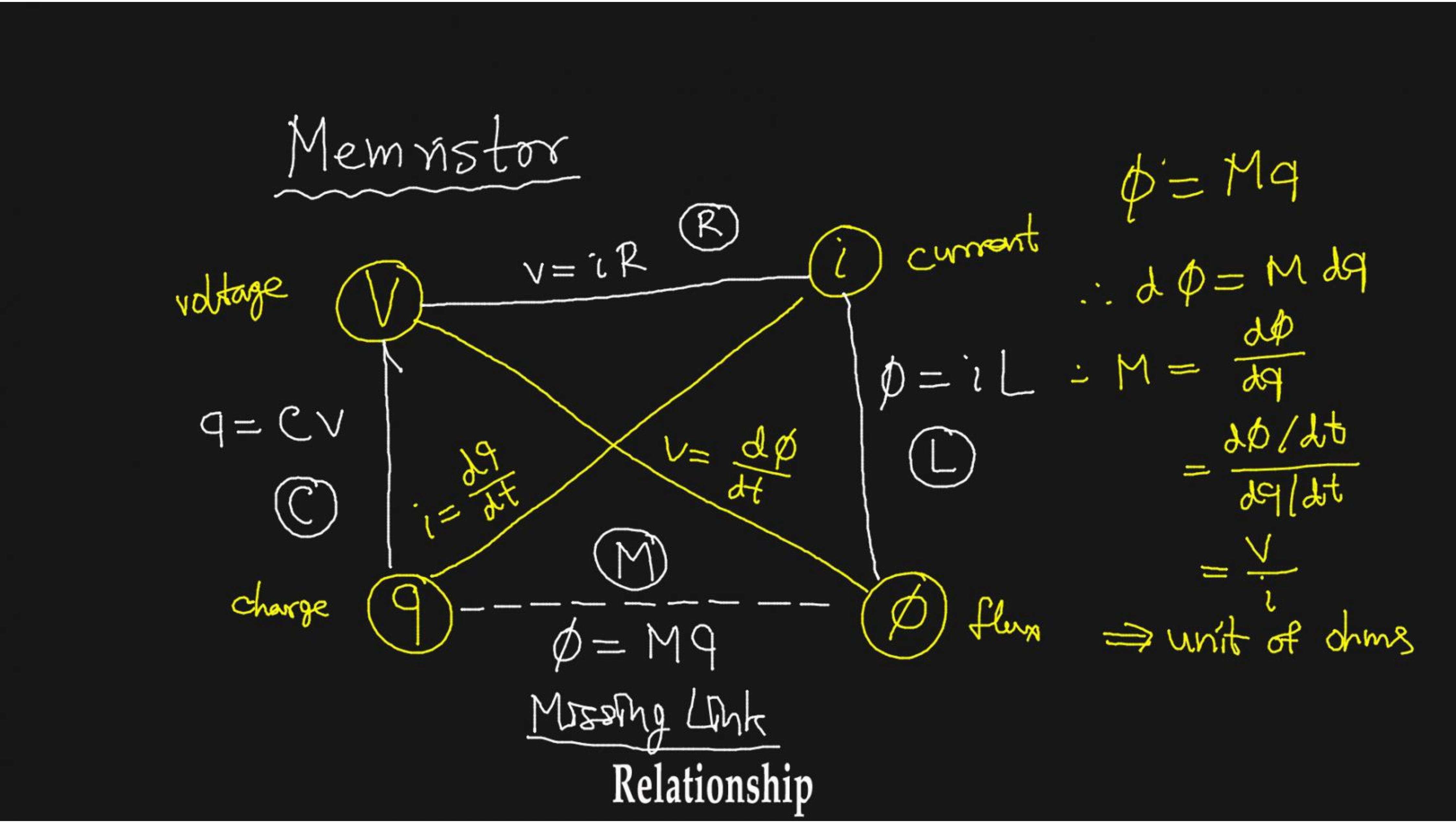
