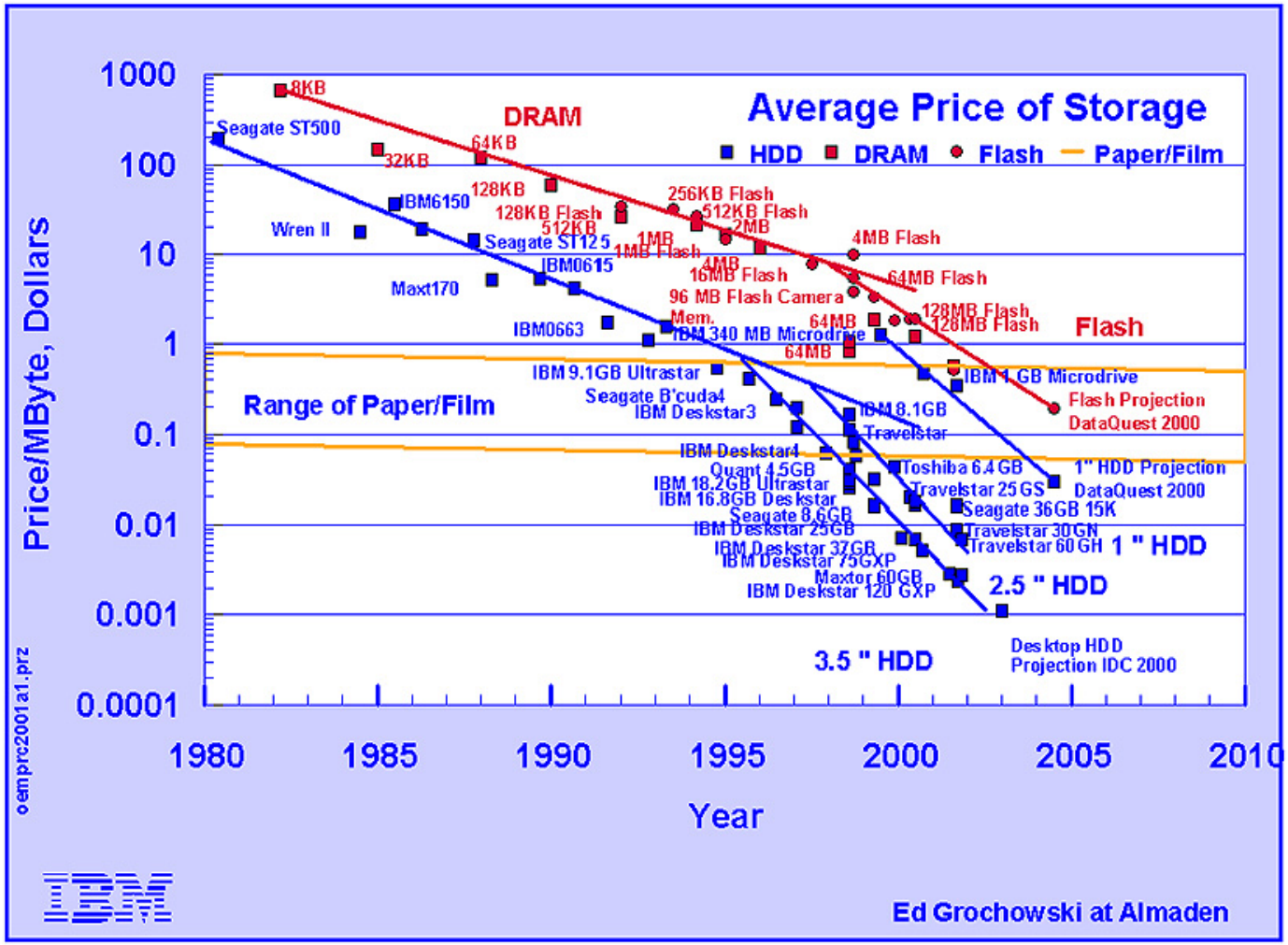
Many Different Dimensions Being Explored

- **Architecture:** RAM-like vs. HDD-like
- **Storage mechanism:** charge vs. magnetic vs. phase change vs. mechanical vs. …
- **Manufacturing:** leverage Si infrastructure vs. new substrates
- **Integration:** with Si vs. separate modules
- Monolayer vs. thicker layer
- Two bits per cell vs. multi-bits per cell
- Stackable vs. single layer
- Volatile vs. non-volatile
- Fast access vs. slower access
- Infinitely re-writable vs. finitely re-writable

Probable Time to Market



Incumbent Technologies Continue to Advance



Tonight's Panel

- **Dr. Stefan K. Lai:** Vice President, Technology and Manufacturing Group Director, California Technology and Manufacturing, Intel Corporation
- **Dr. Shih-Yuan (SY) Wang:** Senior staff scientist, Quantum Science Research, Hewlett-Packard
- **Dr. Randolph H. Levine:** President and CEO ZettaCore, Inc.