Can Iron Burn?

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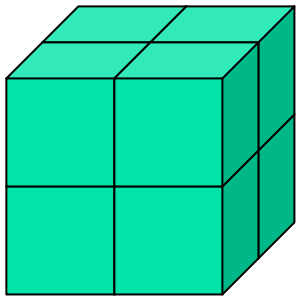
It's a Question of Size

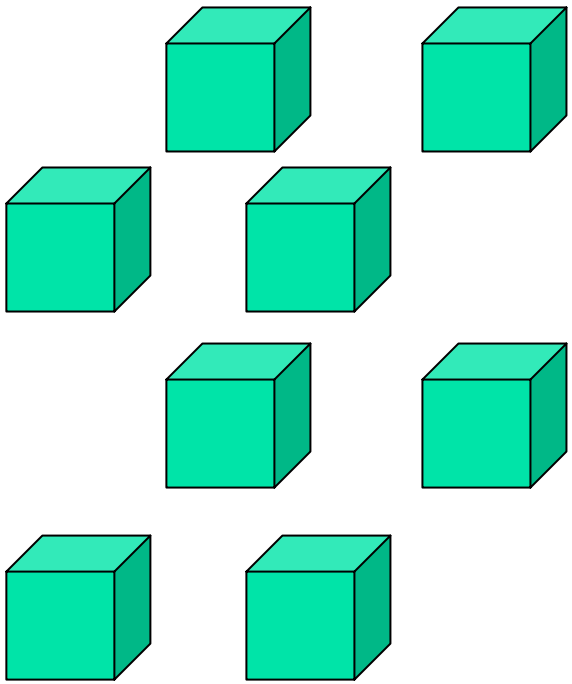
- "Normal" sized iron would never burn, but what happens if we divide it into small pieces?

Images from: http://www.youtube.com/watch?v=7kuUPGOGuIs

Why Does This Happen?

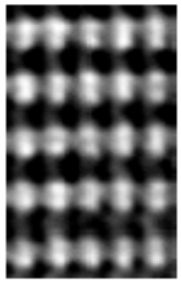


When these eight cubes are assembled Into one large cube, only the outside surface of the large cube is exposed to the air. (4 x 6 = 24 square lengths)



But if I break up the large cube, each small cube exposes *all* of its surfaces to the air and rusting occurs much more quickly! (Area = 6 x 8 = 48 square lengths)

So Where do I Work?