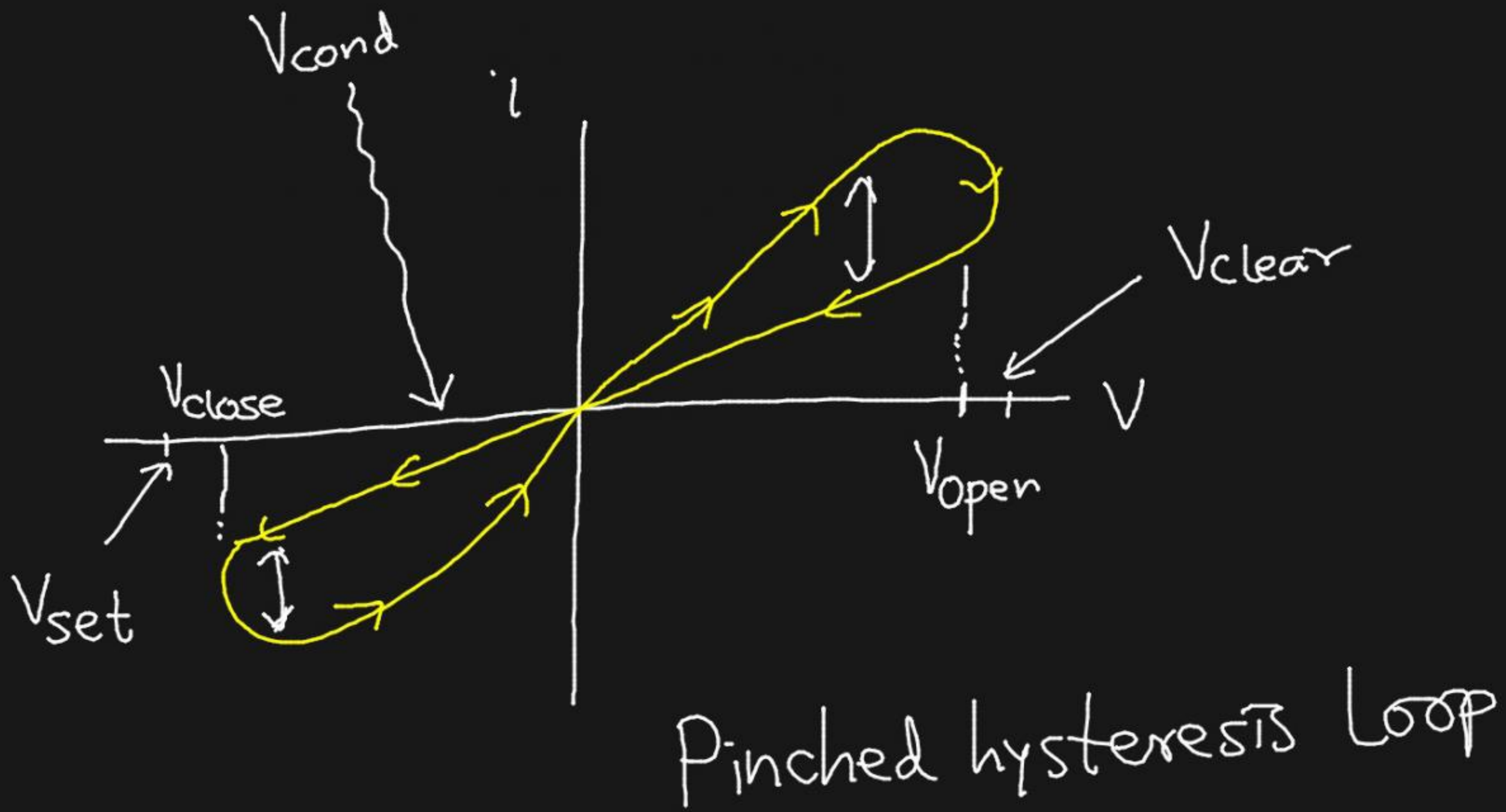
