Twitter Thread by foone

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@Foone

does bubble memory count as solid state?
I guess? I mean, it has no moving parts. but it requires preheating and involves movement of magnetic fields across a surface...

it's kinda like a traditional hard drive where you don't spin the disc, you just trick all the bits to migrate off the edge

who called it "bubble memory" and not "lemming bits"

(obligatory "lemmings don't throw themselves off cliffs, that's an urban legend")

(obligatory "the idea that disney invented that urban legend it itself an urban legend, they just helped popularize it")

@quartizine has the good point that it's not just about movement. Vacuum tubes aren't solid state!
https://t.co/VG3XdoQ6OZ

> That falls apart when you consider that vacuum tubes aren't considered "solid state", something about how they use thermionic emission and magnetic fields is enough to push it out of the realm of just electron movement.
>
> — laura possum #blm (@quartizine) January 3, 2021

in any case, that still probably means bubble memory is solid state.
It has to warm up, yes, but it doesn't melt. The crystal remains solid, and only the magnetic fields move.

interesting this sort of solid-vs-gaseous/liquid distinction means that for optical discs (which aren't normally solid state, because they spin) could conceivably be made solid state... EXCEPT for CD-R/CD-RWs when you're burning them.

because CD-Rs involve a (very brief) one-way state transition from solid->gas->solid, and similarly CD-RWs are solid->liquid->solid every time you write them.

and by "could be made solid state", there's no actual reason WHY a CD-ROM has to spin. It just means you don't need as complicated a laser arrangement

because if you think about how an optical disc works, it's really a 2D surface: you've got the in/out axis (towards the spindle hole or towards the edge) and the around-the-disc axis

and the laser head in your CD-ROM drive has a stepper motor or voice coil that's used to move the laser on the in/out axis. The other axis is managed by spinning the disc, and waiting for it to rotate around.

but you could totally build a CD-ROM drive that works more like a plotter or 3D printer: you could move the head in two dimensions, and not have to spin the disc.

why would you do this?

there's really not any reason.

although the Lasercard format works this way.
https://t.co/JlCPyOXXzL

> So LaserCard is an interesting format: It's fundamentally the same as CD-ROMs, LaserDisc, DVD, etc, but instead of spinning, it's a flat grid layout. pic.twitter.com/bRmMCNL1vD
>
> — foone (@Foone) November 21, 2018

I've not opened up my lasercard drive (I was kinda hoping to find some media for it...) but I think it doesn't fully move the head. it's mostly a moving-mirror system.

although that brings up another point worth arguing about for a medium:
does it count as solid state if doesn't move while in use, but it's connected to things that do?

although if you want to get relativity-absurdist with that, you could then argue that, because there are no special reference frames, that technically traditional hard drives don't spin.
they're immobile, and the universe spins around them?

although now t hat I'm thinking about it I'm not sure rotating reference frames count as "normal", because you can feel forces from the rotation that wouldn't be the same if it was the rest of the universe spinning around you

it's too 6am for this physics bullshit

ANYWAY I think the point out vacuum tubes made me realize something:

solid state discs aren't "solid state" because they're not moving. not moving has nothing to do with if they're solid state or not

solid state disks are solid state because they use solid state electronics, and traditional spinning-rust media does not.

"solid state electronics", as a term, was coined to distinguish semiconductor electronics from vacuum tube electronics.

vacuum tubes use a (near) vacuum and a gas of particles/electrons/ions moving within it.

whereas solid state electronics use a semiconductor, which is a solid crystal. It's just currents being controlled by currents within the solid piece of silicon or germanium or whatever.

so "solid state" refers to things like transistors and diodes and integrated circuits.

and what are SSDs made out of?
integrated circuits. all the flash memory stuff happens inside a die of silicon.

whereas traditional discs are a bit circle of rust spinning around with magnetic fields on it, with a little electromagnet on an arm that moves around it to read off or write magnetic domains

which is a lot of things, but it's not transistors, diodes, or integrated circuits. So it's not "solid state" in the same way an orange isn't solid state: it's not made of remotely the same things.

so I think the answer to "is bubble memory solid state?" is both "yes" and "no".

it's "yes" in the sense of: the state of the memory storage medium is solid, and is always solid. at no point is it liquid or gas.

it's "no" in the sense of: when we say "solid state", we mean "solid state electronics", which it isn't.
It's a chunk of garnet, not anything semiconductory

btw, this also means that core memory isn't solid state either, since it's similarly electromagnety, even though nothing is moving.

so I'd argue that you could say it's something like "solid phase memory" but "solid state" has a pre-determined meaning in electronics and applying it to things that aren't made of "solid state electronics" is confusing and incorrect.

ANYWAY this reminds me of something I was talking to @gewt about the other day:
I want to make a rotating solid state disk.

the obvious way to do this is slip rings. I did a whole thread on these:
https://t.co/aVU1sri57P

> I was actually researching something about slip rings, and found this lovely picture.
> Want some ethernet you can rotate 360 degrees? NOW YOU CAN! pic.twitter.com/dLqMxAR5Hv
>
> — foone (@Foone) September 16, 2020

but I think SATA might be too fragile and complicated to easily put through a slip ring, so I think I'm gonna go for USB. basically take an SSD, a SATA2USB adapter, and then get a USB slip ring (I think Moog (not that one) sells off-the-shelf

ones!) and a motor.

you see?