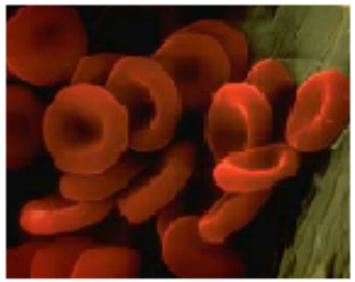
Atoms of silicon
spacing 0.078 nm

DNA
~2-1/2 nm diameter

5 nm

Tom's Particles

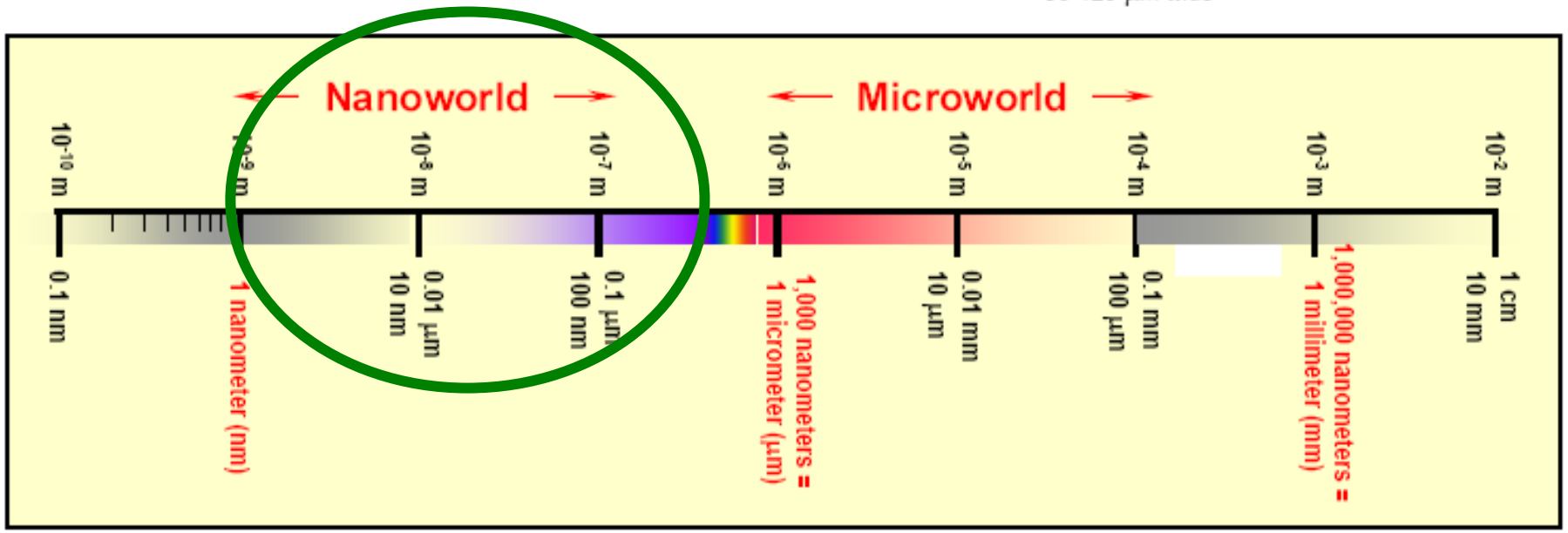
500 nm



Red blood cells
(~7-8 µm)

Human hair
~ 50-120 µm wide

Ant
~ 5 mm



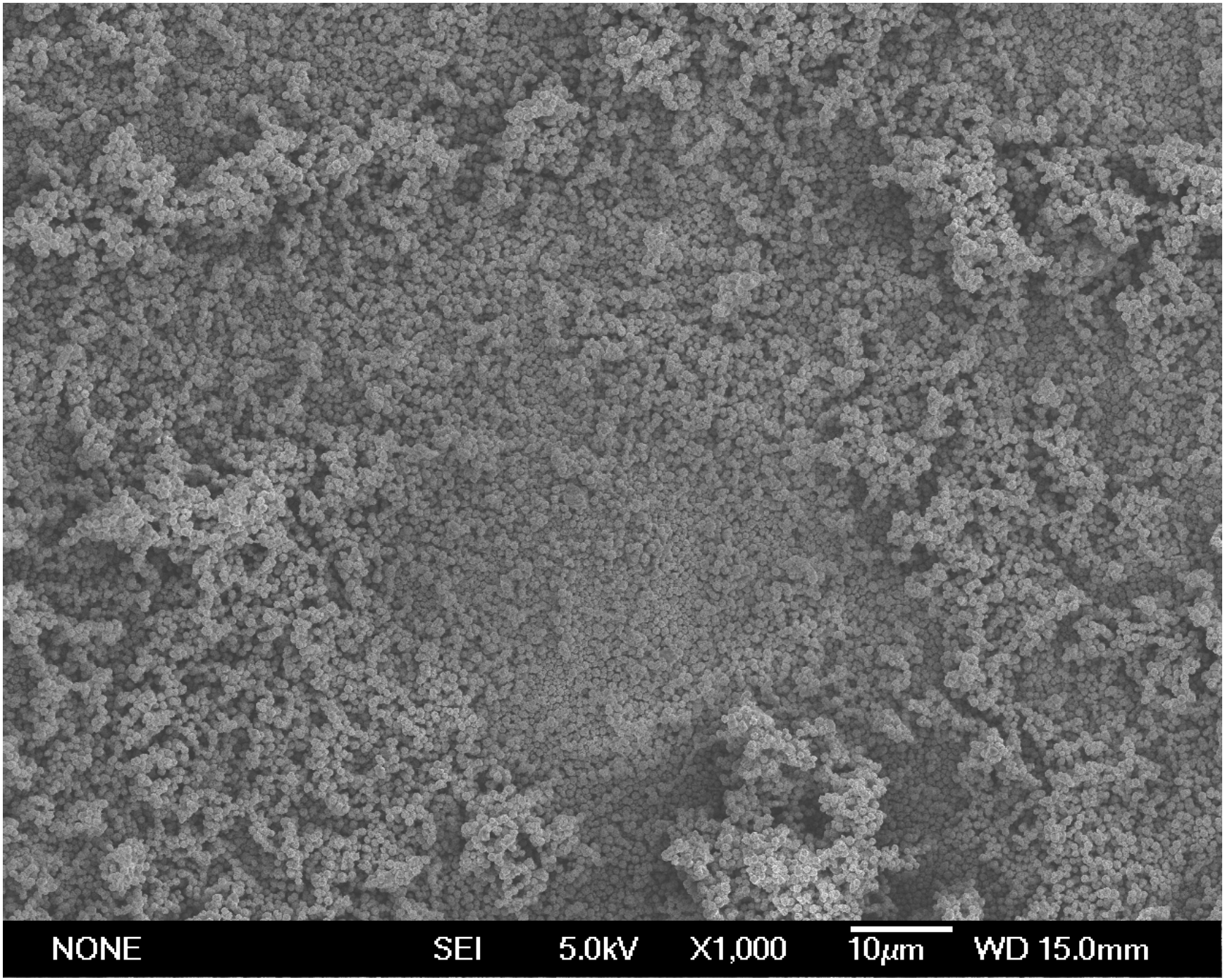
Images adapted from http://www.er.doe.gov/bes/scale_of_things.html