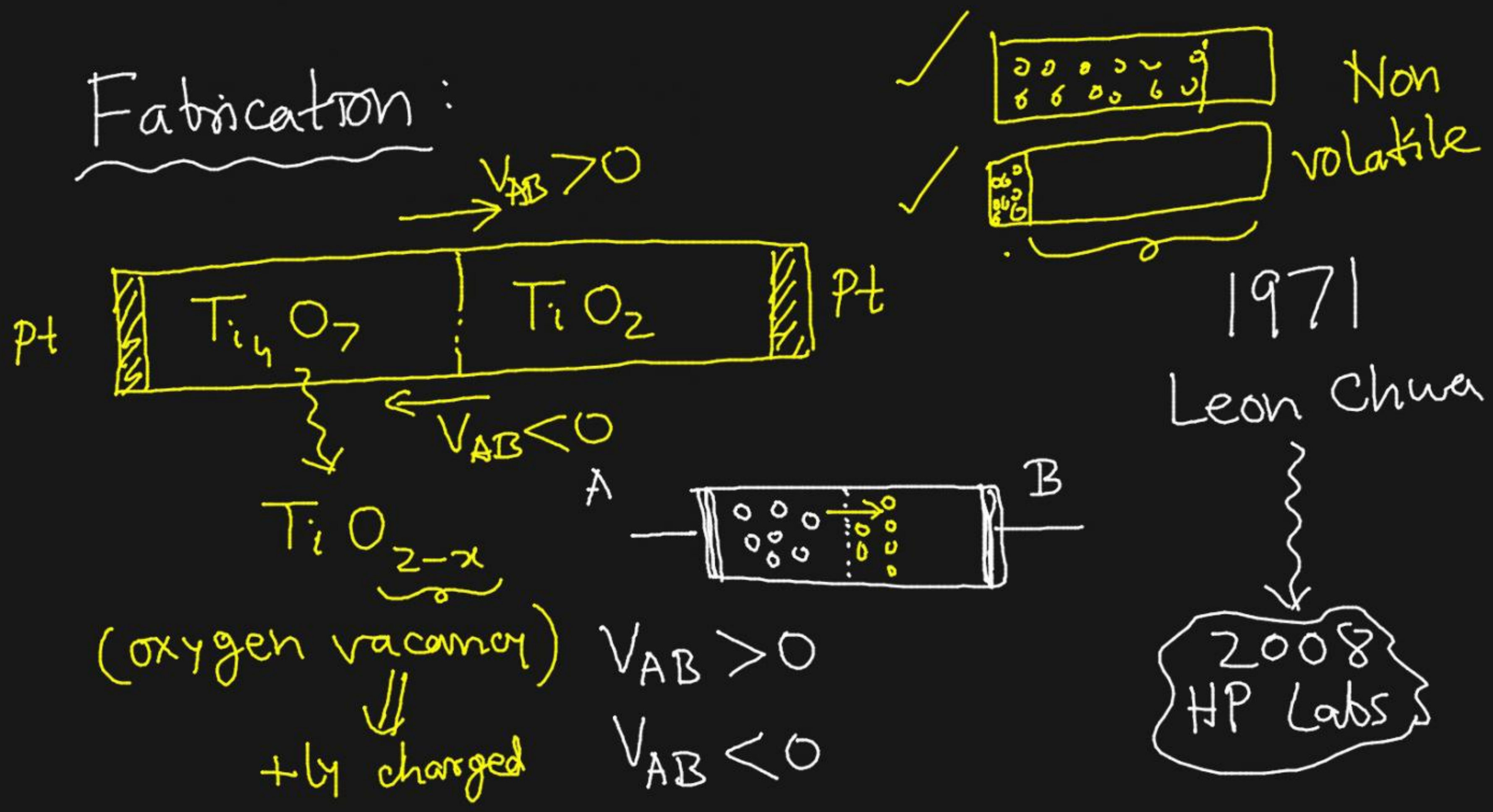