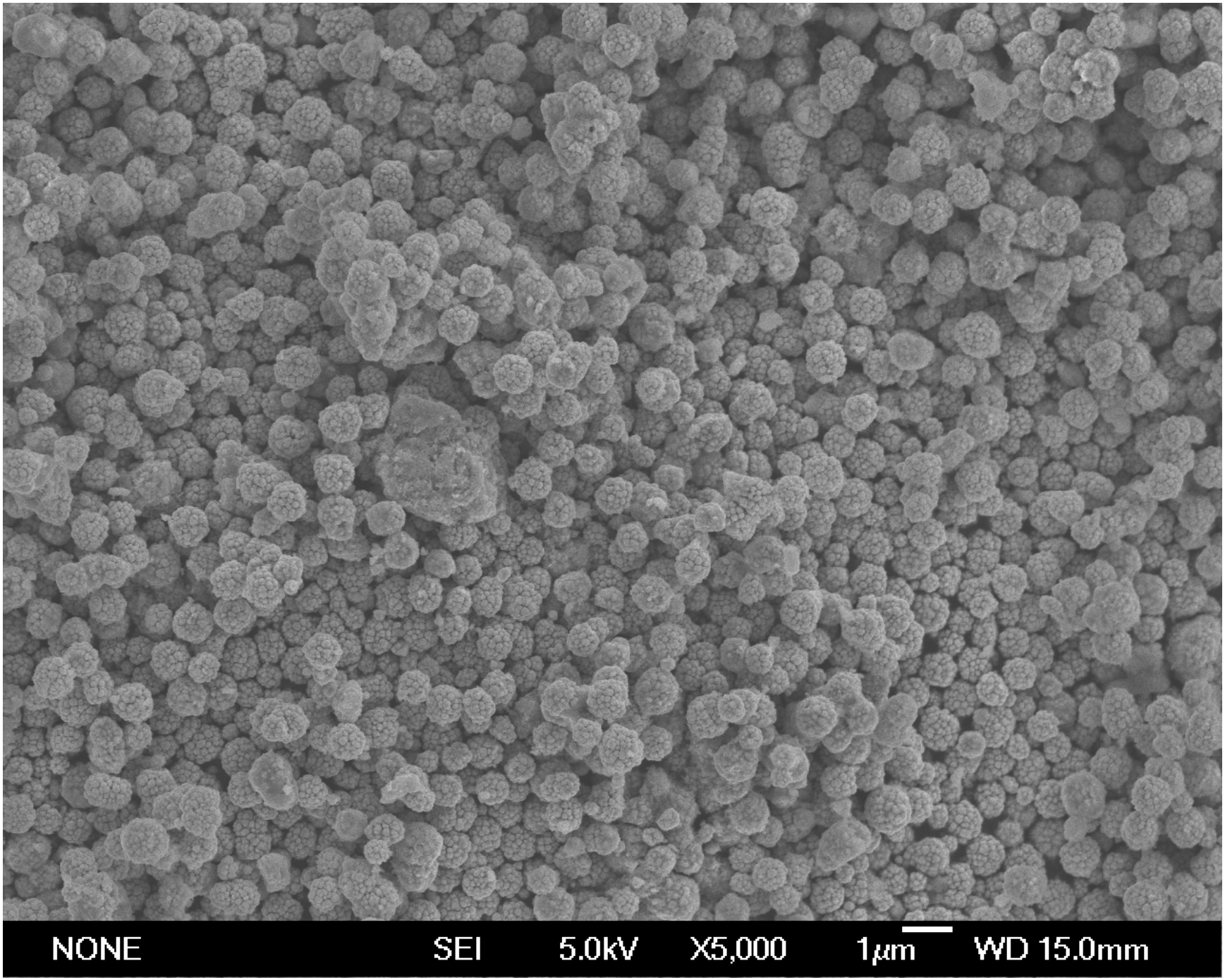
But How Small is This?

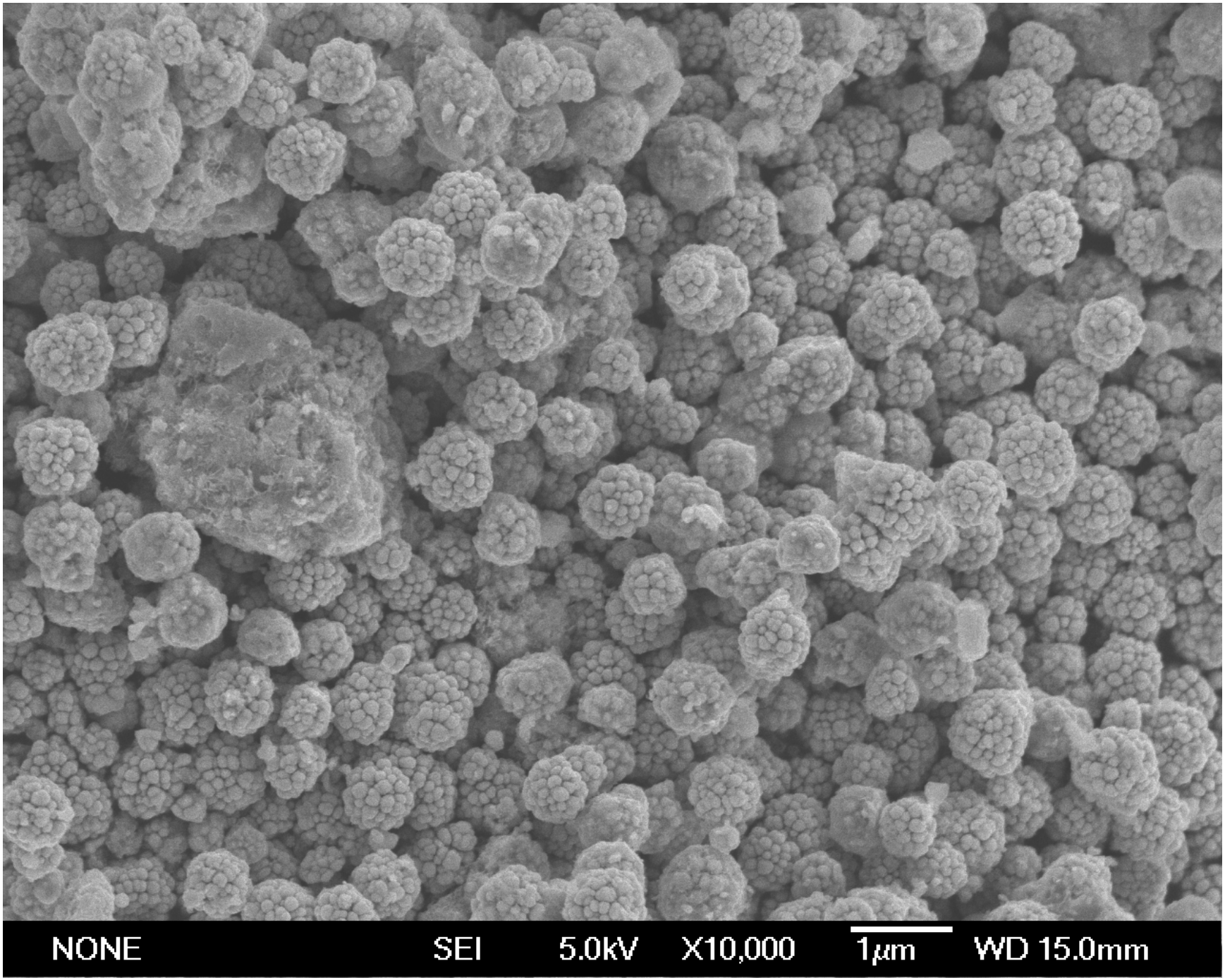
- A human hair is about 50 micrometers thick.
- My particles are more than 1,000 times smaller!
- What's this mean?