Memristor
R
v = iR
voltage
V
i
current
q = CV
C
i = dq/dt
v = dφ/dt
φ = iL
L
M
charge
q
φ
flux
φ = Mq
Missing Link
Relationship
φ = Mq
∴ dφ = M dq
∴ M = dφ/dq
= (dφ/dt)/(dq/dt)
= v/i
⇒ unit of ohms



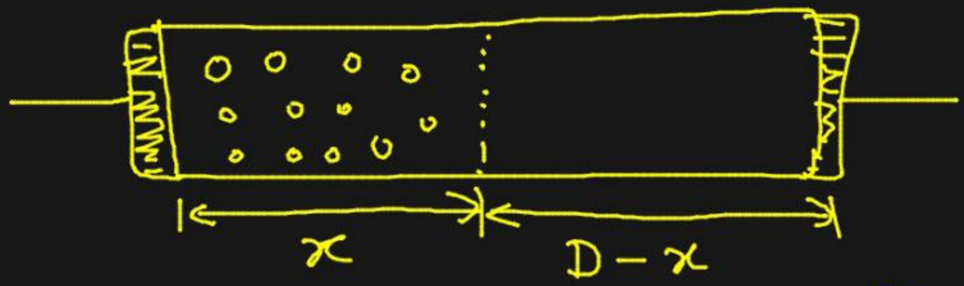
Hystereris



TiO2-Fabrication

Memristor Fabrication:

$R_{off} >> R_{on}$



Pure TiO_2

High resistance

Doped TiO_2

(Ti_4O_7)