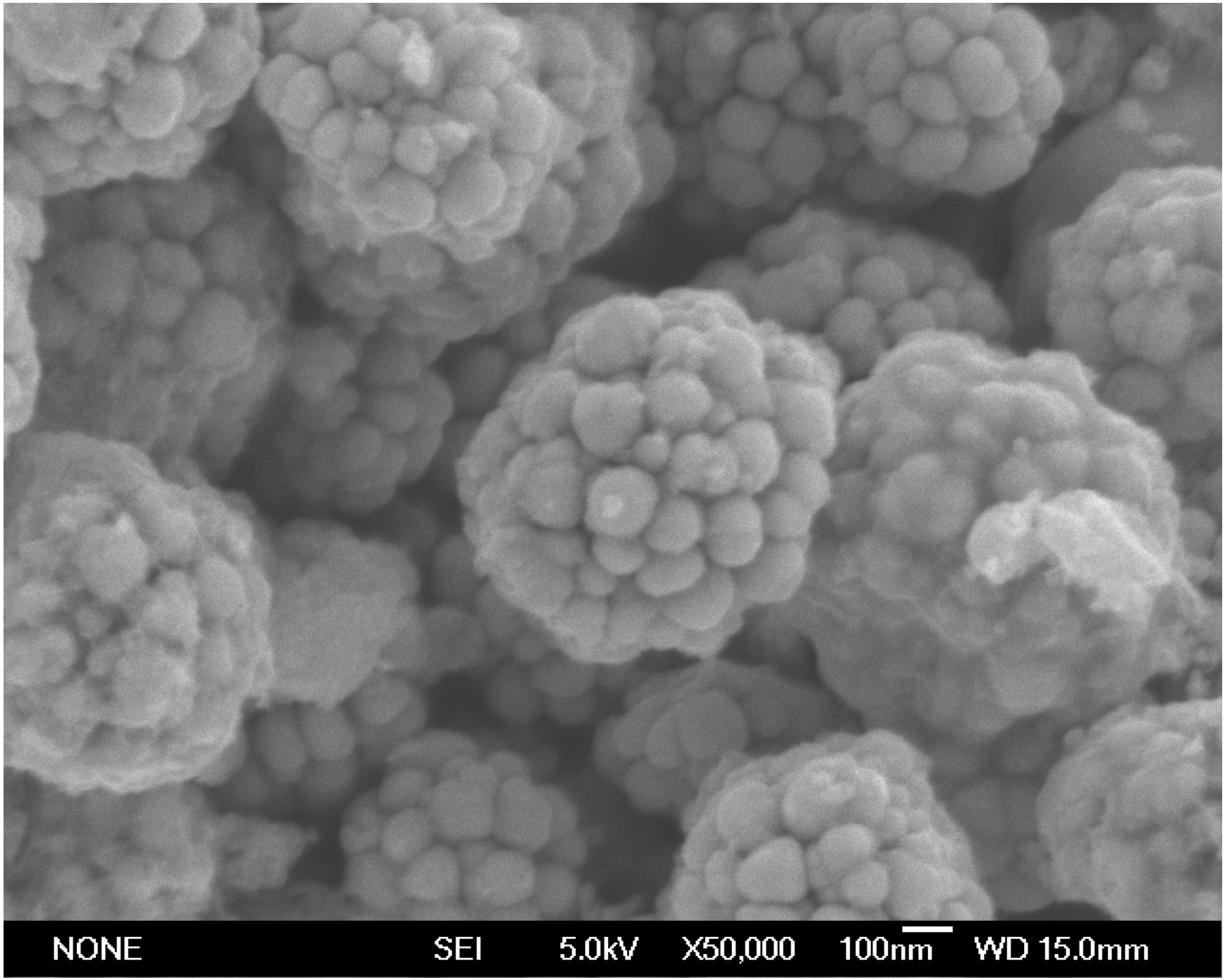
If my average particle were the size of a meterstick, then a human hair would be *more than half a mile* thick!

So let's take a look!