Low resistance

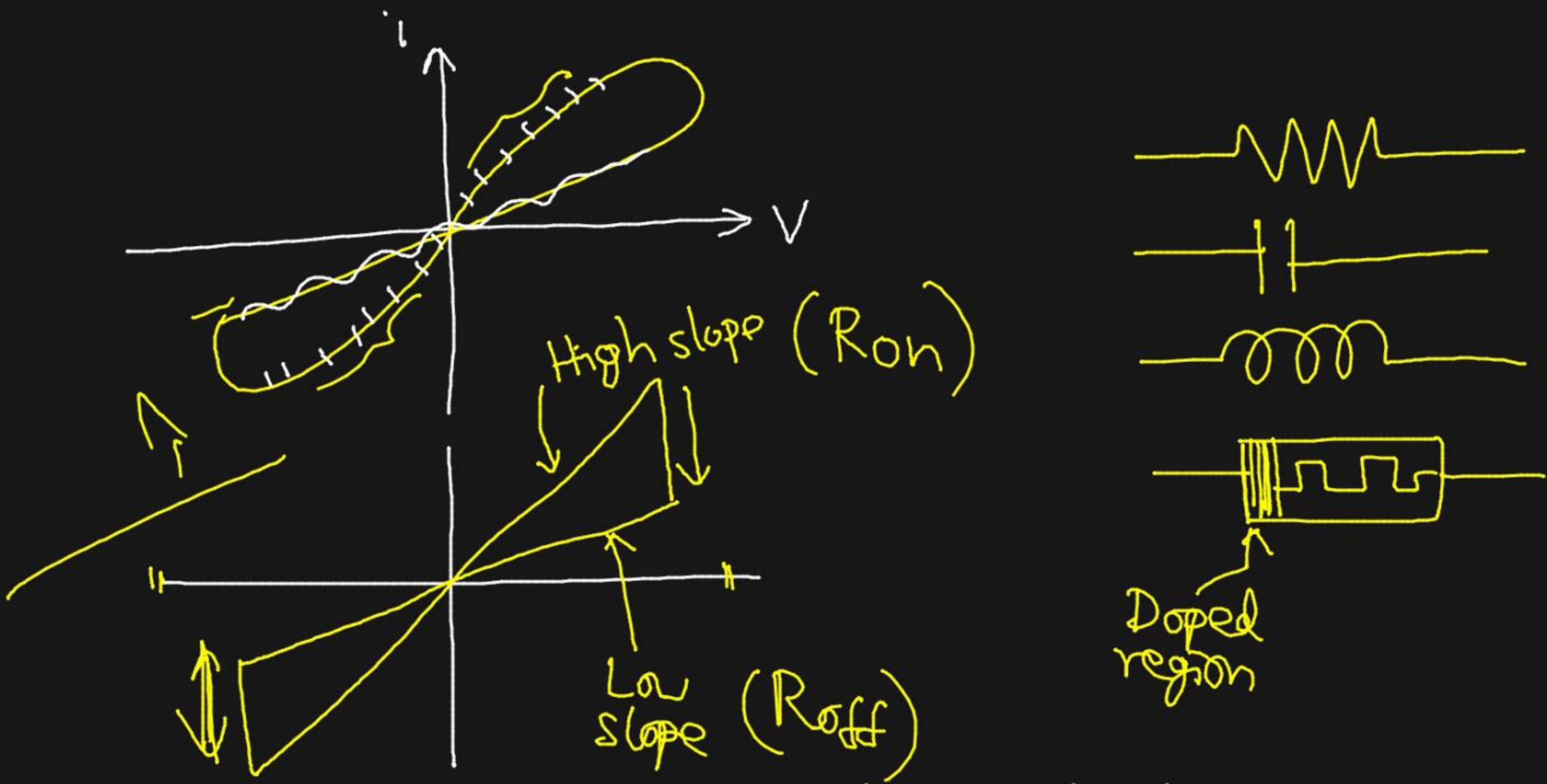
R_{on} = resistance when $x = D$

R_{off} = " " $x = 0$

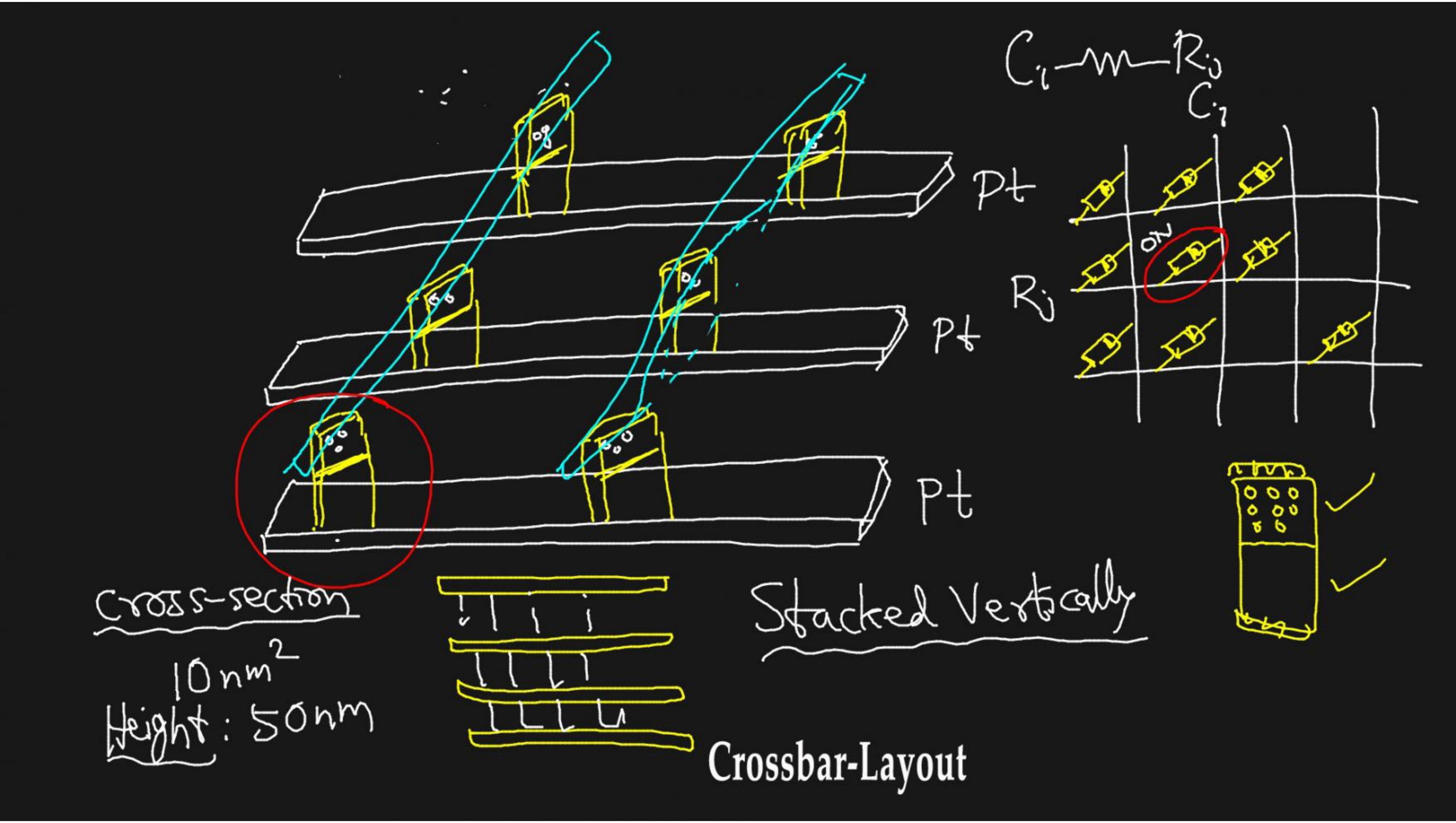
Memristance $$M = R_{on} \cdot \frac{x}{D} + R_{off} \cdot \frac{D-x}{D}$$