NONE
SEI
5.0kV
X1,000
10µm
WD 15.0mm


NONE
SEI
5.0kV
X5,000
1μm
WD 15.0mm


NONE
SEI
5.0kV
X10,000
1μm
WD 15.0mm


NONE
SEI
5.0kV
X50,000
100nm
WD 15.0mm

How is it Useful?

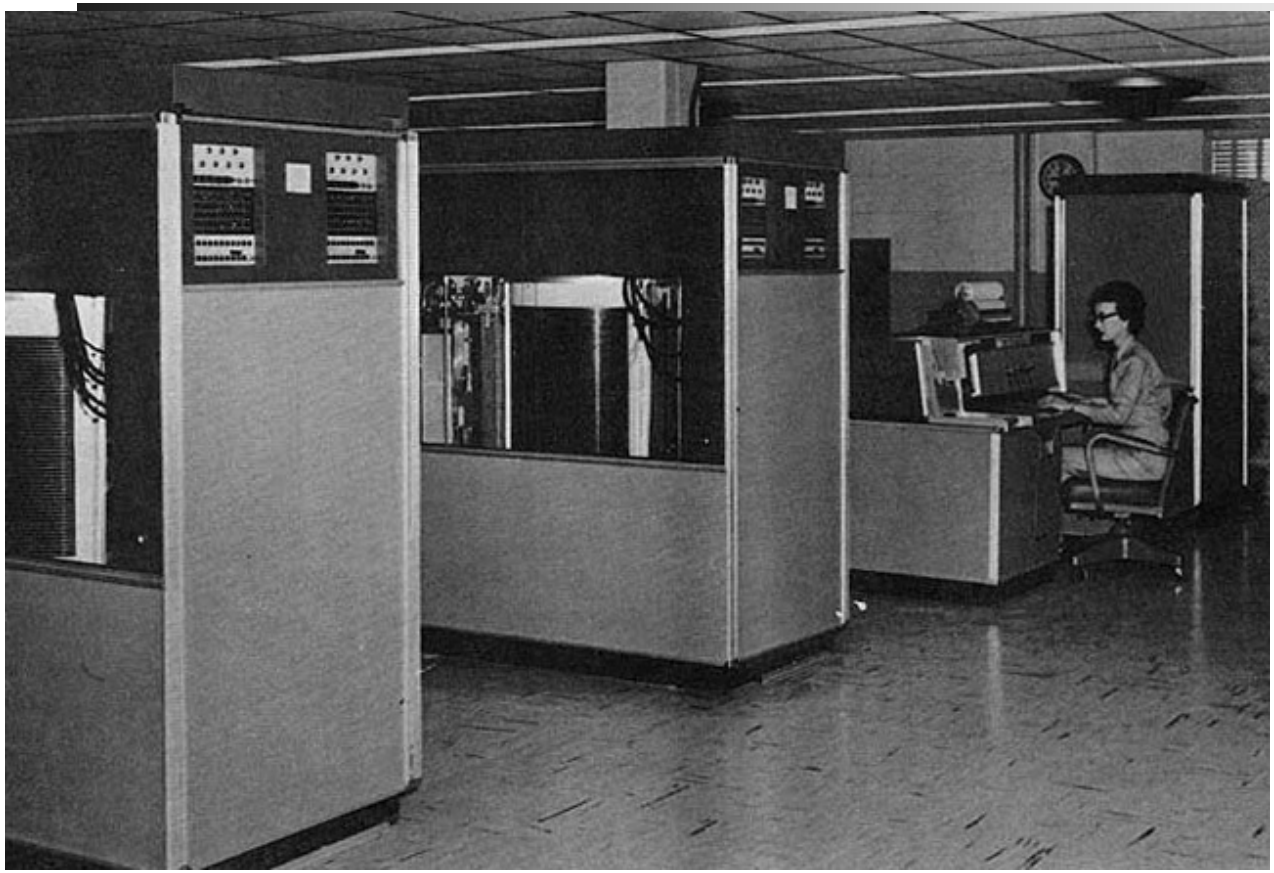
This is a platter from the first model of hard drive, released in 1956.

It is two feet across and stores 0.1 megabytes.

There are many small particles in the coating on this hard disk drive. If we can make the particles smaller then we can store more data!

Image from:
http://upload.wikimedia.org/wikipedia/commons/f/f7/RAMAC_305_disk_.JPG

I Said, How is it Useful?