Function of x

TiO2-Length-Fabrication



Hysteresis-Approximation


Ci Rj
Ci
Pt
Pt
Pt
ON
Rj
Cross-section
10nm²
Height: 50nm
Stacked Vertically
Crossbar-Layout

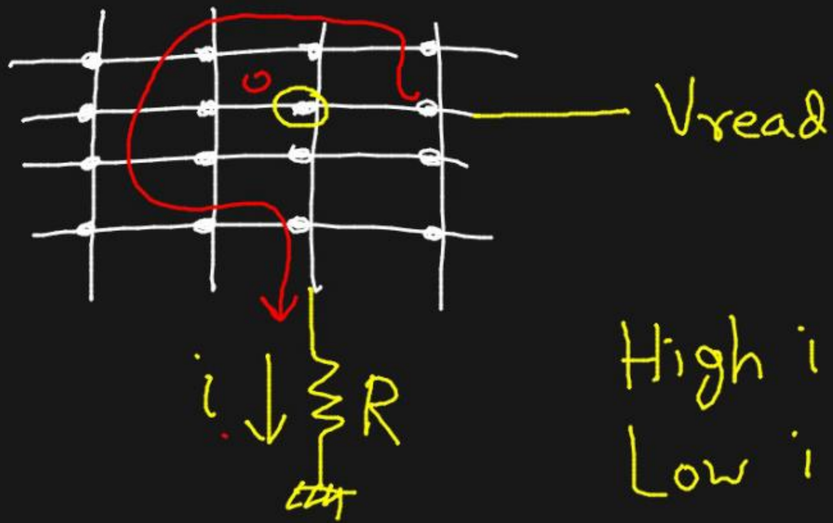
Crossbar:

* Very high density
  ($\approx$ Terra $= 10^{12}$ memristors/chip)
* Resistive memory || Non-volatile memory
  Ron = 1 , Roff = 0
* Carry out logic operations

Crossbar-Density

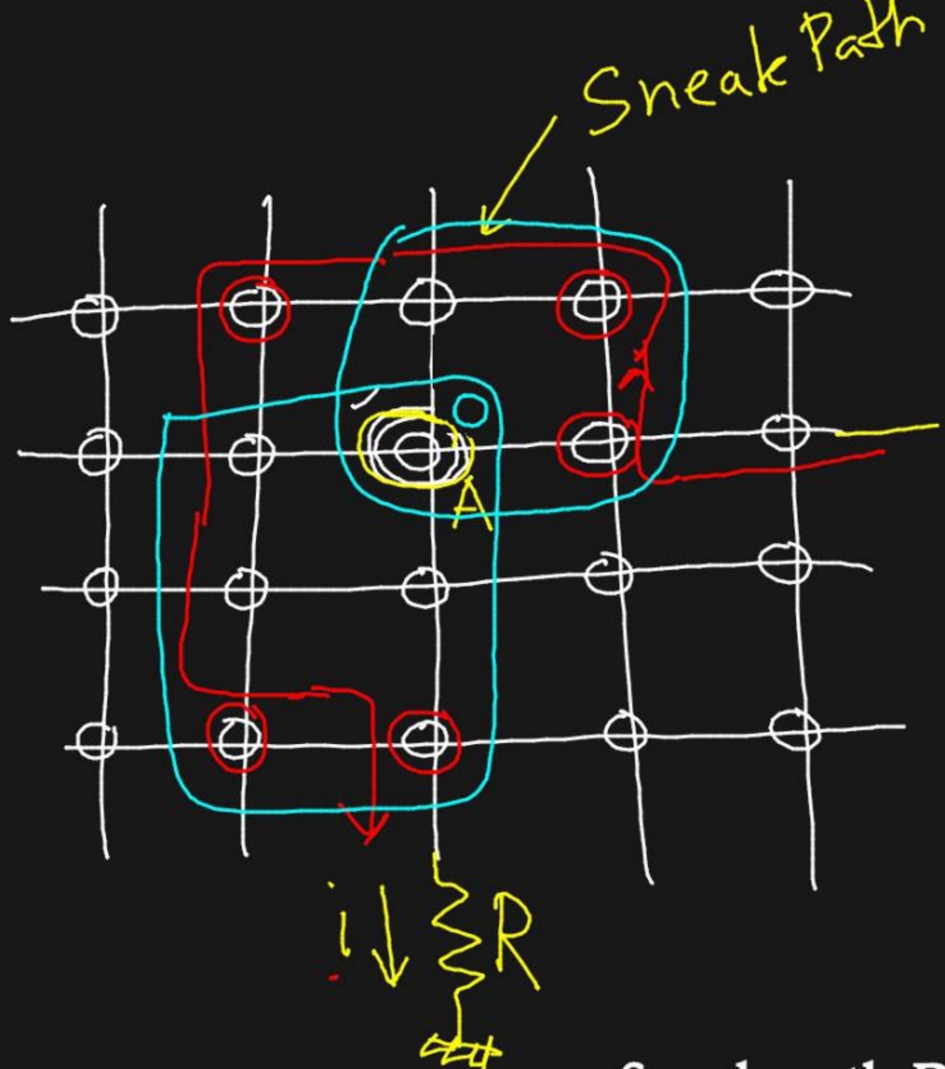
Sneak Paths:

Read ⇒ problems
↓
Parallel current flowing paths



High i : Ron (1)
Low i : Roff (0)

Sneak-path-Basic



Isolated Zero Rectangle

* Imaginary rectangle

A single 0 in the four corners.

⇓

Possibility of sneak path

Sneak-path-Detection