Capacity:
Two songs

Approximate Size:
A refrigerator

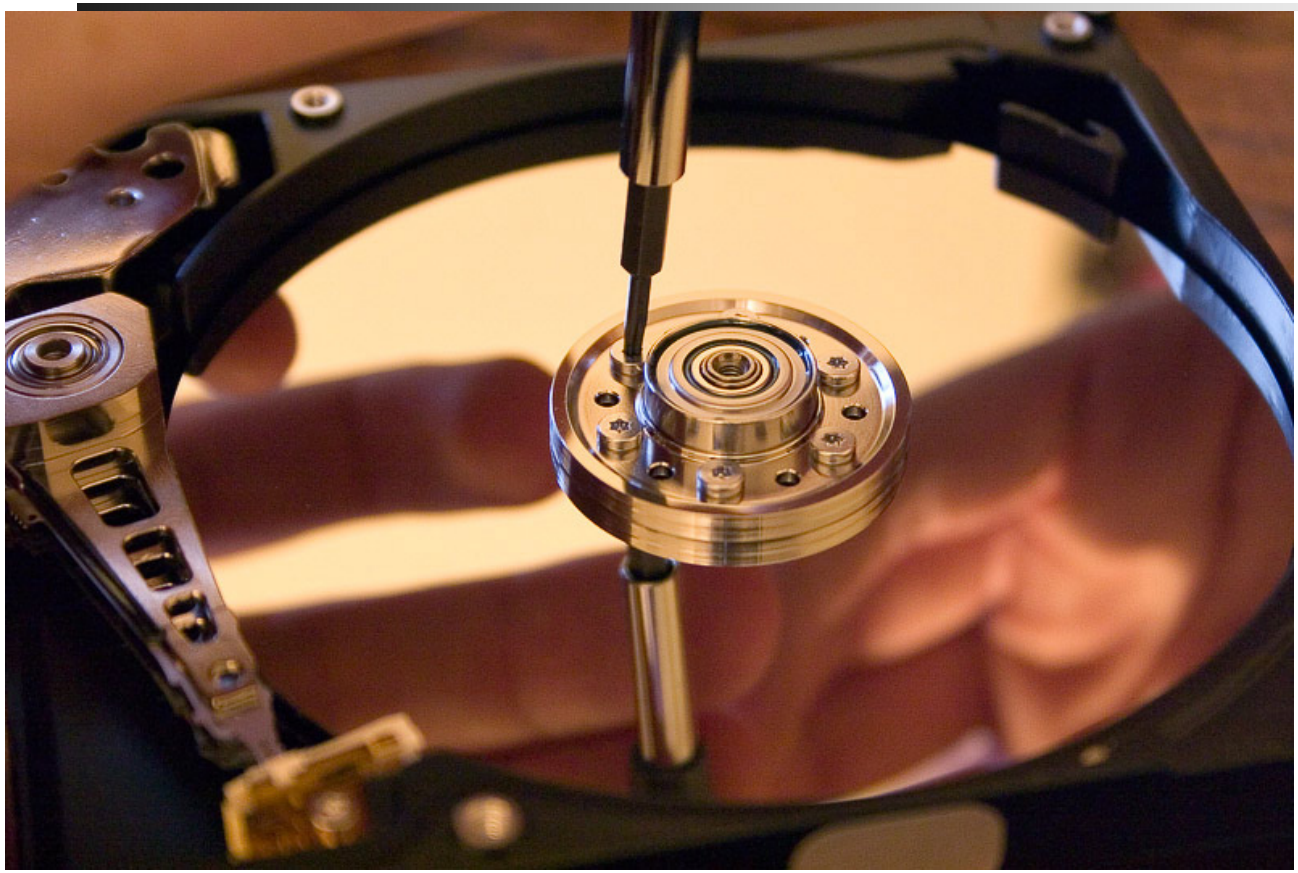
Weight:
About one ton

Cost: $250,000 lease per year!

Cost per song: $125,000!

Image from:
http://upload.wikimedia.org/wikipedia/commons/d/d3/BRL61-IBM_305_RAMAC.jpeg

Really Though, How is it Useful?



Capacity:
400,000 Songs

Approximate Size:
A tissue box

Weight:
Six pounds

Cost: $250, it's not a lease, you own it!

Cost per song: 1/16 of a cent.

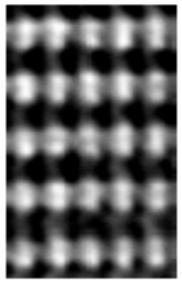
Image from:
http://upload.wikimedia.org/wikipedia/en/1/1d/Hard_disk_platter_reflection.jpg

Is That It?

An MRI watches how your cells respond to an alternating magnetic field. If we put small iron particles inside you, we can see your cells better!

Images from:
http://en.wikipedia.org/wiki/Image:Modern_3T_MRI.JPG
http://en.wikipedia.org/wiki/Image:MRI_head_saggital.jpg

So Why Else is Size Important?



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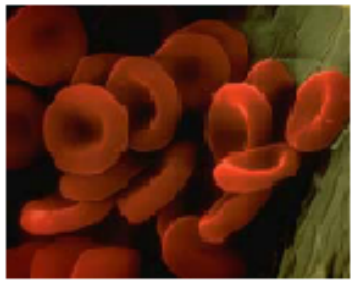

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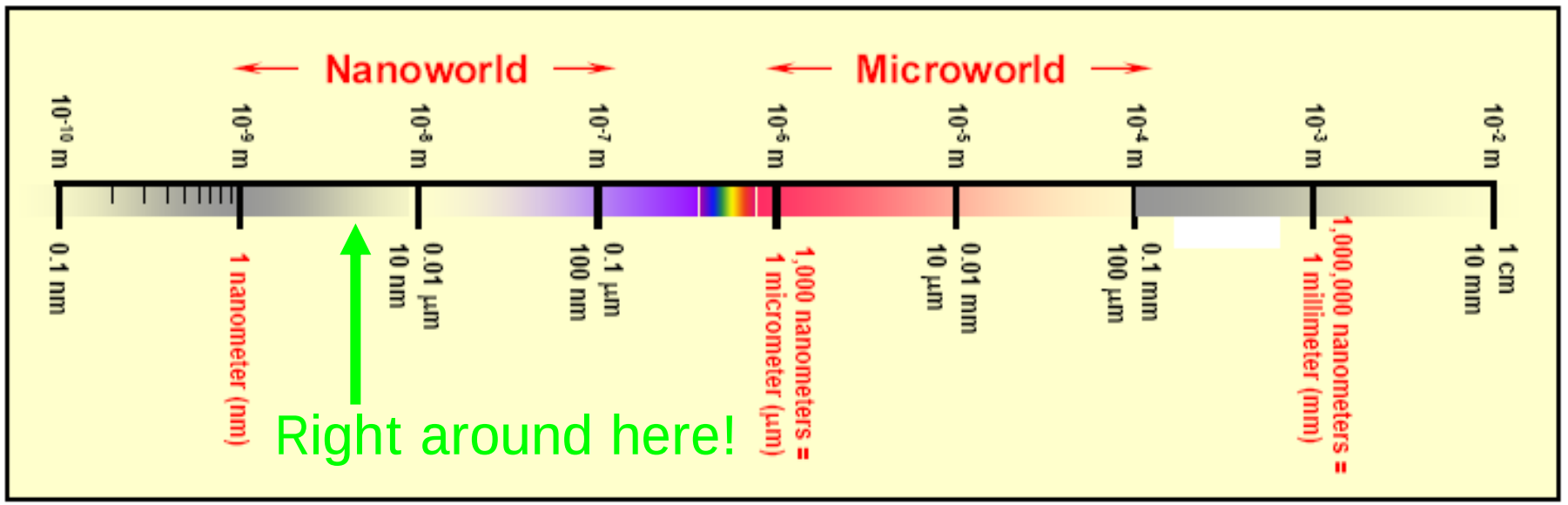

As iron gets smaller and smaller it can burn, but its also true that as it gets smaller and smaller, it will stop being magnetic!

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About Me:


Moved back to:
Hamlin, NY
Moved to:
Newark, DE
Moved to:
Bloomington, IN
Street View
Traffic
100 mi
200 km
©2007 Google - Map data ©2007 NAVTEQ

About Me:

Grade: 23rd.

Why? To get a PhD in Physics.

Why? To get a job as a college/university professor.
(Or maybe work for the government.)

Why? To have a job that both pays the bills and isn't boring.

What do I like to do when I'm not working?
ROAD TRIPS!

What is my favorite road trip?
Skipping school in senior year of high school to see Pink Floyd in concert.

My Favorite Place: