



THE UNIVERSITY OF
CHICAGO



ENRICO FERMI
INSTITUTE



Philipp Windischhofer
September 30, 2023

A large crowd of people is gathered around the Cloud Gate sculpture in Millennium Park, Chicago. The sculpture is highly reflective, mirroring the surrounding city buildings and the sky. The text "Technology is everywhere!" is overlaid in yellow on the sculpture. The scene is set in a dense urban environment with tall buildings in the background.

Technology
is everywhere!

Technology
is everywhere!



- 1. A person in the foreground on the left, looking down at a device.
- 2. A person in the middle ground, looking at a smartphone.
- 3. A person in the middle ground, looking at a smartphone.
- 4. A person in the foreground, looking at a smartphone.
- 5. A person in the middle ground, looking at a smartphone.
- 6. A person in the middle ground, looking at a smartphone.
- 7. A person in the middle ground, looking at a smartphone.
- 8. A person in the foreground on the right, looking at a smartphone.

A large crowd of people is gathered around the Cloud Gate sculpture in Millennium Park, Chicago. The sculpture is highly reflective, mirroring the surrounding city buildings and the sky. The text "Technology is everywhere!" is overlaid in yellow on the sculpture. The scene is set in a dense urban environment with tall buildings in the background.

Technology
is everywhere!

Technology
is everywhere!



A large crowd of people is gathered around the Cloud Gate sculpture in Millennium Park, Chicago. The sculpture is highly reflective, mirroring the surrounding city buildings and the sky. The text "Technology is everywhere!" is overlaid in yellow on the sculpture. The scene is set in a city with tall buildings and a clear blue sky.

Technology
is everywhere!



Technology
is everywhere!

A large crowd of people is gathered around the Cloud Gate sculpture in Millennium Park, Chicago. The sculpture is highly reflective, mirroring the surrounding city buildings and the sky. The text "Technology is everywhere!" is overlaid in yellow on the sculpture. The scene is set in a city with tall buildings and a clear blue sky.

Technology
is everywhere!

Technology
is everywhere!



A large crowd of people is gathered around the Cloud Gate sculpture, a large, reflective, bean-shaped structure. The sculpture is highly polished and reflects the surrounding city buildings and the sky. The people are of various ages and are engaged in different activities, such as walking, talking, and taking photos. The background consists of tall, multi-story buildings with many windows, typical of a dense urban environment. The sky is clear and blue. The overall scene is bright and sunny, suggesting a clear day.

Technology
is everywhere!

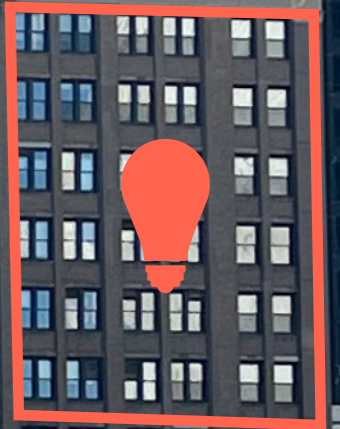


Technology
is everywhere!

A large crowd of people is gathered around the Cloud Gate sculpture in Millennium Park, Chicago. The sculpture is highly reflective, mirroring the surrounding city buildings and the sky. The text "Technology is everywhere!" is overlaid in yellow on the sculpture. The scene is set in a dense urban environment with tall buildings in the background.

Technology
is everywhere!

Technology
is everywhere!



A large crowd of people is gathered around the Cloud Gate sculpture in Millennium Park, Chicago. The sculpture is highly reflective, mirroring the surrounding city buildings and the sky. The text "Technology is everywhere!" is overlaid in yellow on the sculpture. The scene is set in a dense urban environment with tall buildings in the background.

Technology
is everywhere!



Day-runners transported important messages in ancient Greece

V. V. Illouqnsy.

Why didn't they have radios?



*"People listening to a radio in ancient Greece"
as imagined by a stable diffusion model*

Bracelet with gold wire
4th-3rd century BC [source]



Bracelet with gold wire
4th-3rd century BC [source]



Bronze water vessel
7th-6th century BC [source]



Bracelet with gold wire
4th-3rd century BC [source]



Bronze water vessel
7th-6th century BC [source]



Glass amphora
2nd-1st century BC



Bracelet with gold wire
4th-3rd century BC [source]



Bronze water vessel
7th-6th century BC [source]

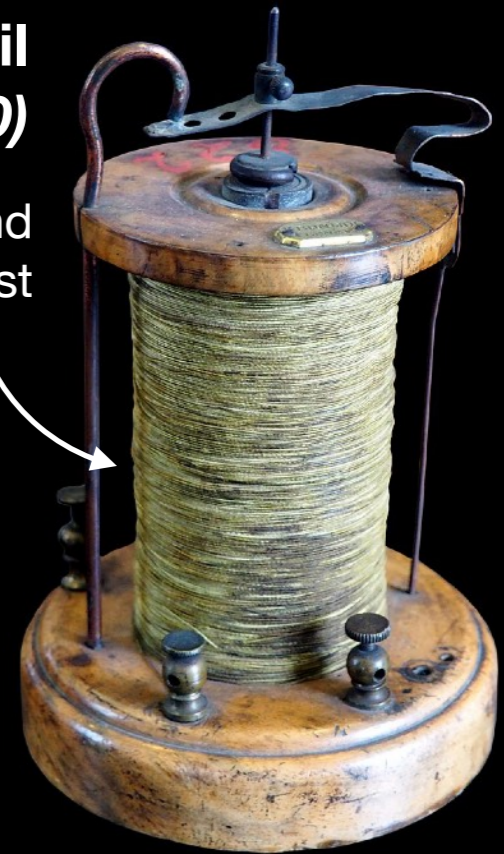


Glass amphora
2nd-1st century BC



Induction coil
(Ca. 1900)

Wire wound around
wooden post



Bracelet with gold wire
4th-3rd century BC [source]



Bronze water vessel
7th-6th century BC [source]

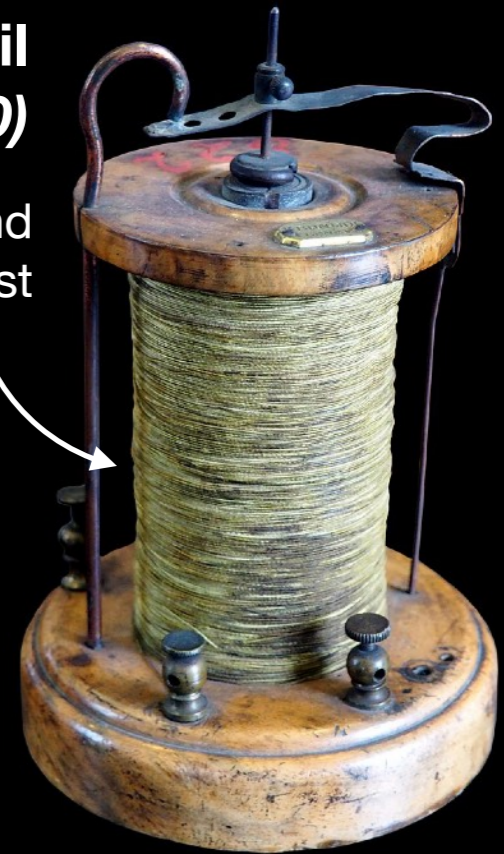


Glass amphora
2nd-1st century BC

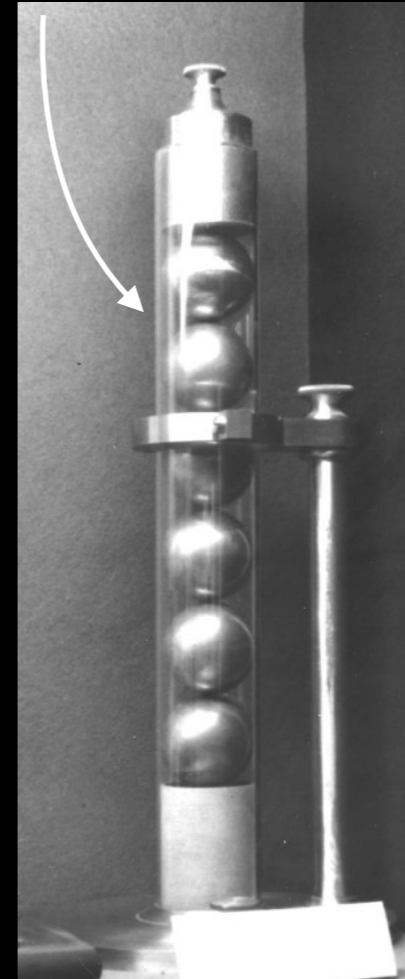


Induction coil
(Ca. 1900)

Wire wound around
wooden post



Metal balls in
glass tube



Ball coherer
(1899)

Bracelet with gold wire
4th-3rd century BC [source]



Bronze water vessel
7th-6th century BC [source]

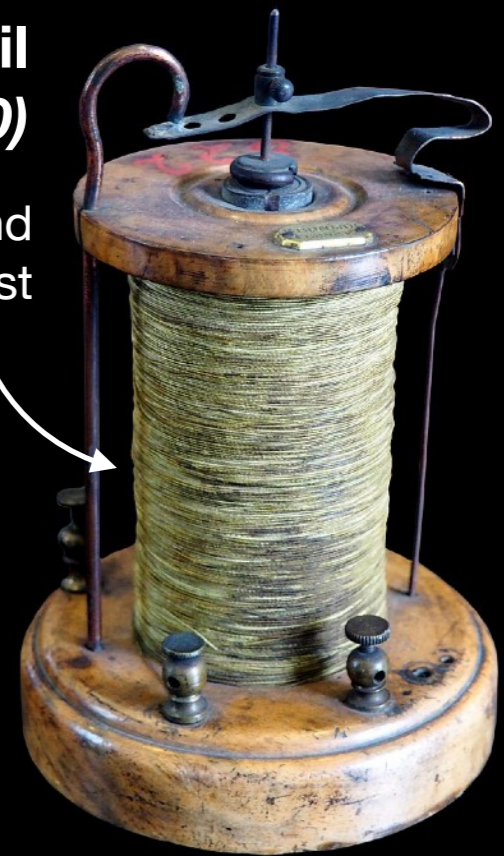


Glass amphora
2nd-1st century BC

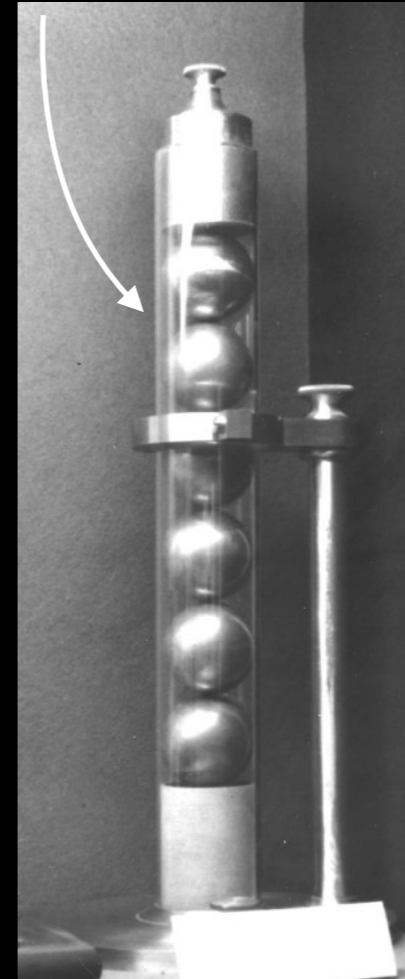


Induction coil
(Ca. 1900)

Wire wound around
wooden post



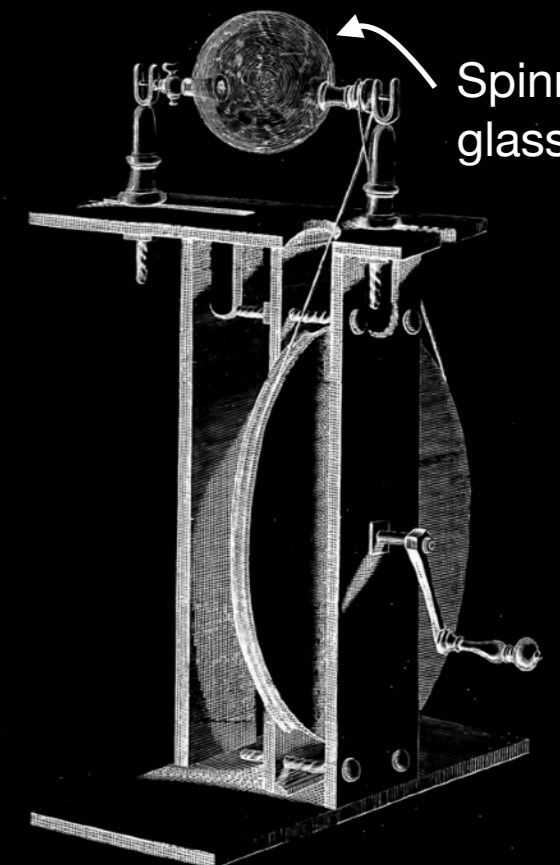
Metal balls in
glass tube



Ball coherer
(1899)

Electrical machine
(Ca. 1719)

Spinning
glass globe



Bracelet with gold wire
4th-3rd century BC [source]



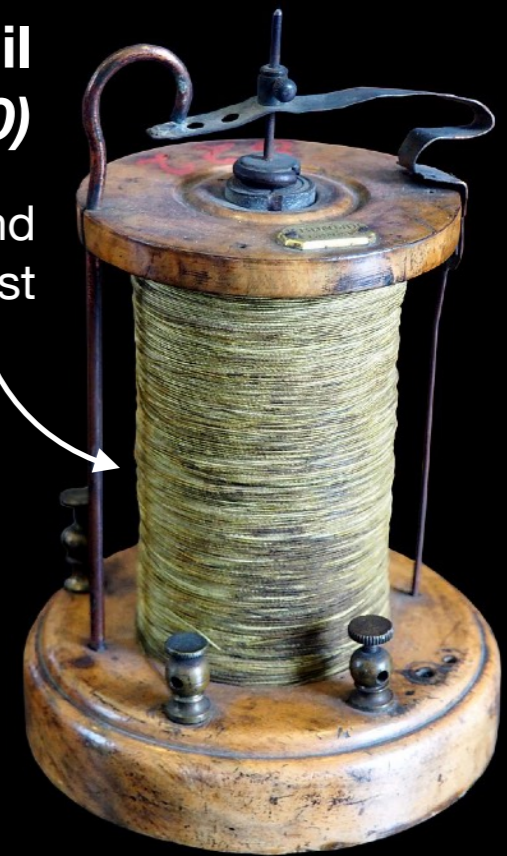
Bronze water vessel
7th-6th century BC [source]



Why didn't the ancient Greeks pioneer radio communication?

Induction coil
(Ca. 1900)

Wire wound around wooden post

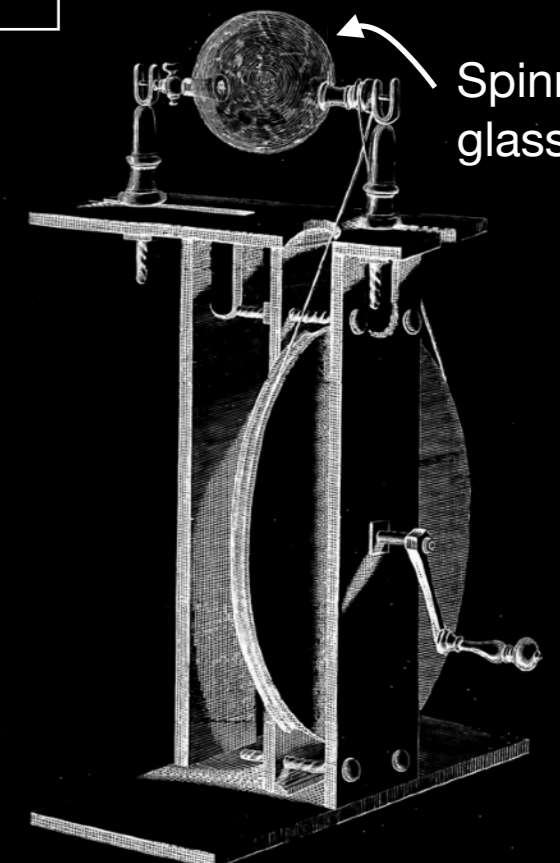


Metal balls in glass tube

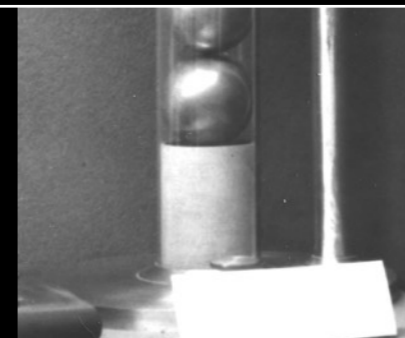


Electrical machine
(Ca. 1719)

Spinning glass globe



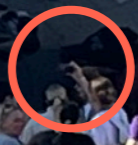
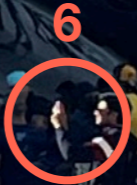
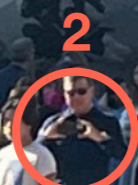
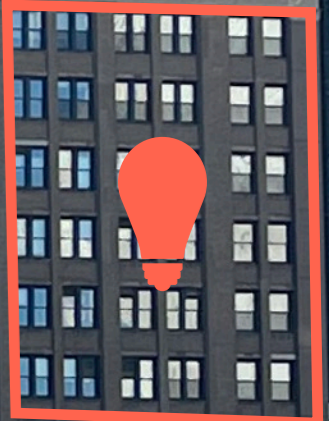
Ball coherer
(1899)





Technology is everywhere!

—how did we learn to manipulate nature around us?



My attempt at an answer in eight lectures:

My attempt at an answer in eight lectures:

HOW FUNDAMENTAL SCIENCE HAS CHANGED THE WORLD

My attempt at an answer in eight lectures:

HOW FUNDAMENTAL SCIENCE HAS CHANGED THE WORLD

A STORY OF INVENTION AND DISCOVERY

My attempt at an answer in eight lectures:

How did scientific discoveries
come about?

And how did they pave the way
for technological progress?

My attempt at an answer in eight lectures:

“How did we get here?”



The program for today:

“Where are we now?”

The program for today:

“Where are we now?”

“How did we roughly get here?”

The program for today:

“Where are we now?”

“How did we roughly get here?”

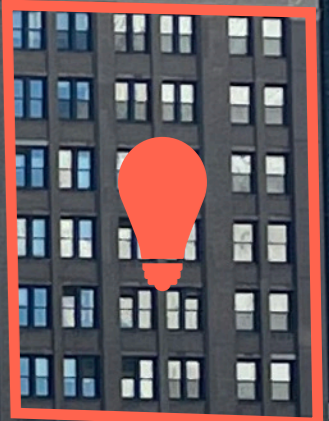
Next week: the real story begins

The program for today:

“Where are we now?”

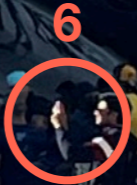
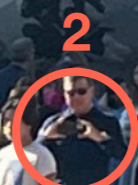
“How did we roughly get here?”

Next week: the real story begins



Technology is everywhere!

—let's get a taste



Where does electricity come from?

Where does electricity come from?



Your TV remote control
(or your cellphone)

Where does electricity come from?



Your TV remote control
(or your cellphone)



My computer

Where does electricity come from?

A source of electricity



Your TV remote control
(or your cellphone)



My computer

Where does electricity come from?

A source of electricity



Your TV remote control
(or your cellphone)

Not a source of electricity



My computer

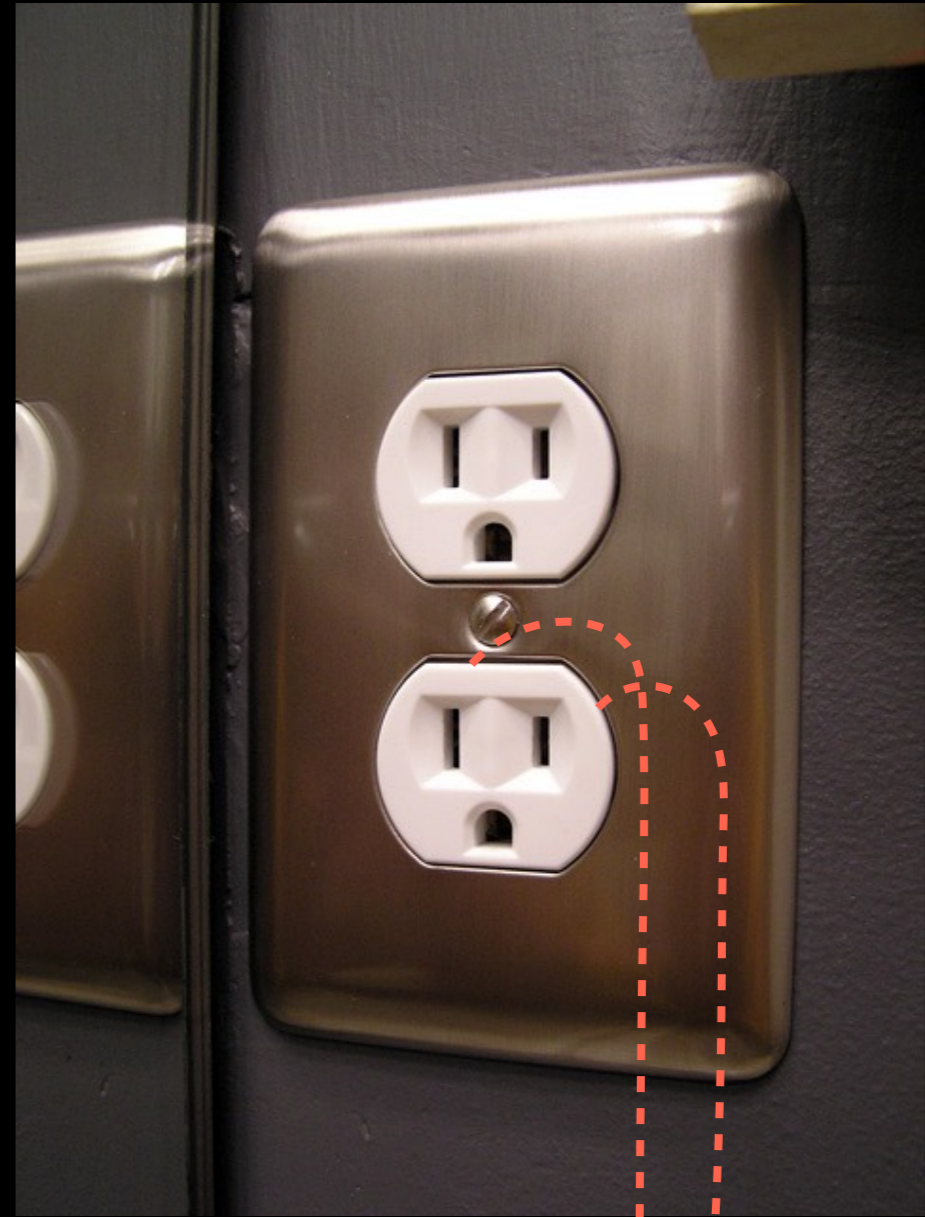
Where does electricity come from?

A source of electricity



Your TV remote control
(or your cellphone)

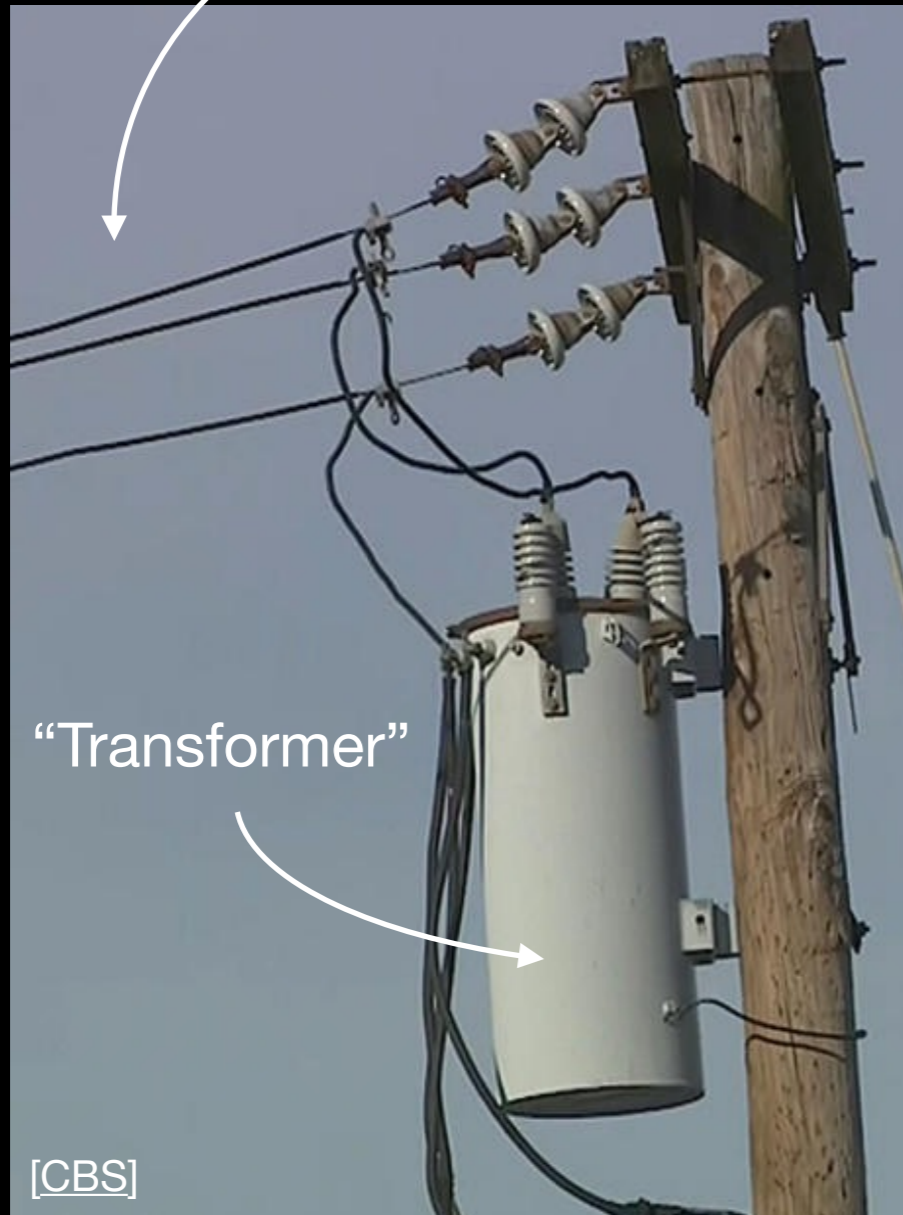
Not a source of electricity



My computer

Where does electricity come from?

Towards power station



To house

Not a source of electricity

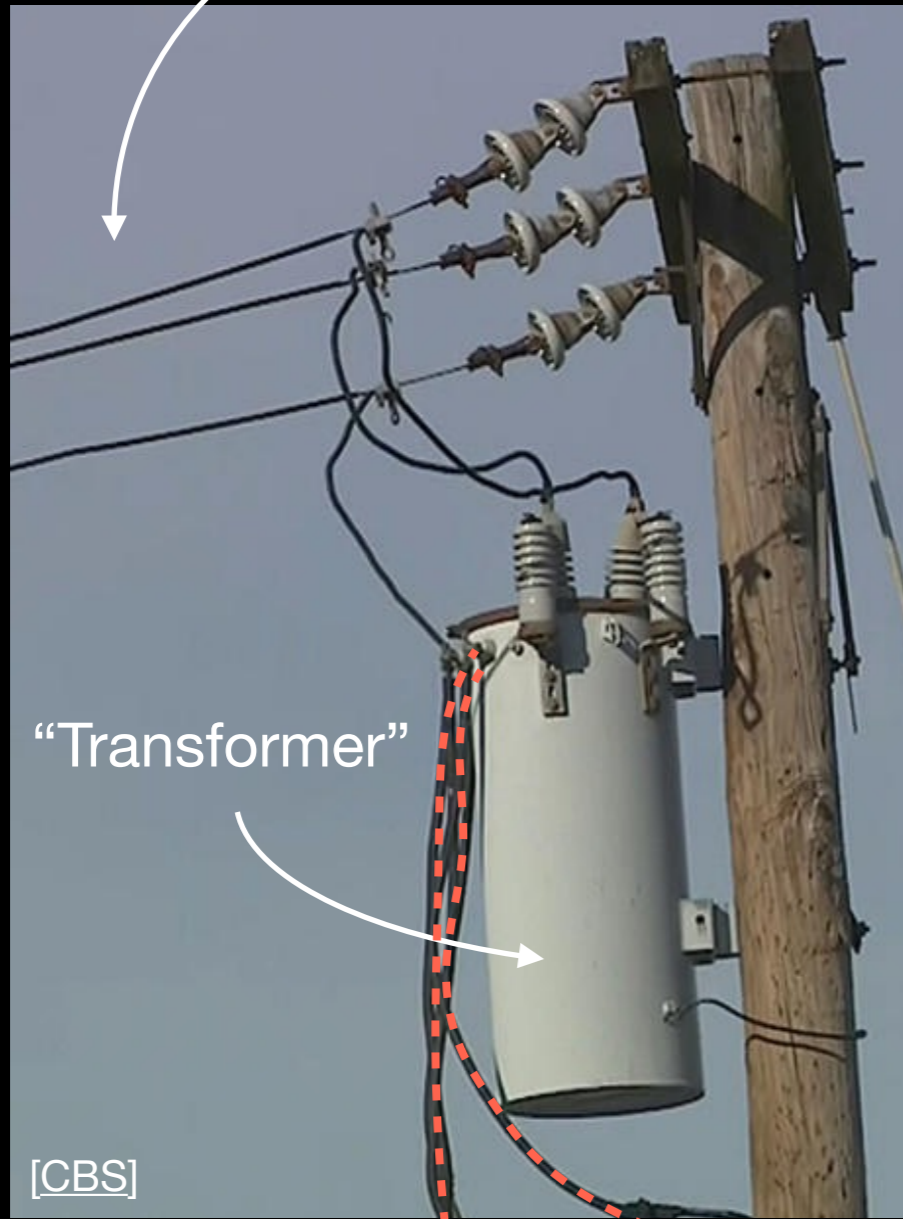


My computer

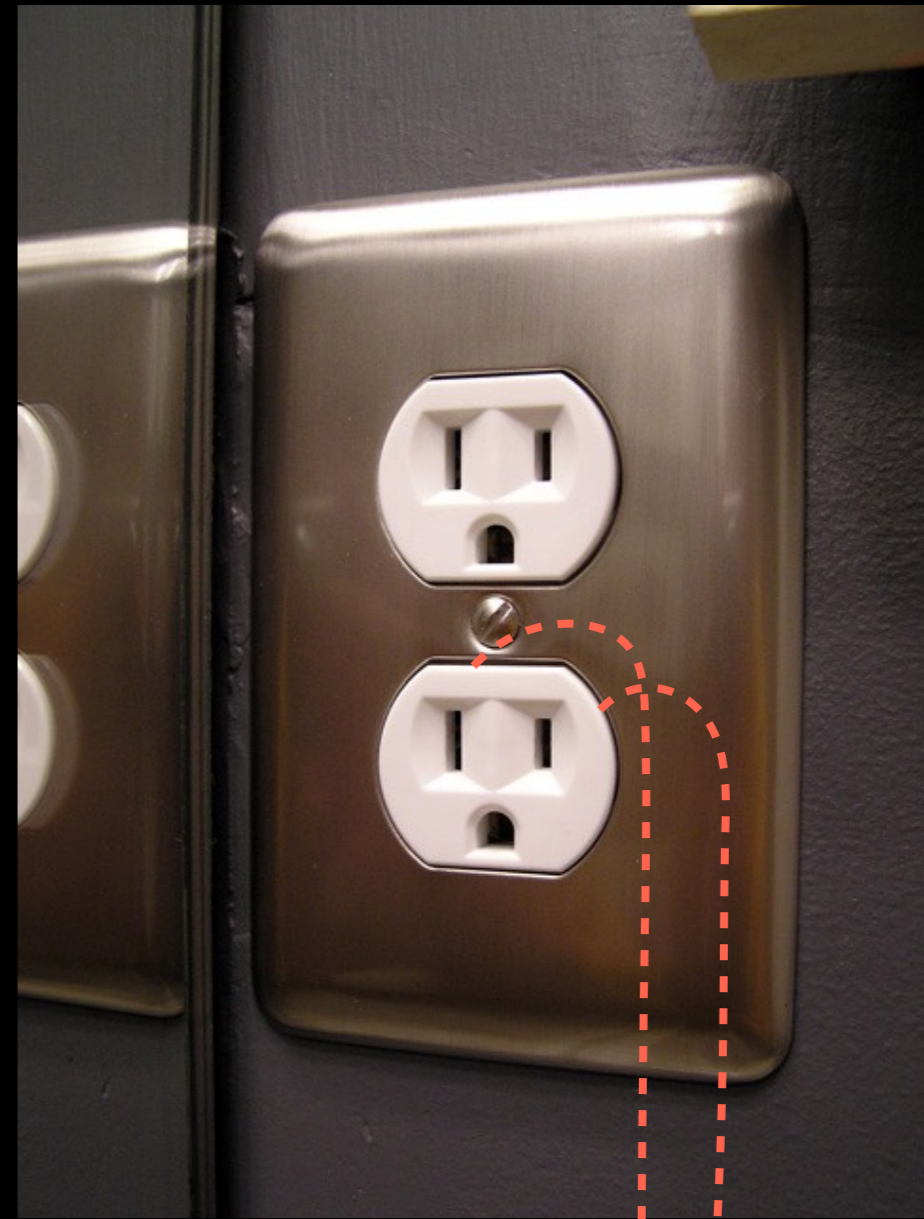
Where does electricity come from?

Not a source of electricity

Towards power station



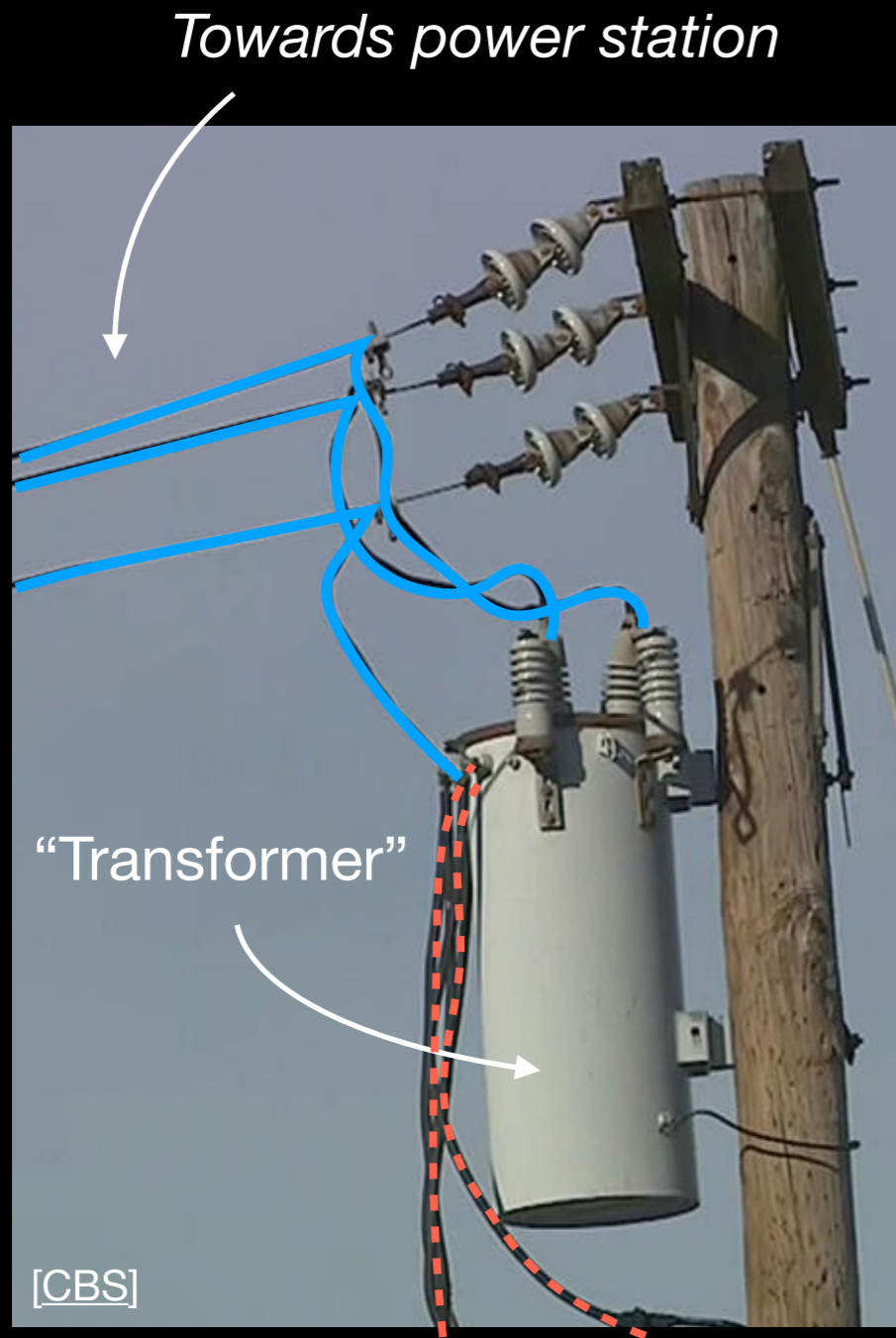
To house



My computer

Where does electricity come from?

Not a source of electricity



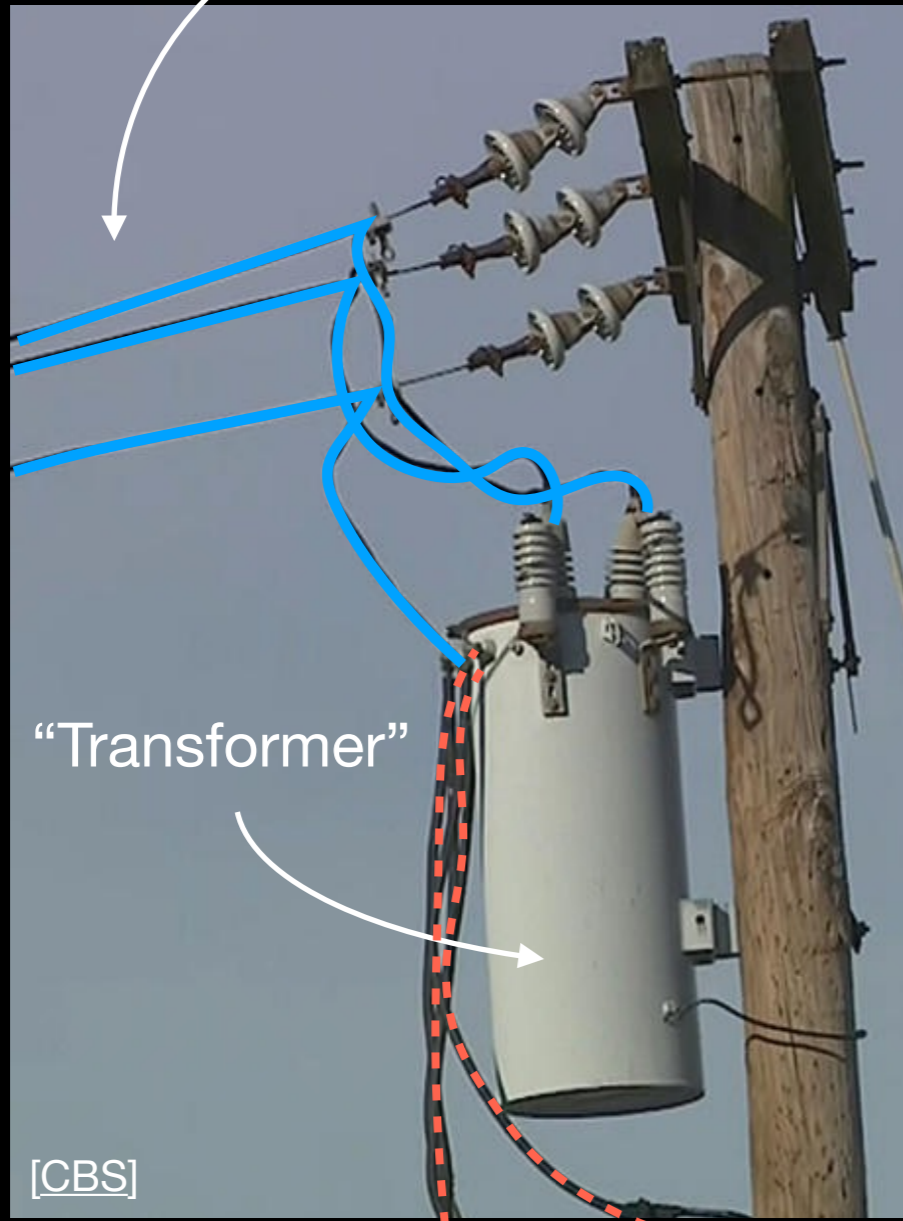
To house



My computer

Where does electricity come from?

Towards power station

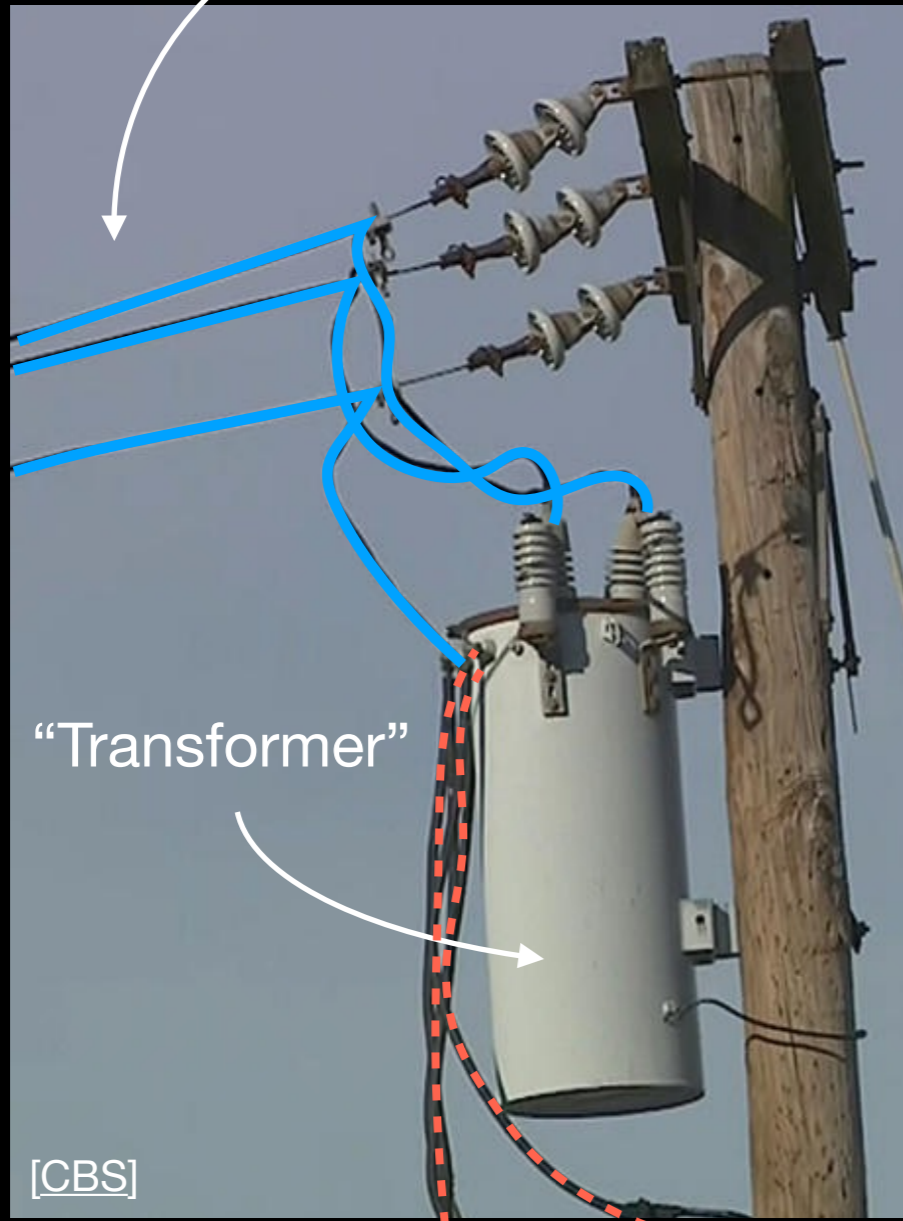


To house



Where does electricity come from?

Towards power station



"Transformer"

[CBS]

To house



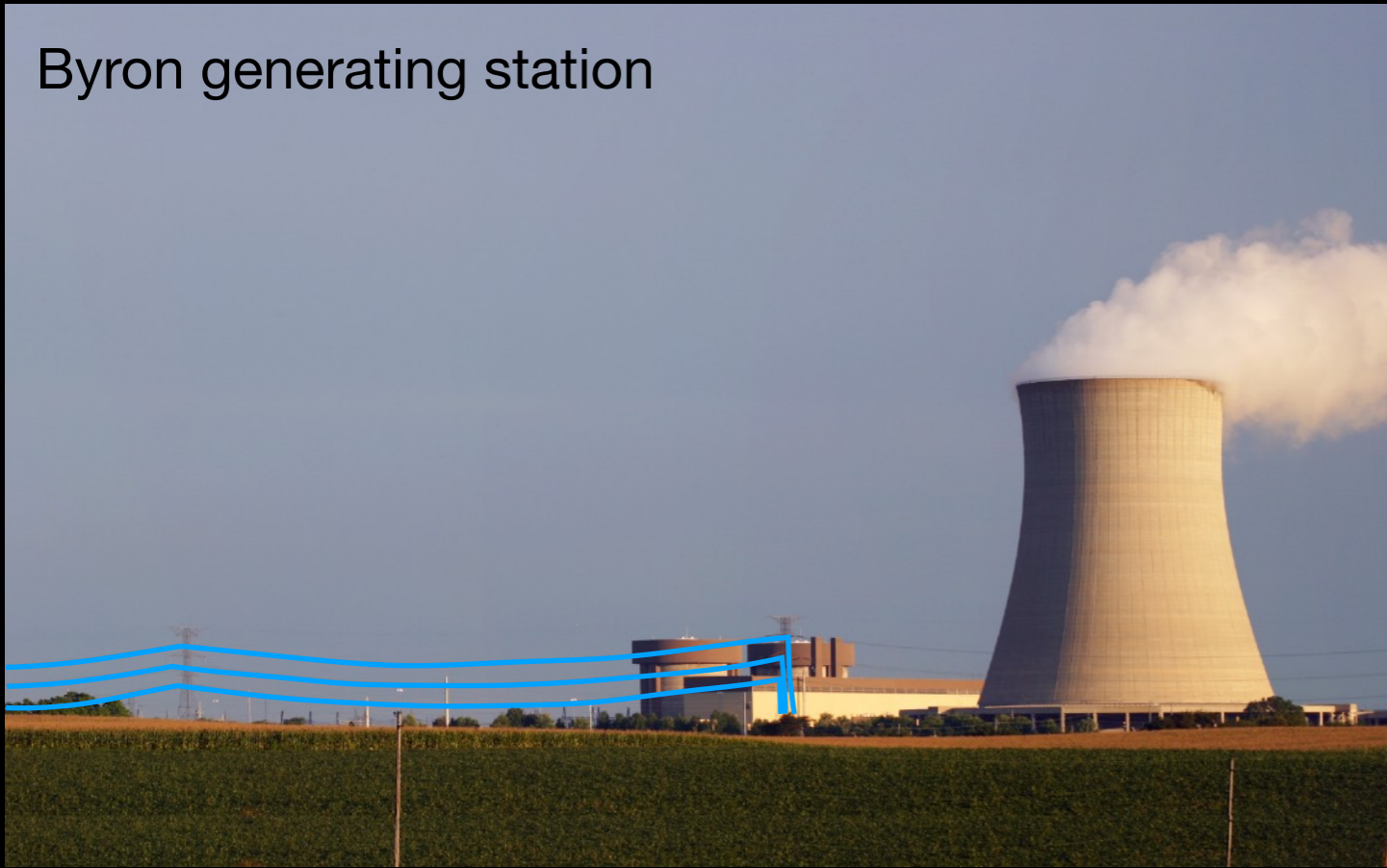
Where does electricity come from?

Byron generating station



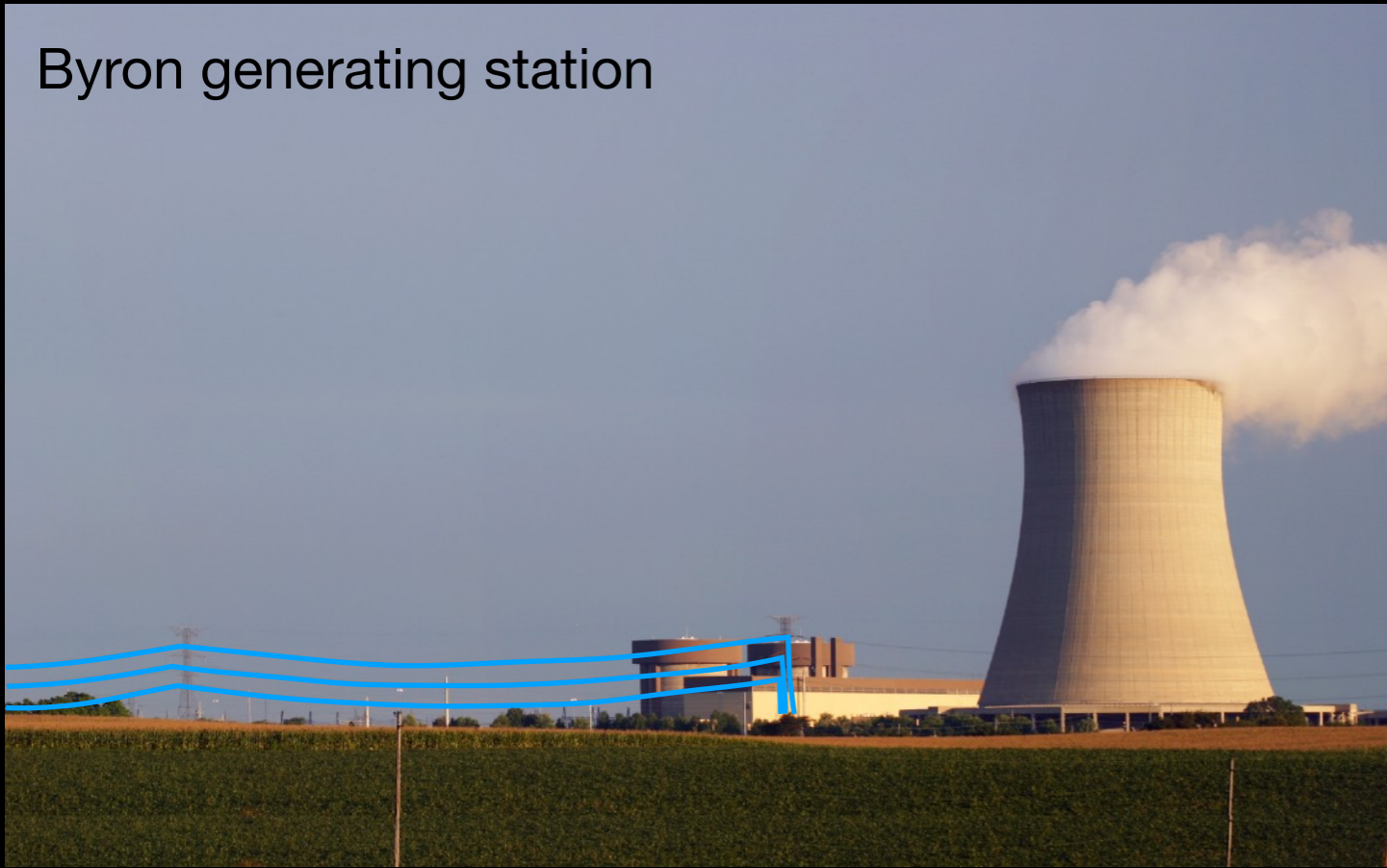
Where does electricity come from?

Byron generating station



Where does electricity come from?

Byron generating station

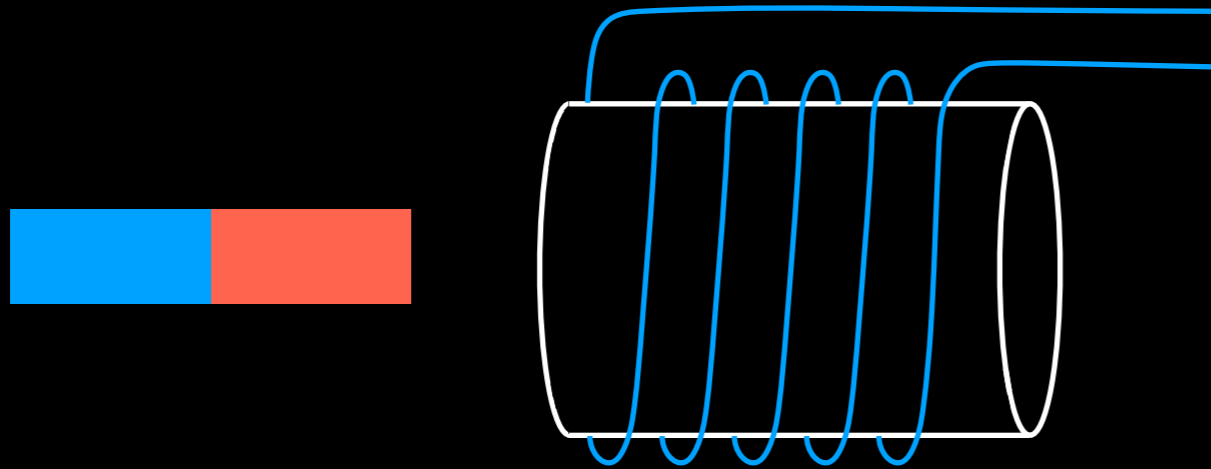


Where does electricity come from?

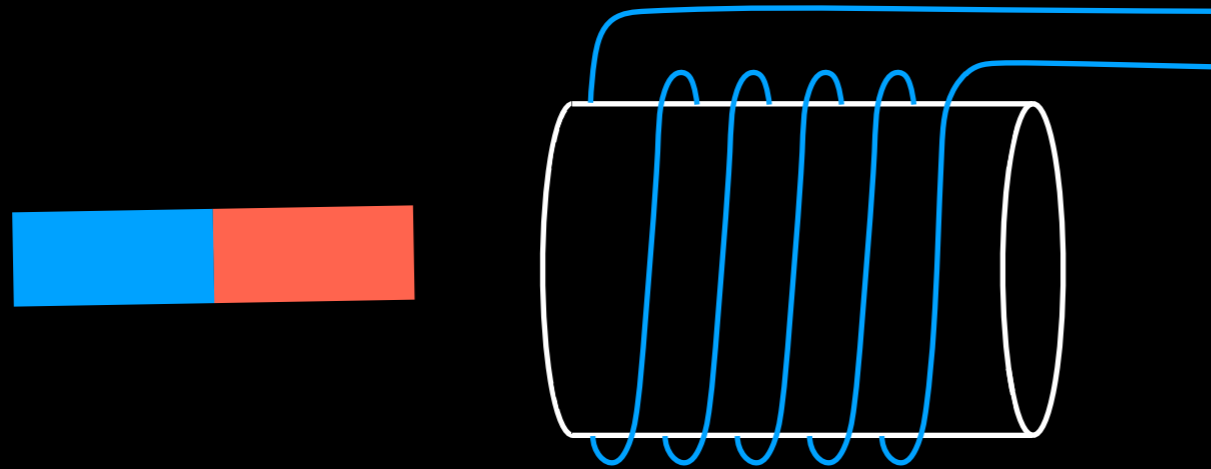
Byron generating station



Where does electricity come from?



Where does electricity come from?

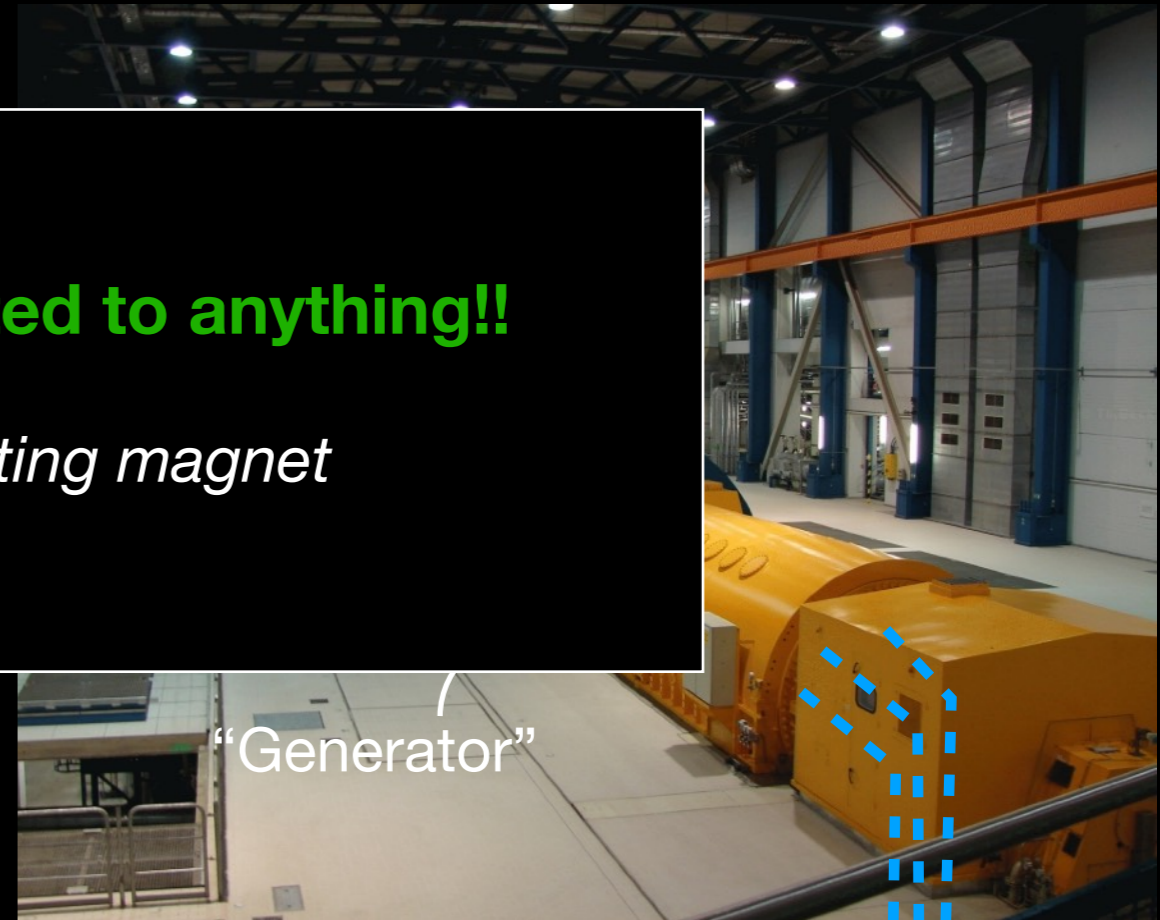
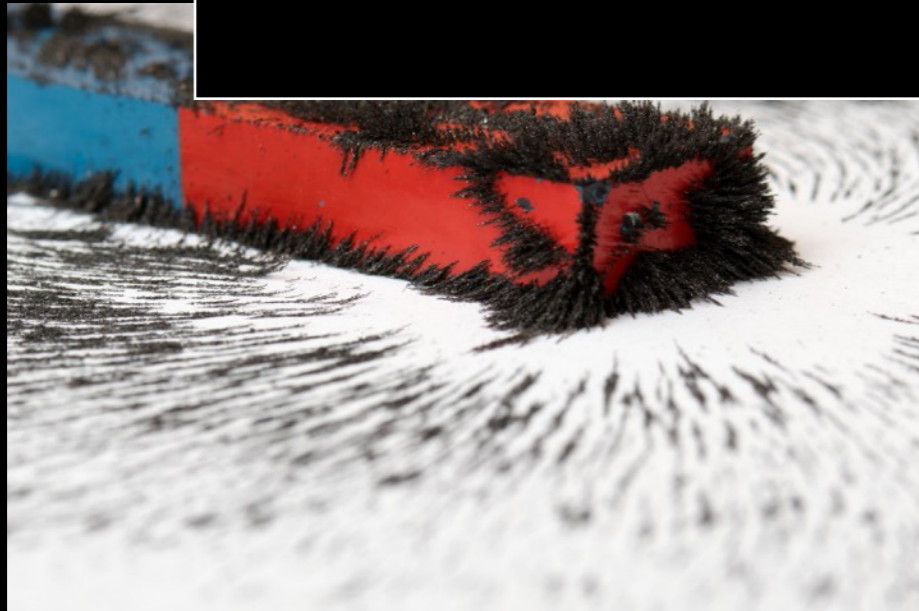


Where does electricity come from?



The wires are not connected to anything!!

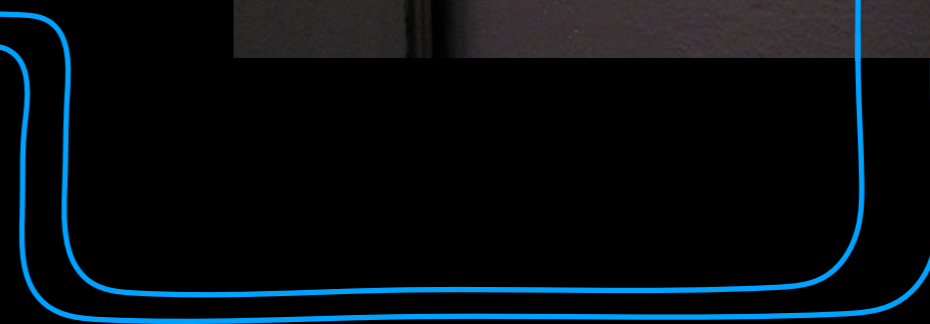
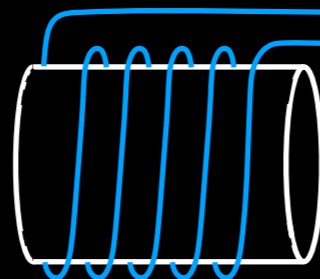
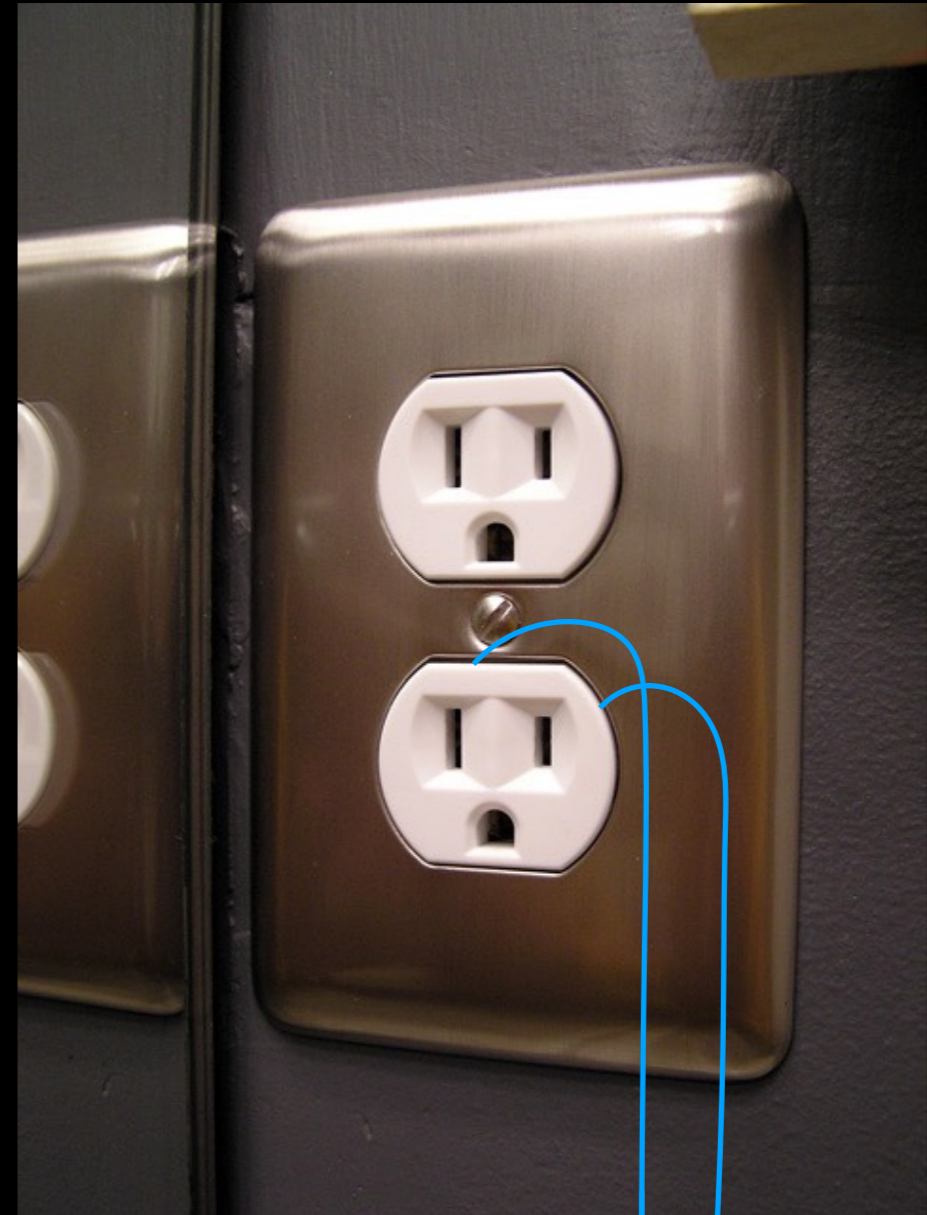
They just pass by a rotating magnet



Where does electricity come from?

“120 V / 60 Hz”

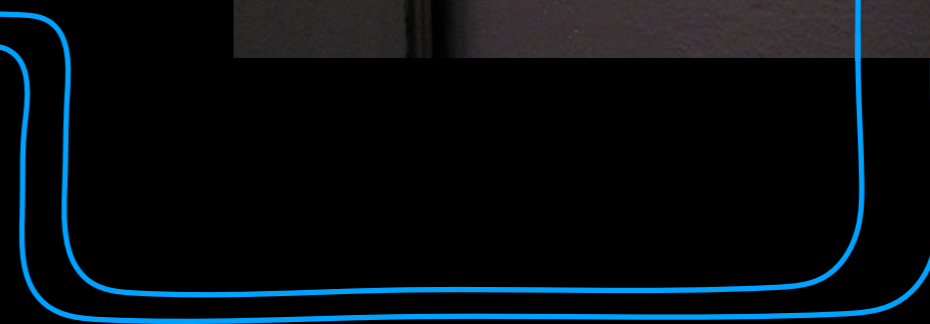
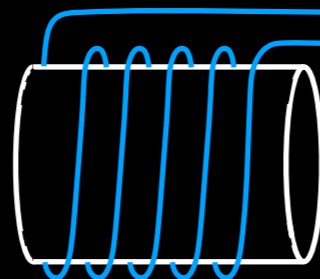
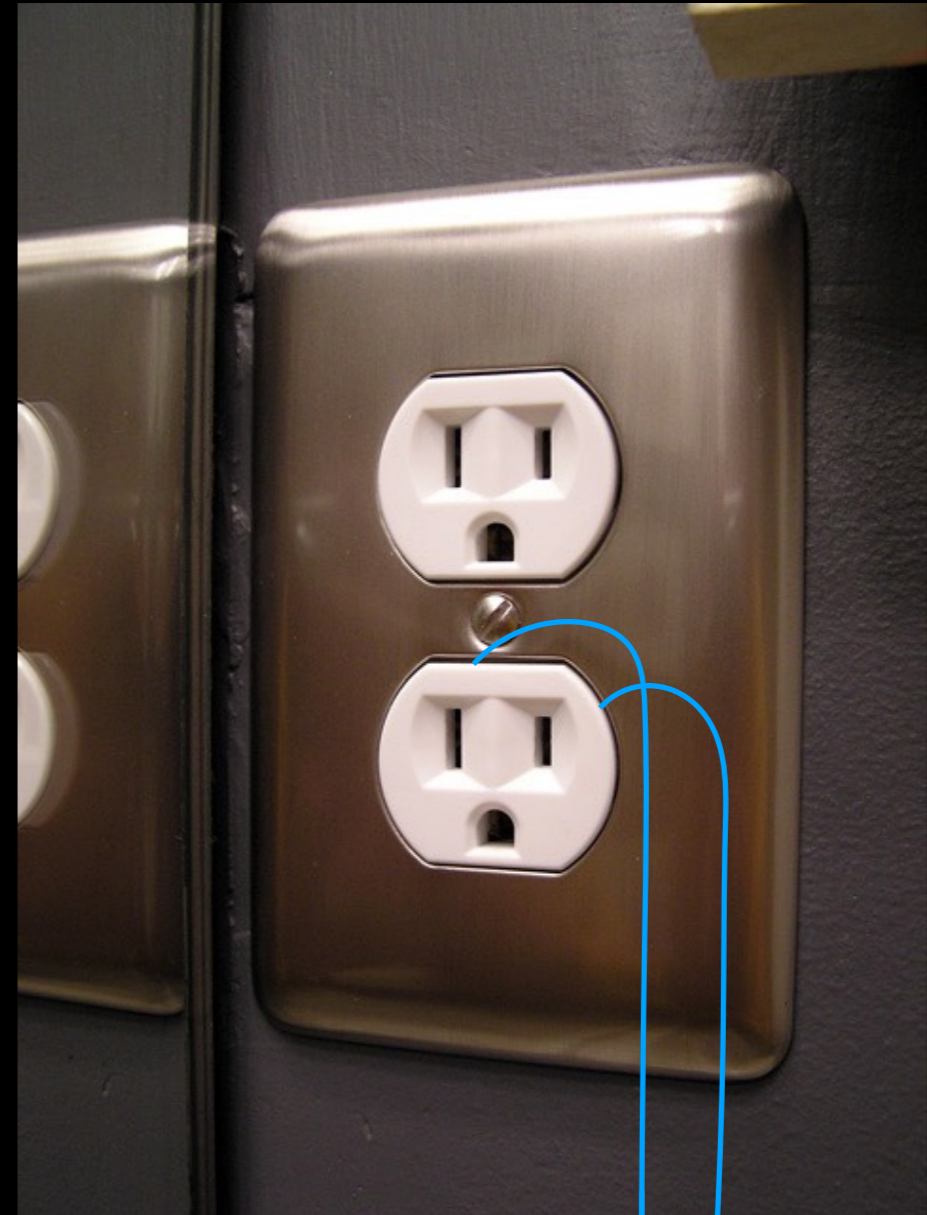
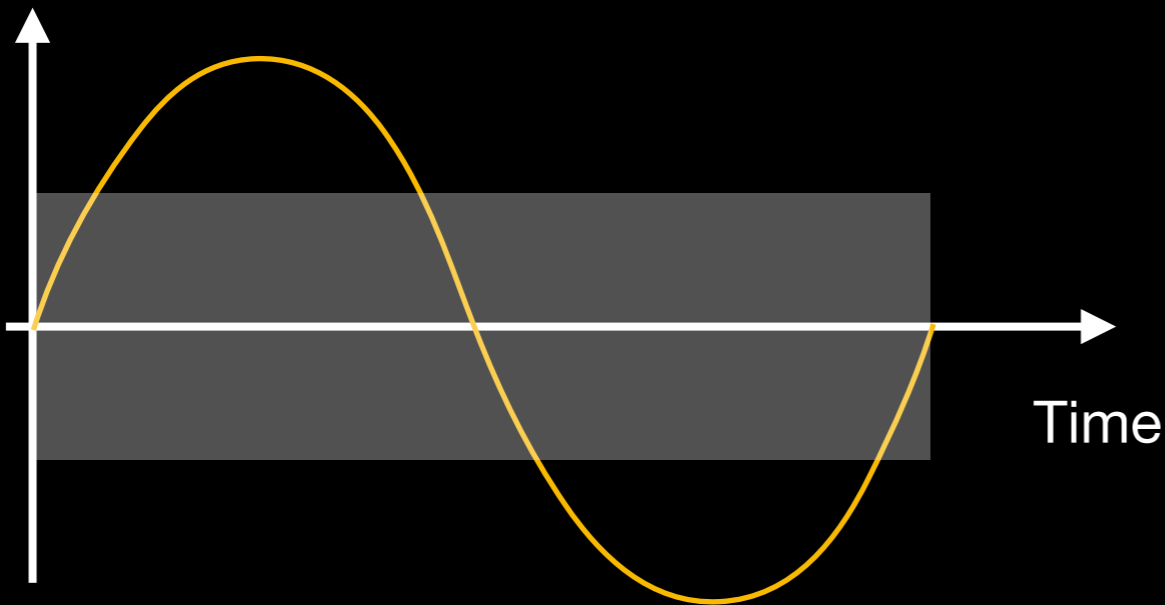
Voltage



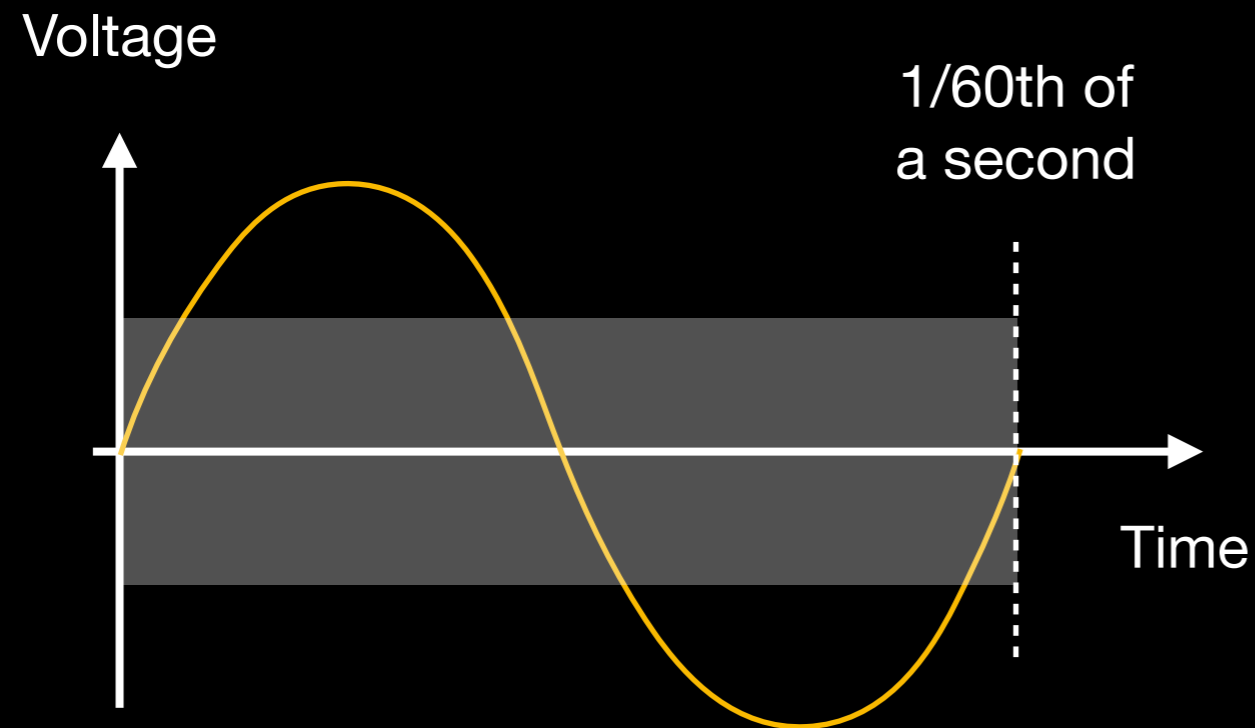
Where does electricity come from?

“120 V / 60 Hz”

Voltage

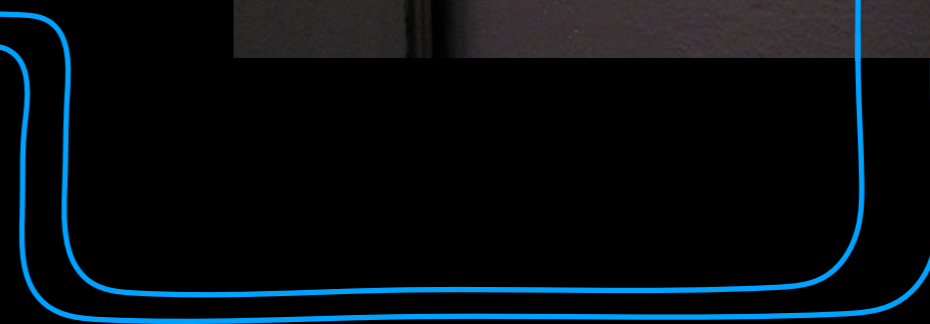
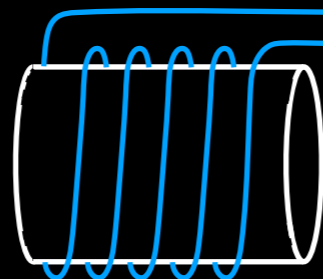
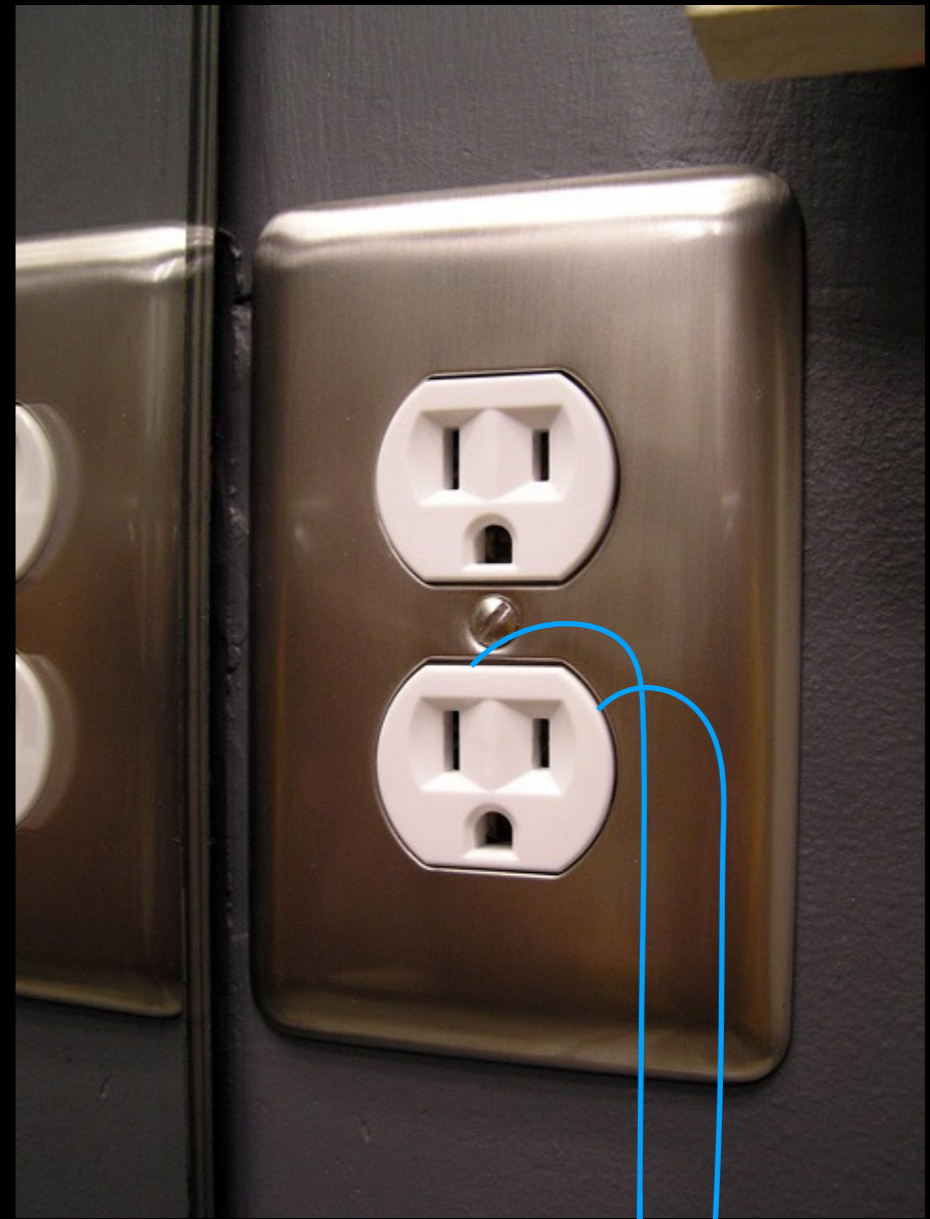


Where does electricity come from?



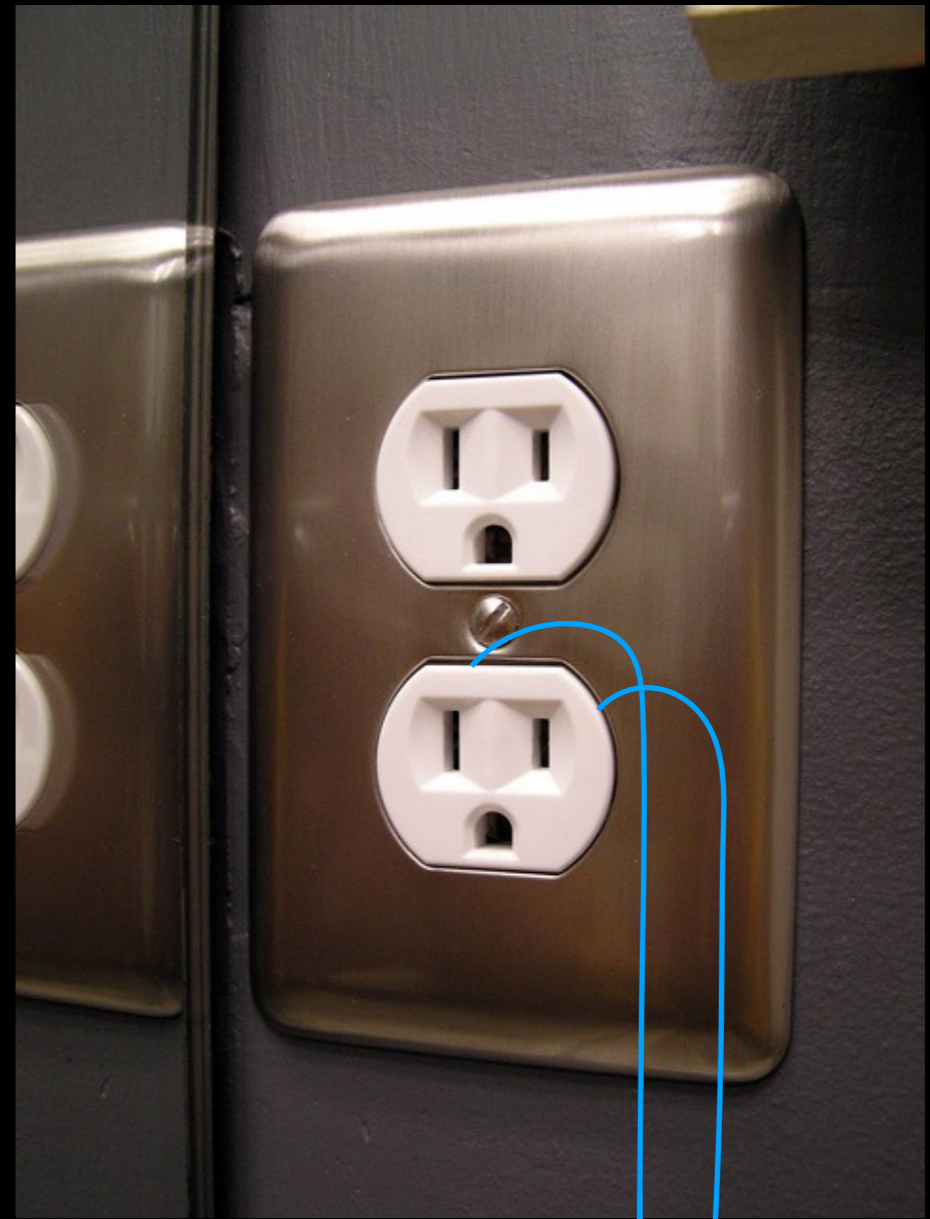
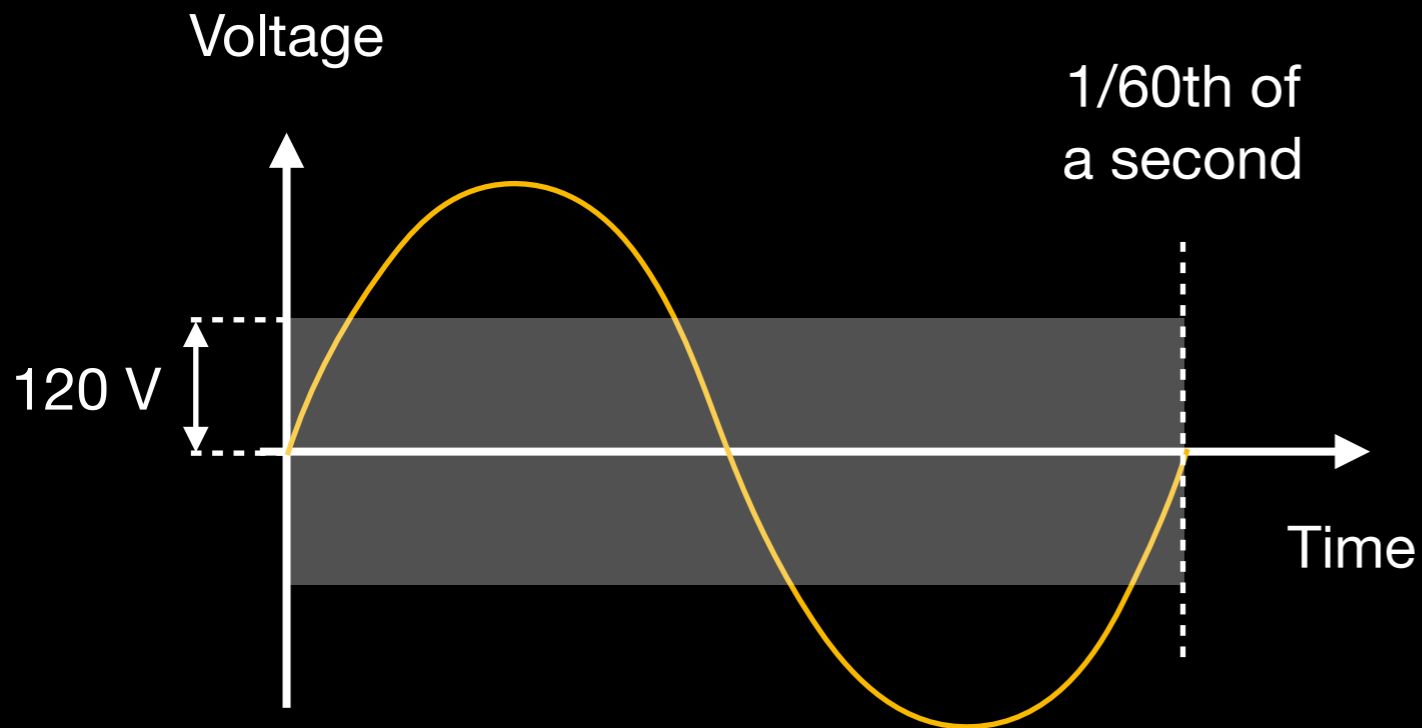
“120 V / 60 Hz”

Hertz



Where does electricity come from?

Volt \curvearrowright \curvearrowright Hertz
"120 V / 60 Hz"



Where does electricity come from?

Volt \curvearrowright "120 V / 60 Hz" \curvearrowleft Hertz



Where does electricity come from?

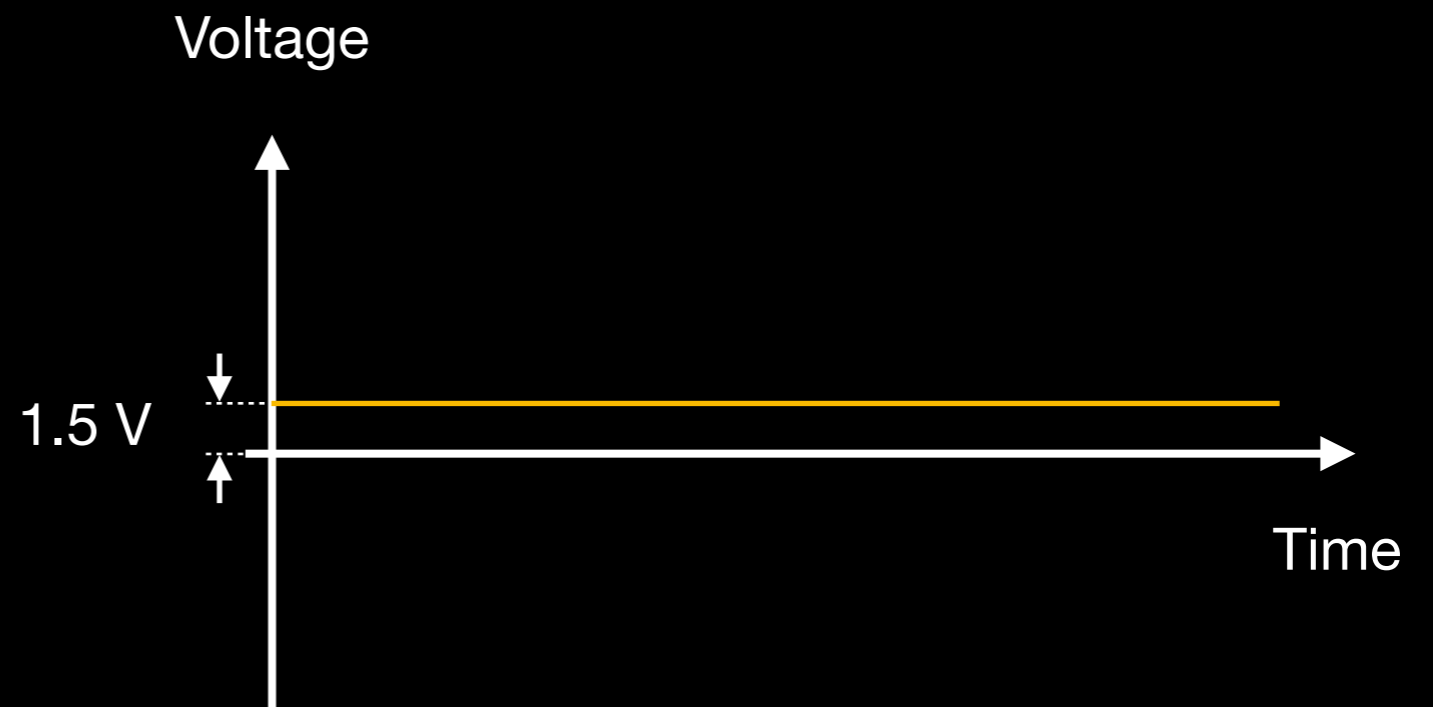


Where does electricity come from?

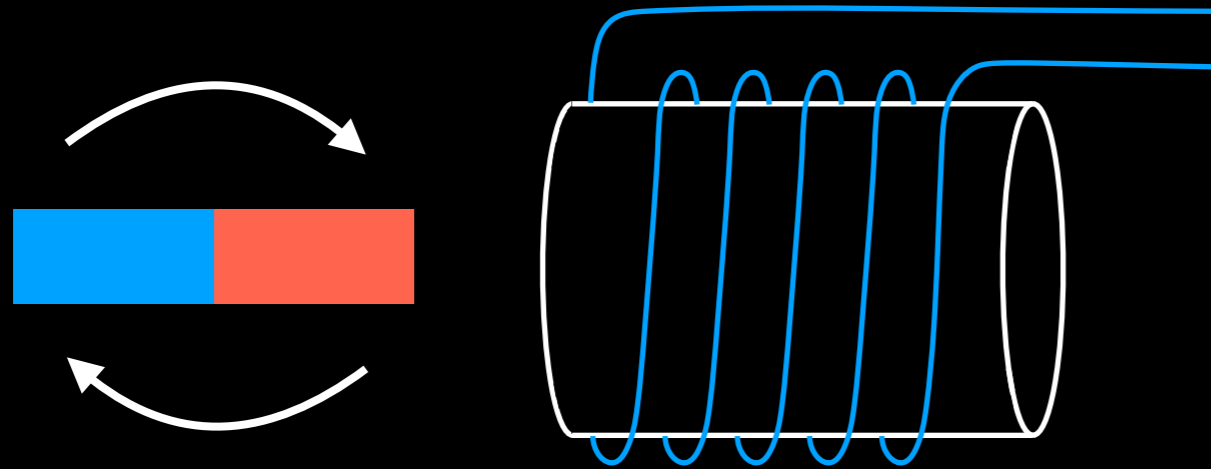


Where does electricity come from?

No spinning magnets inside!

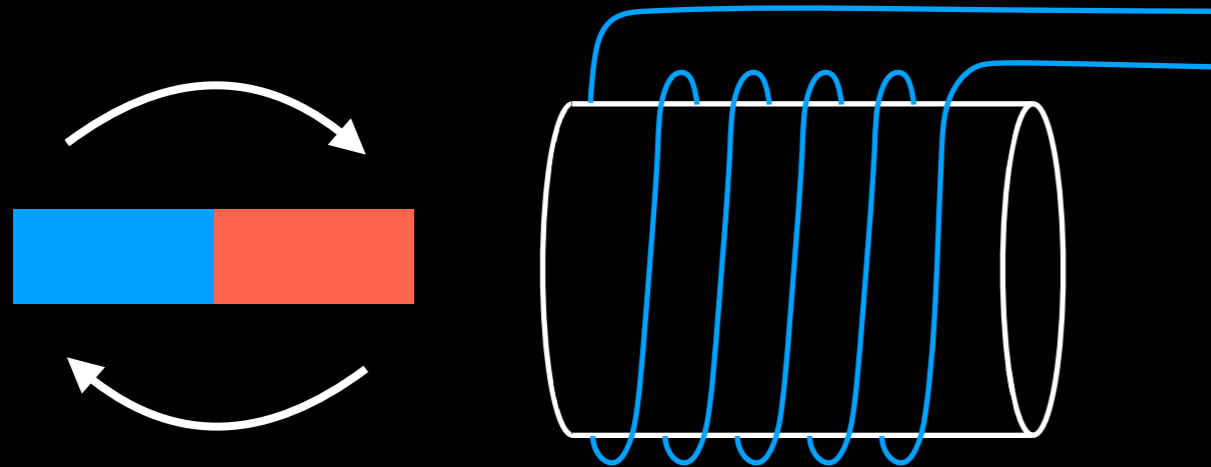


Where does electricity come from?



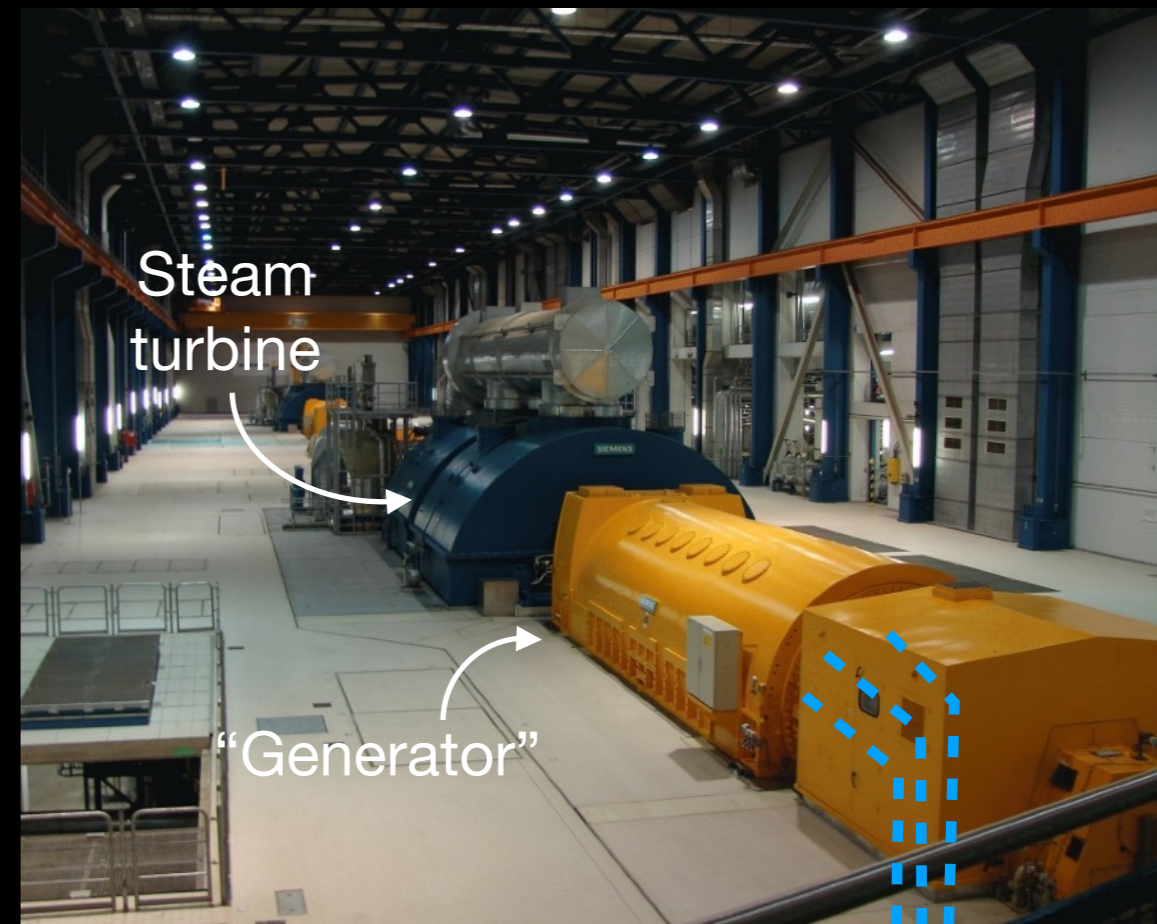
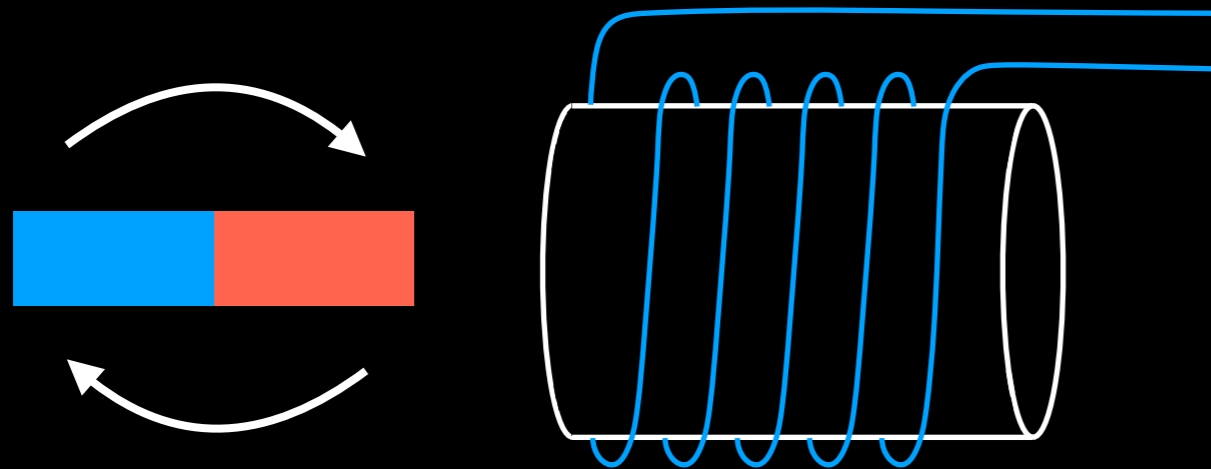
Where does electricity come from?

What makes the magnet turn?

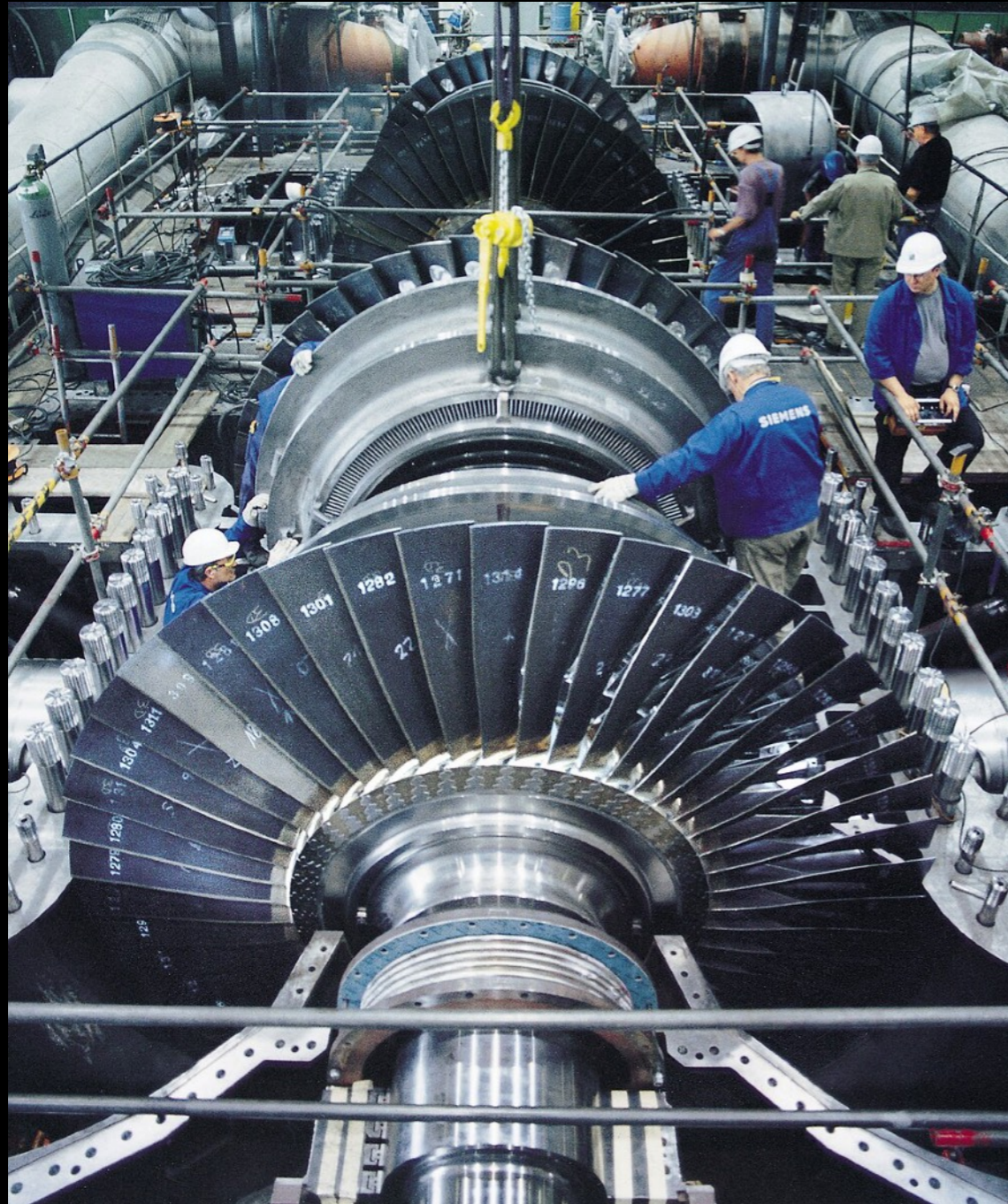


Where does electricity come from?

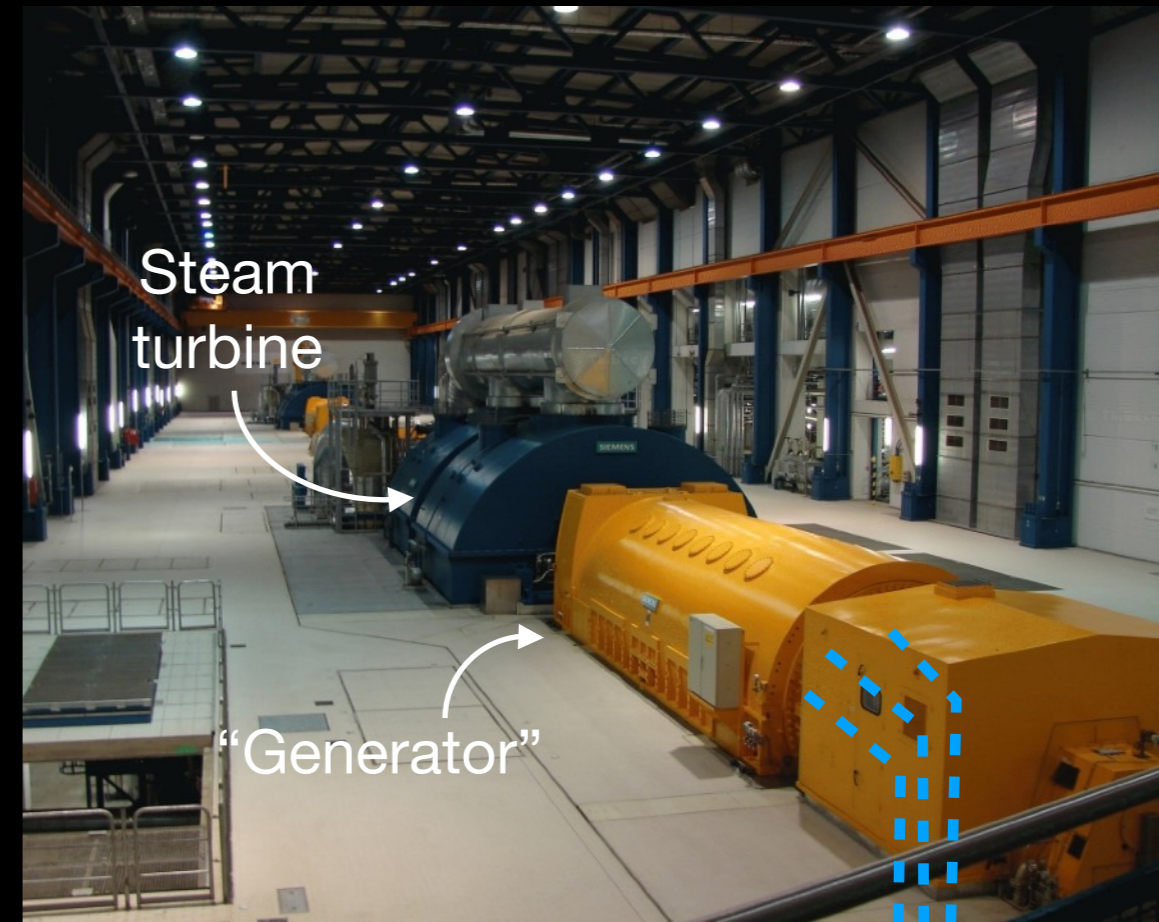
What makes the magnet turn?



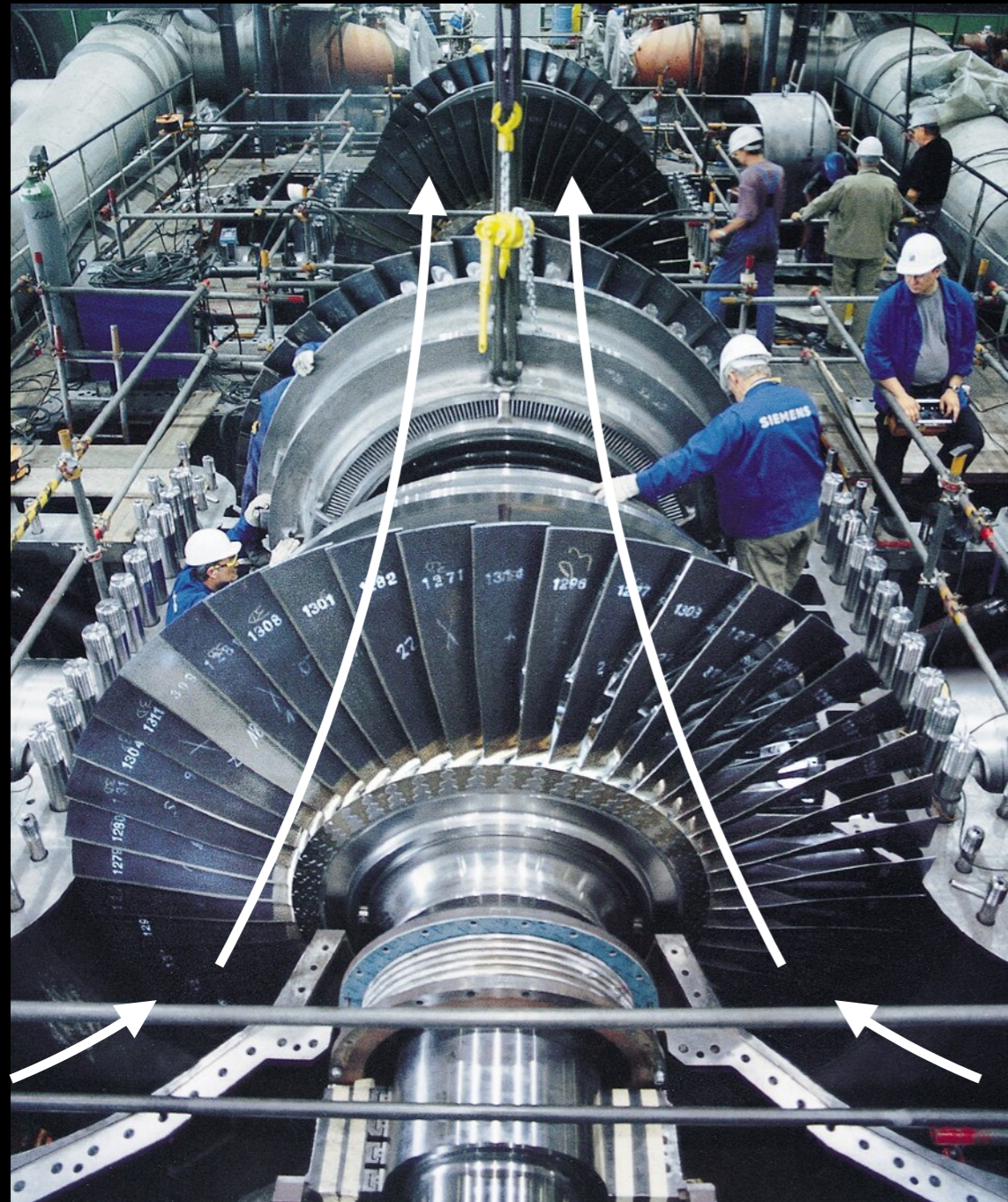
Where does electricity come from?



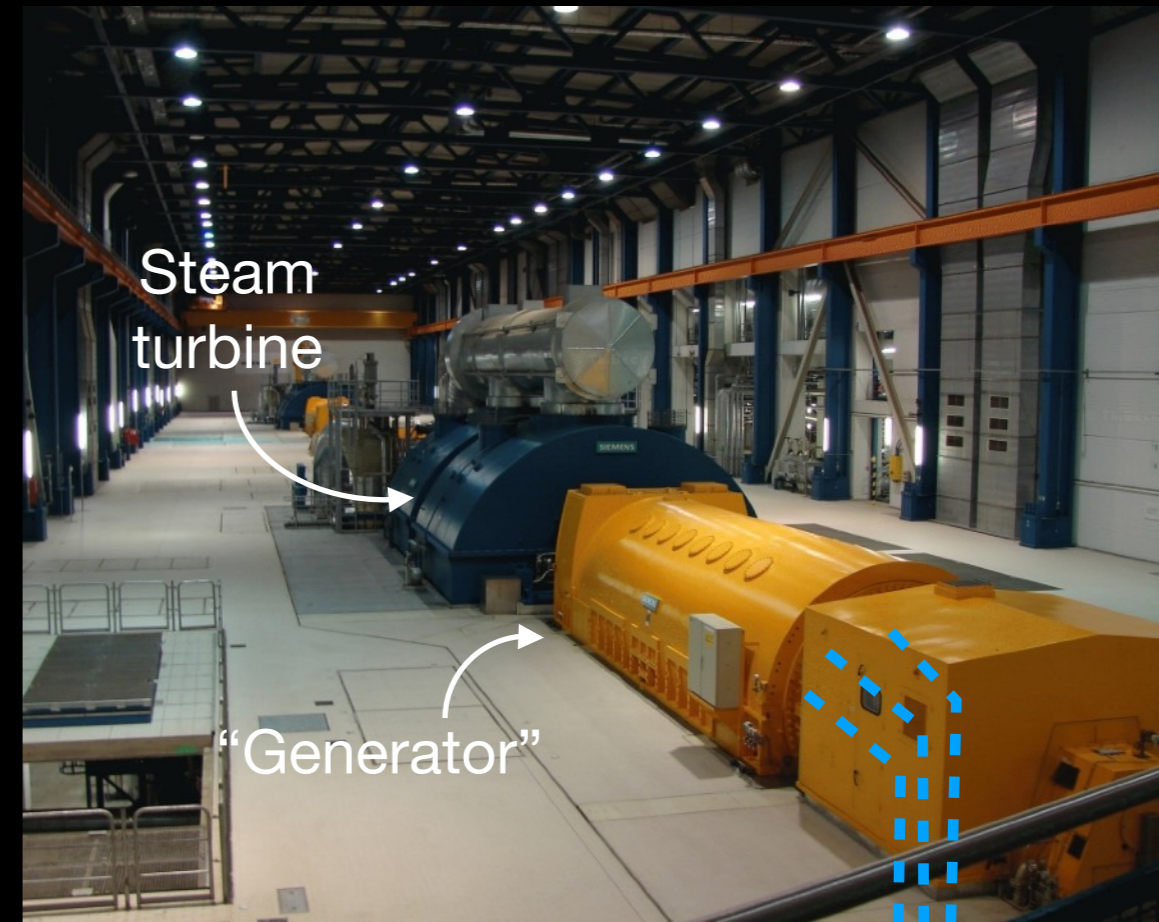
What makes the magnet turn?



Where does electricity come from?

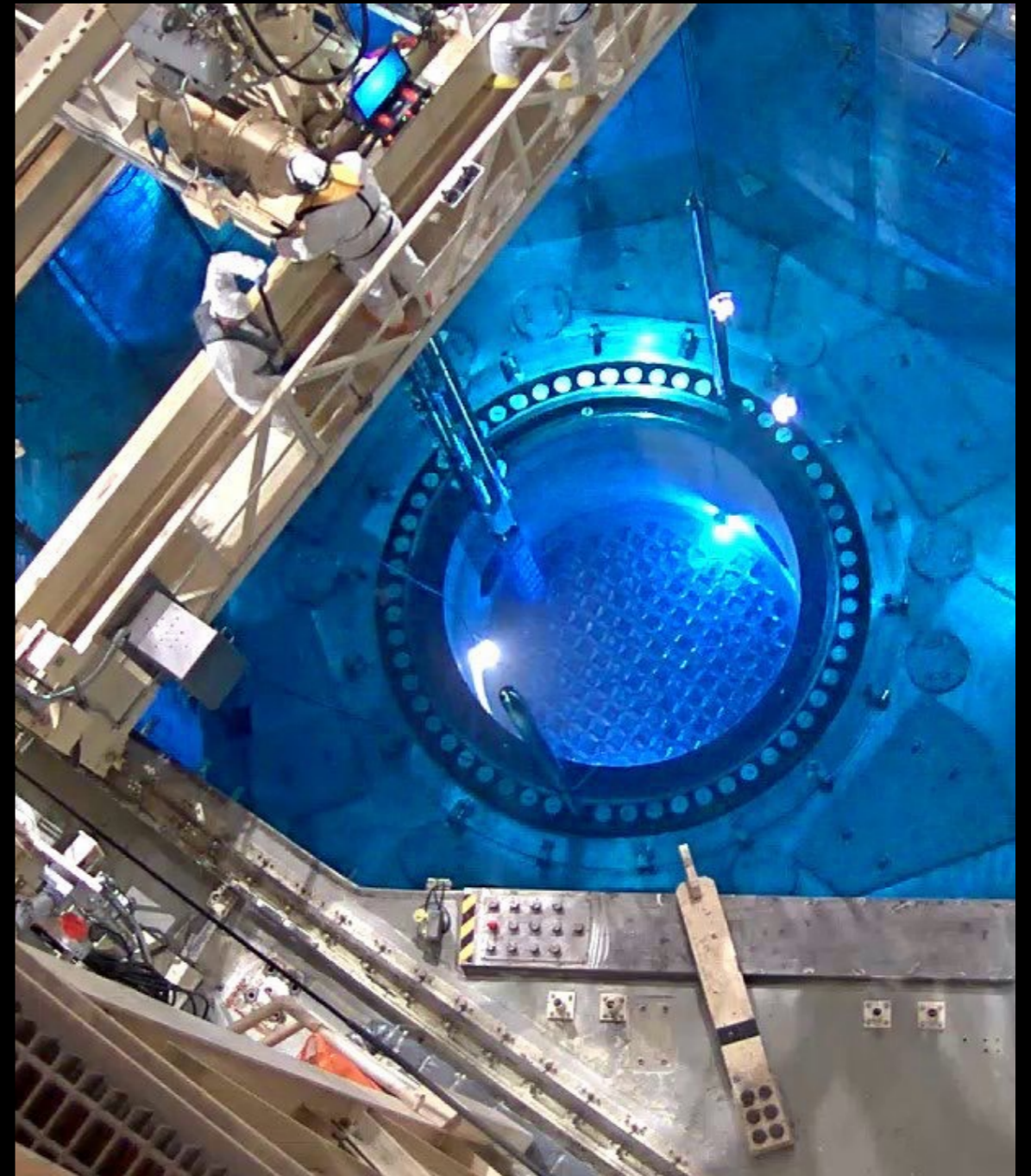
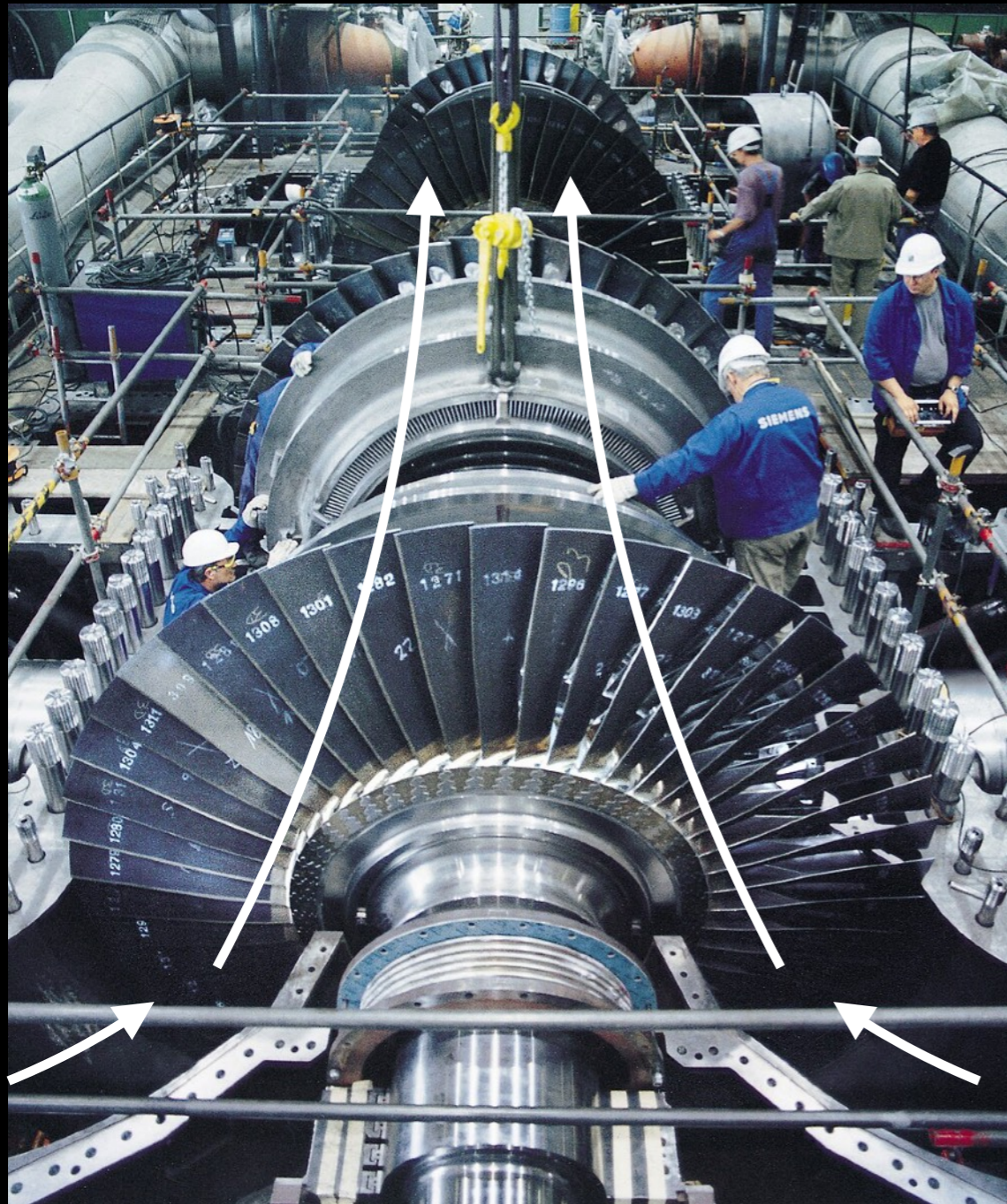


What makes the magnet turn?



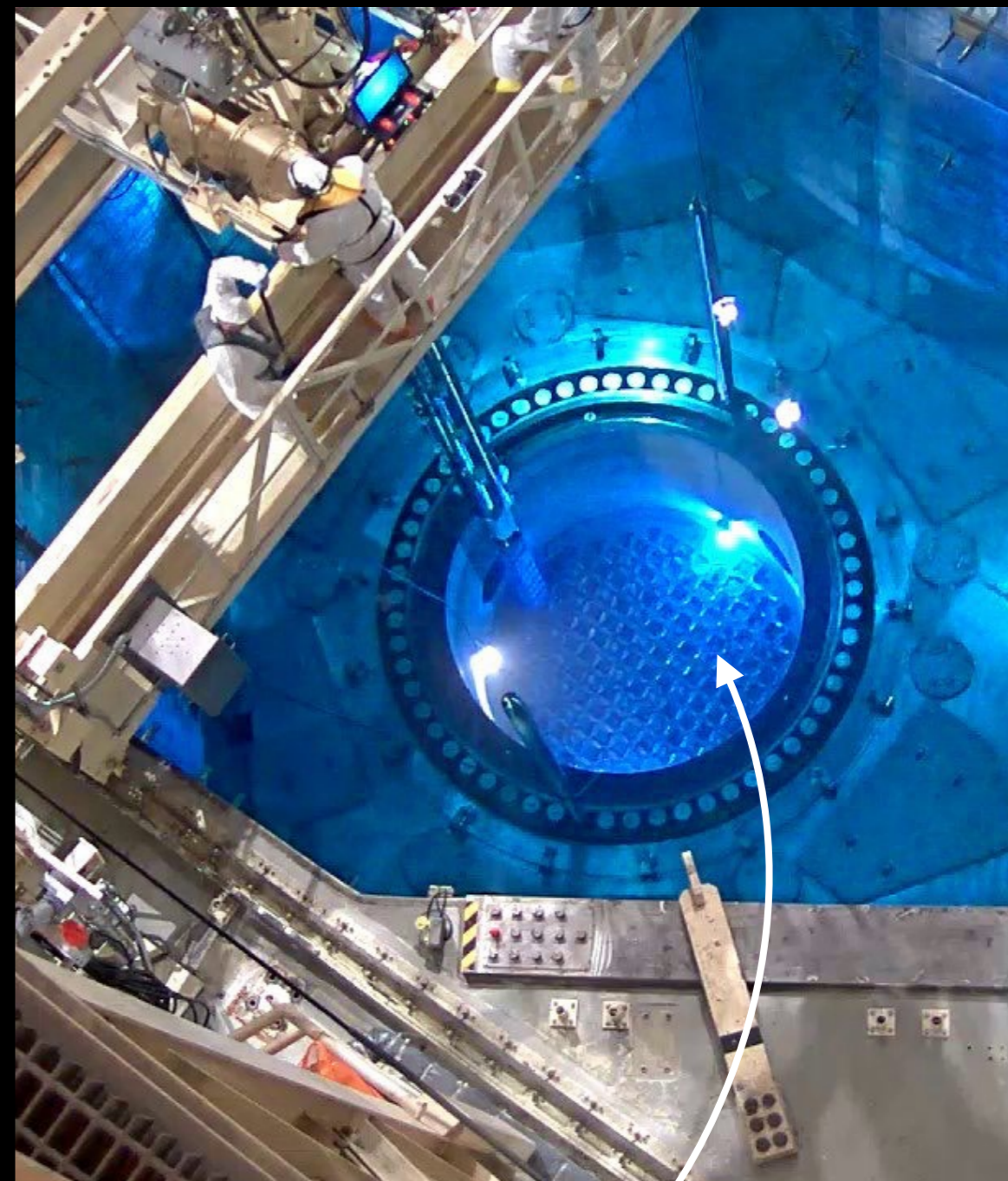
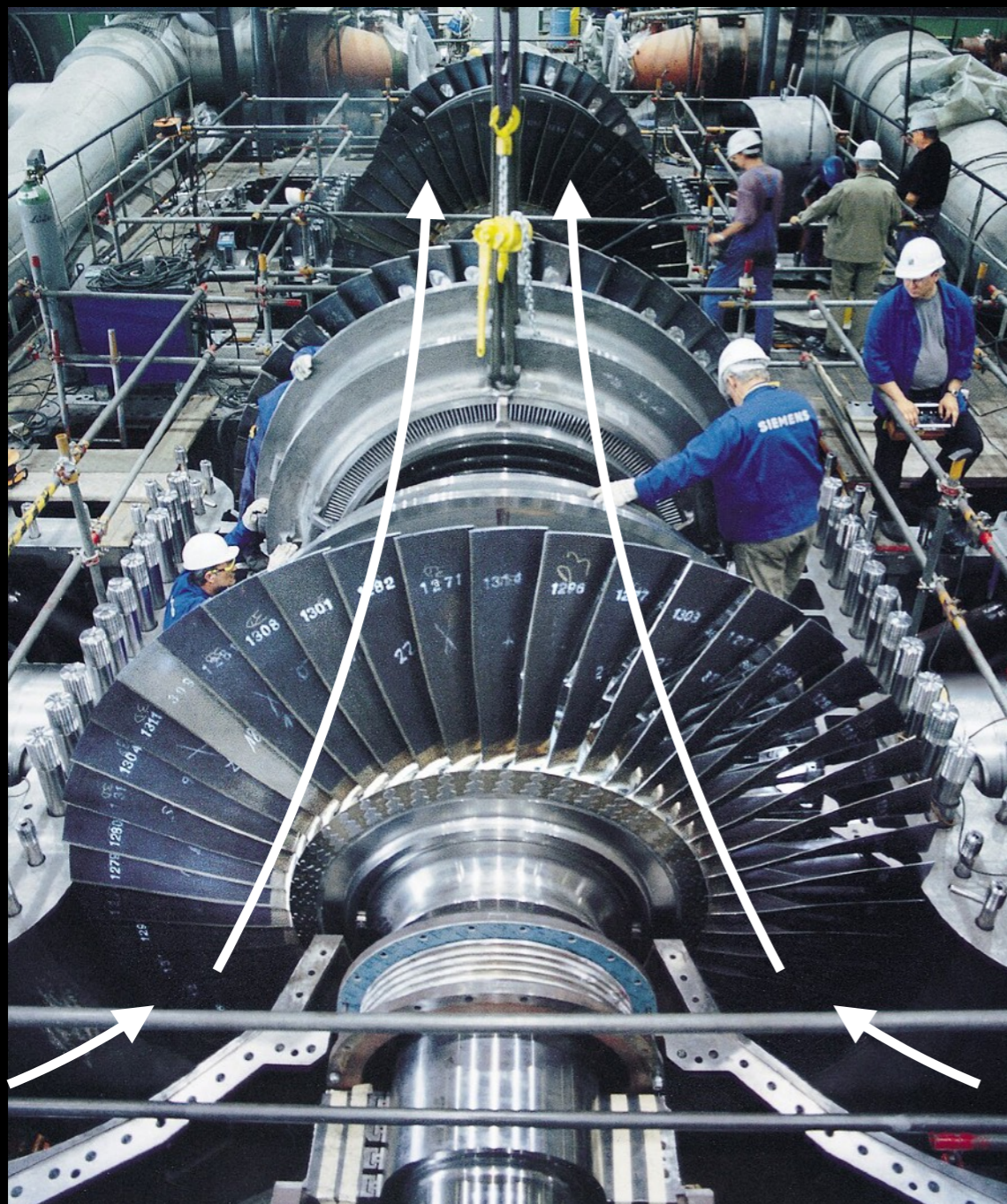
Where does the steam come from?

[Southern Nuclear]



Where does the steam come from?

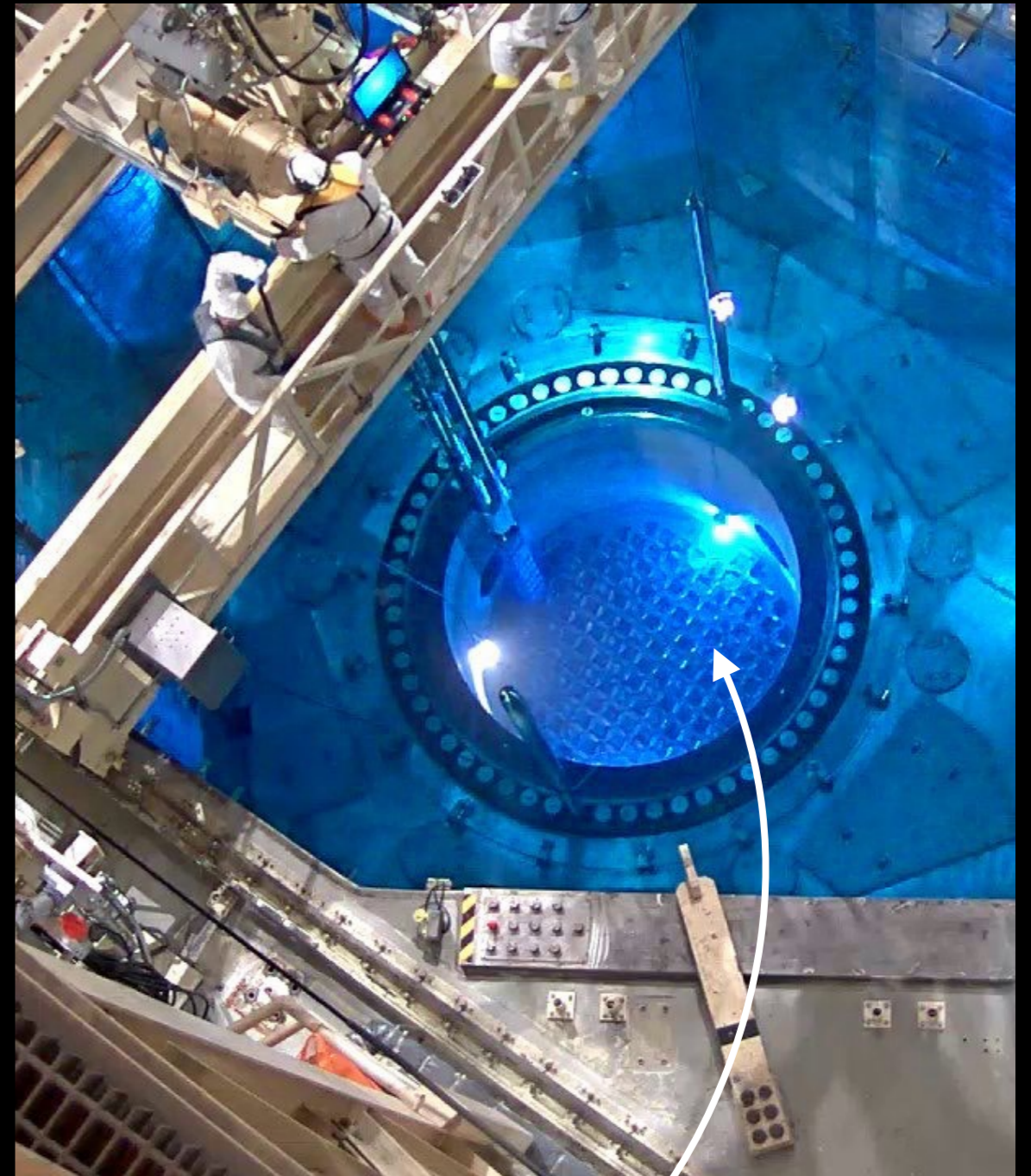
[Southern Nuclear]



Pool of (boiling) water

Why does the water start boiling?

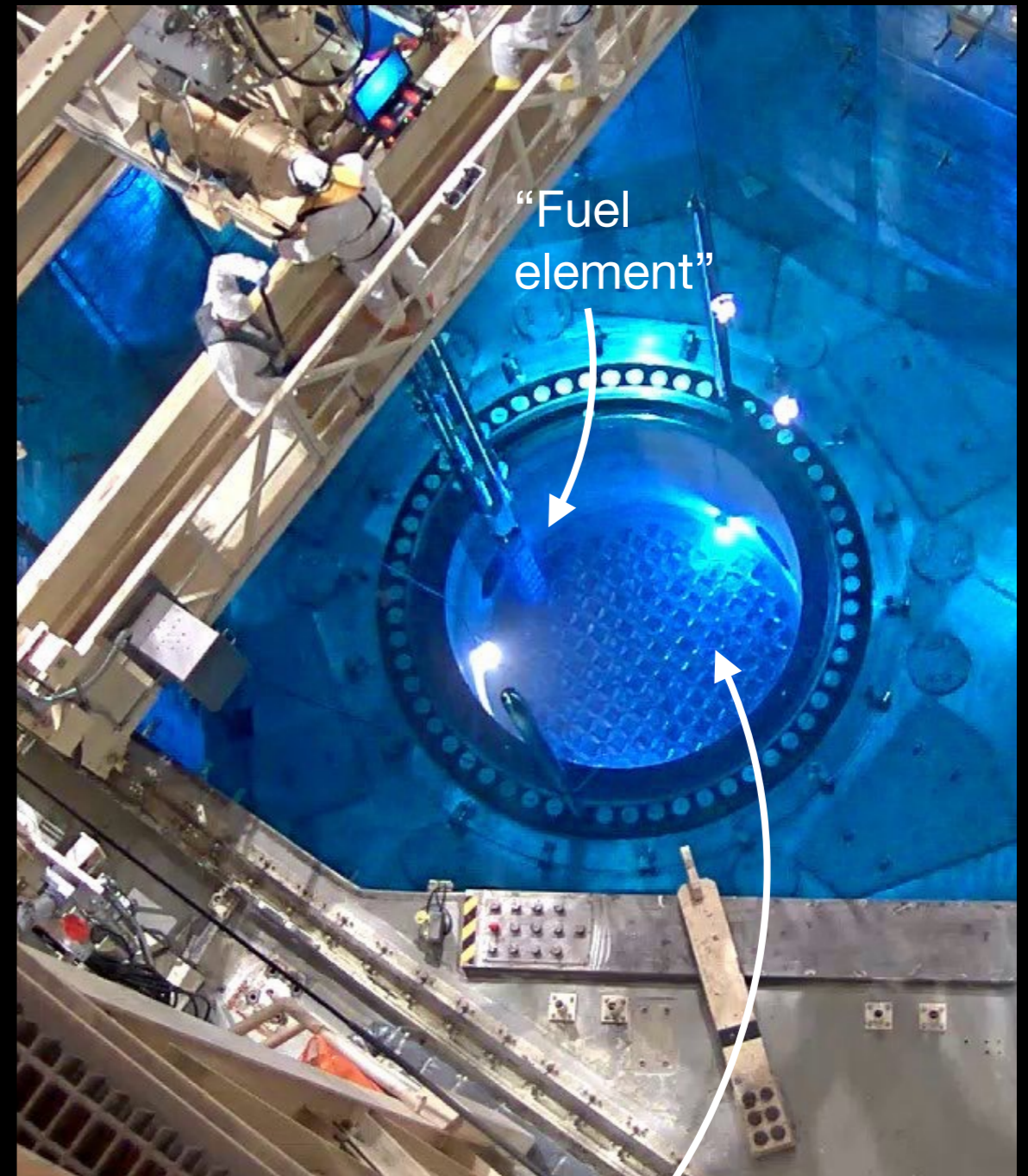
[Southern Nuclear]



Pool of (boiling) water

Why does the water start boiling?

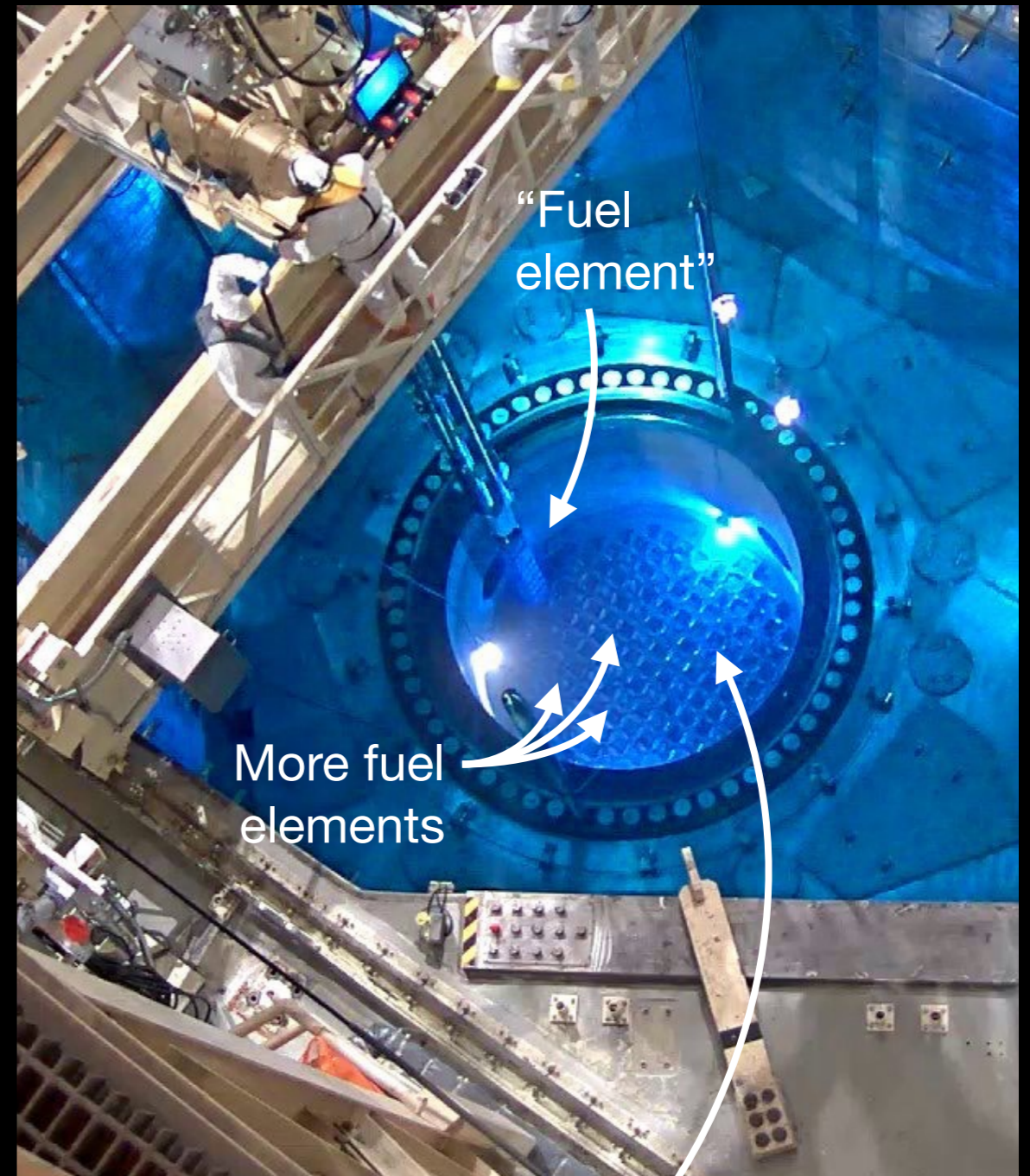
[Southern Nuclear]



Pool of (boiling) water

Why does the water start boiling?

[Southern Nuclear]



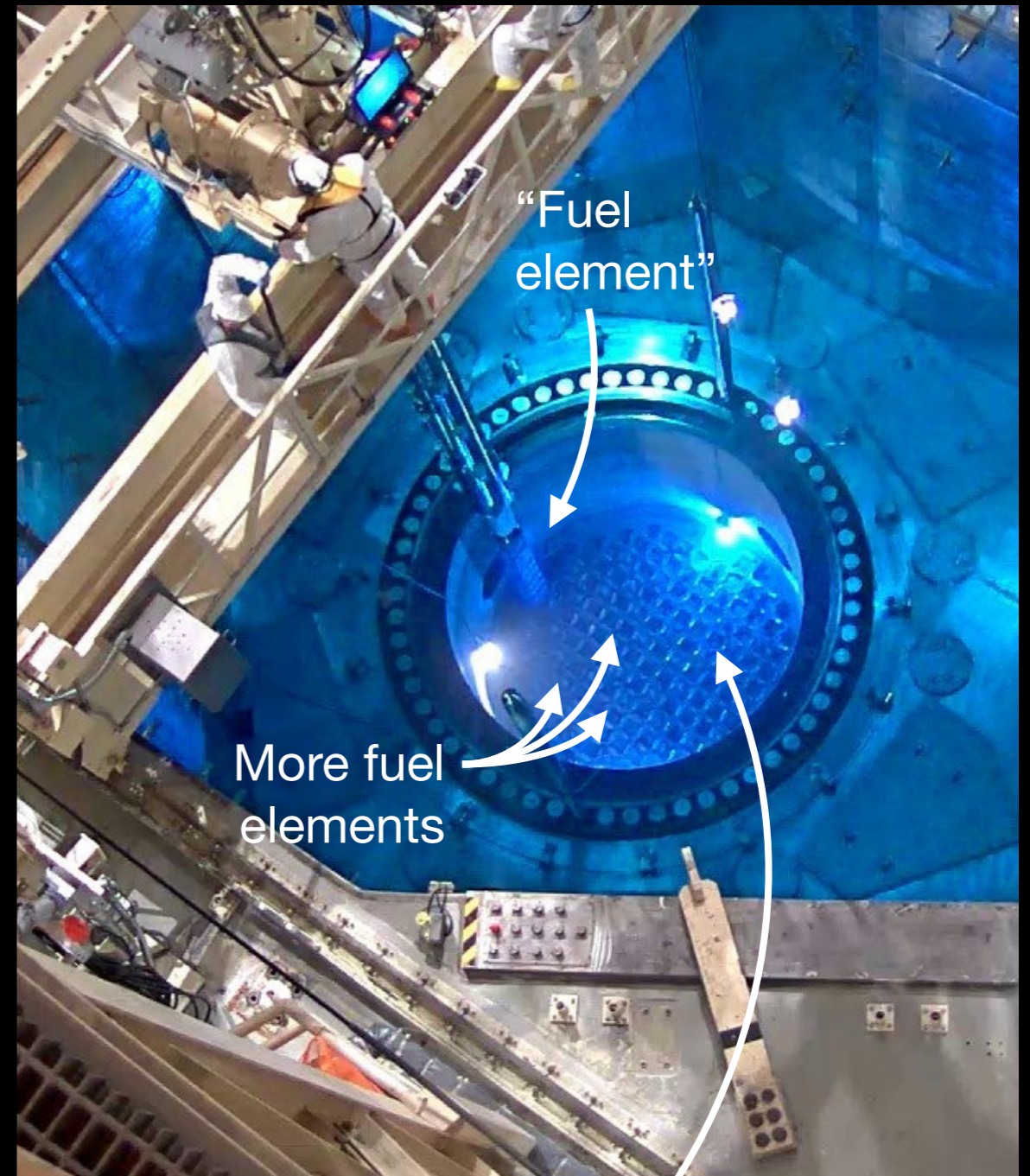
Pool of (boiling) water

Why does the water start boiling?

Fuel element



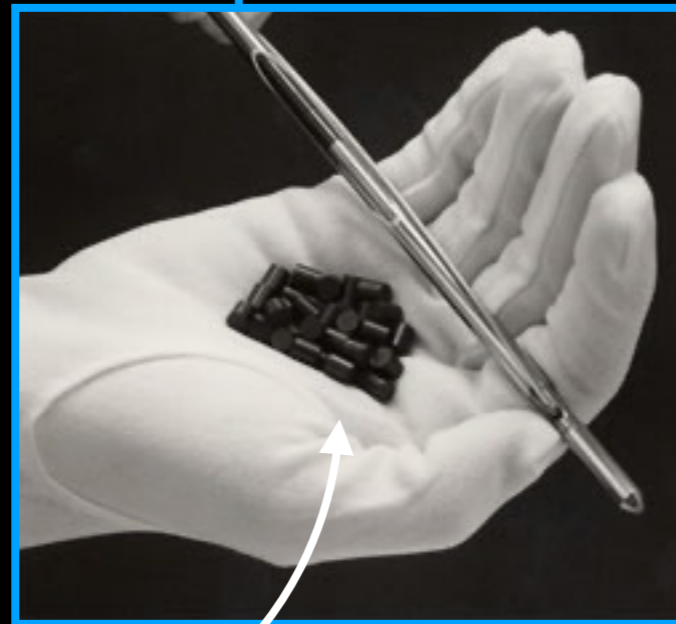
[Southern Nuclear]



Pool of (boiling) water

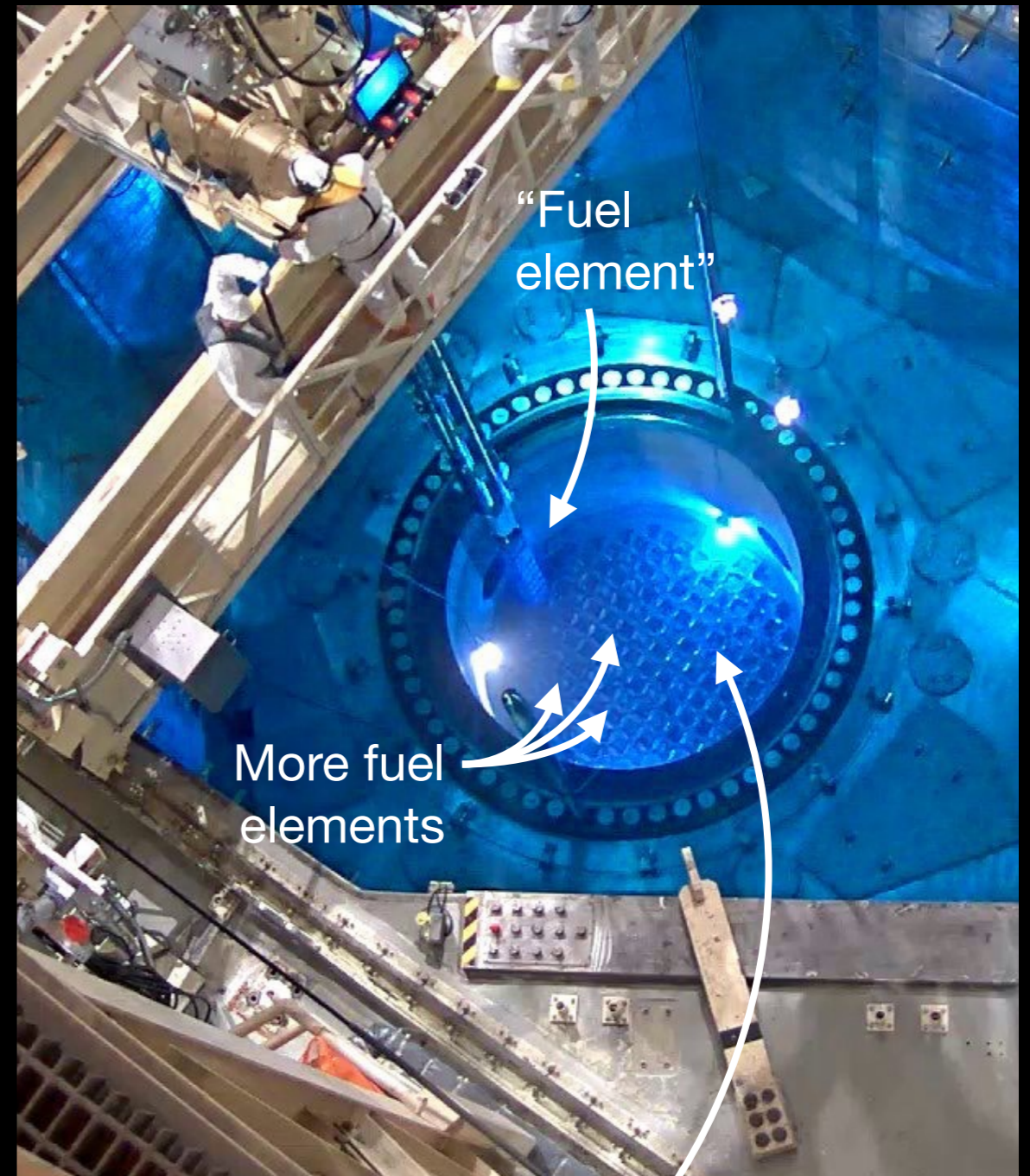
Why does the water start boiling?

Fuel element



Fuel pellets

[Southern Nuclear]



"Fuel element"

More fuel elements

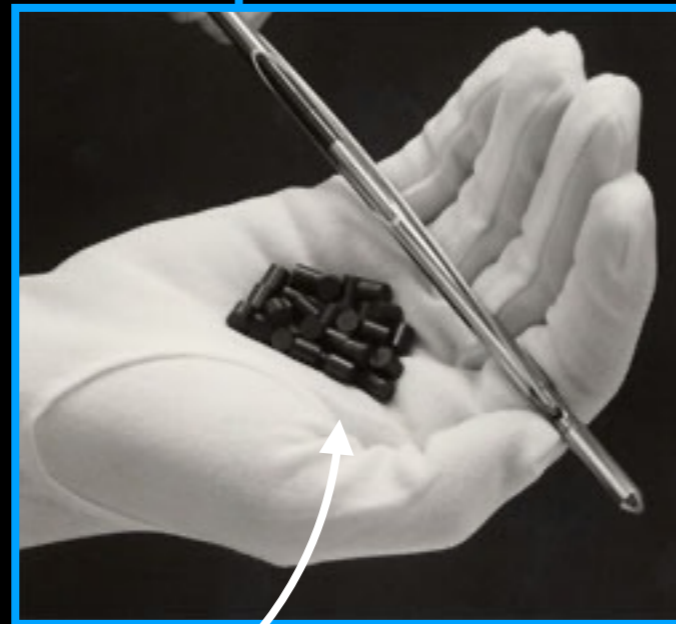
Pool of (boiling) water

Why does the water start boiling?

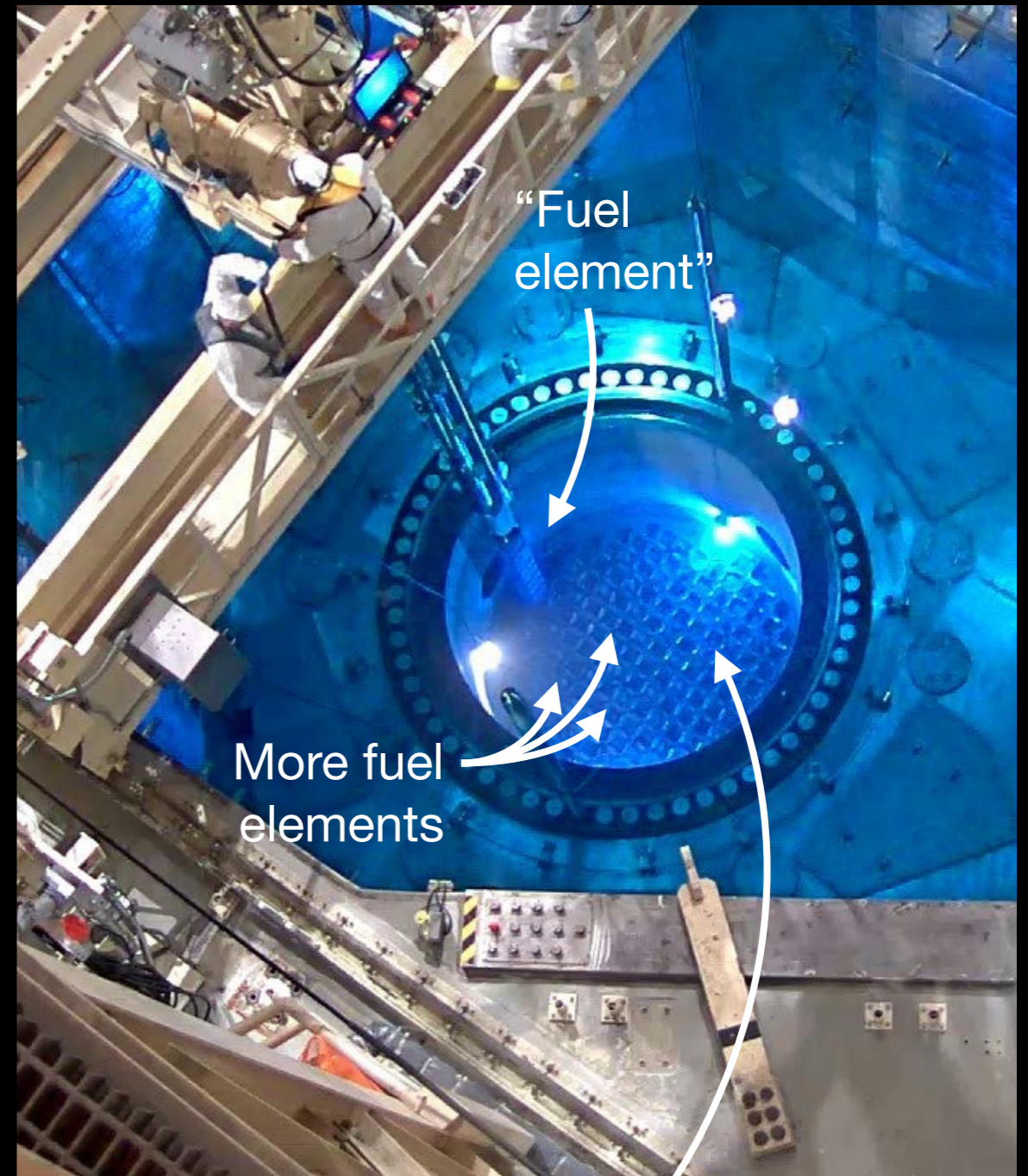
Fuel element

Because the fuel pellets get hot!

[Southern Nuclear]

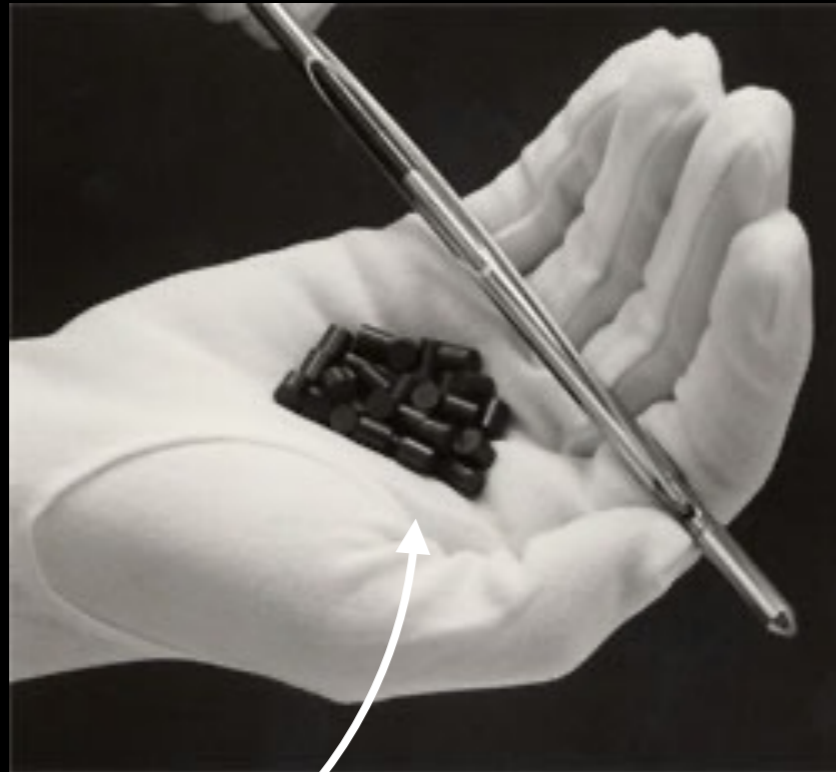


Fuel pellets

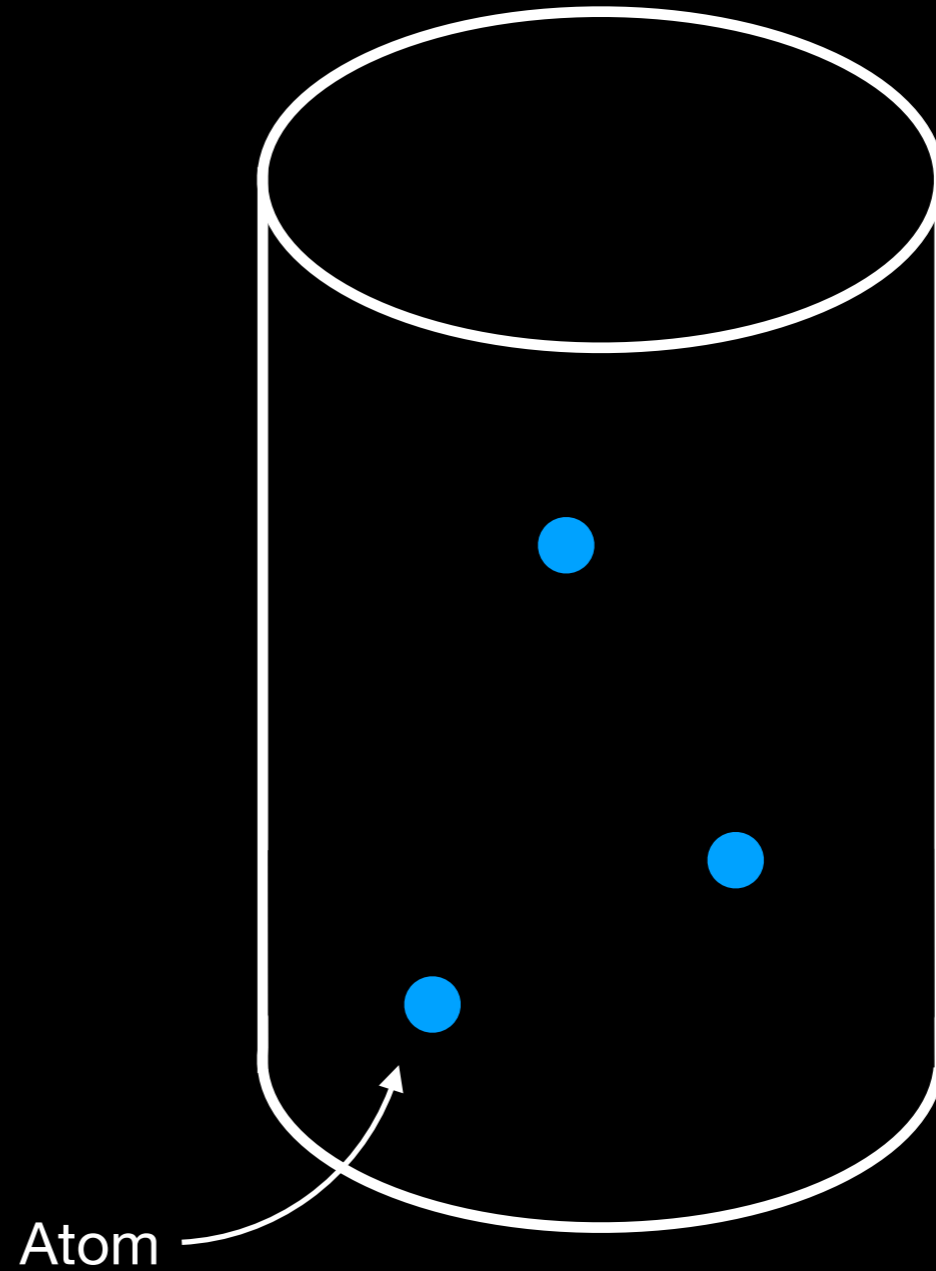


Pool of (boiling) water

Why do the fuel pellets get hot?

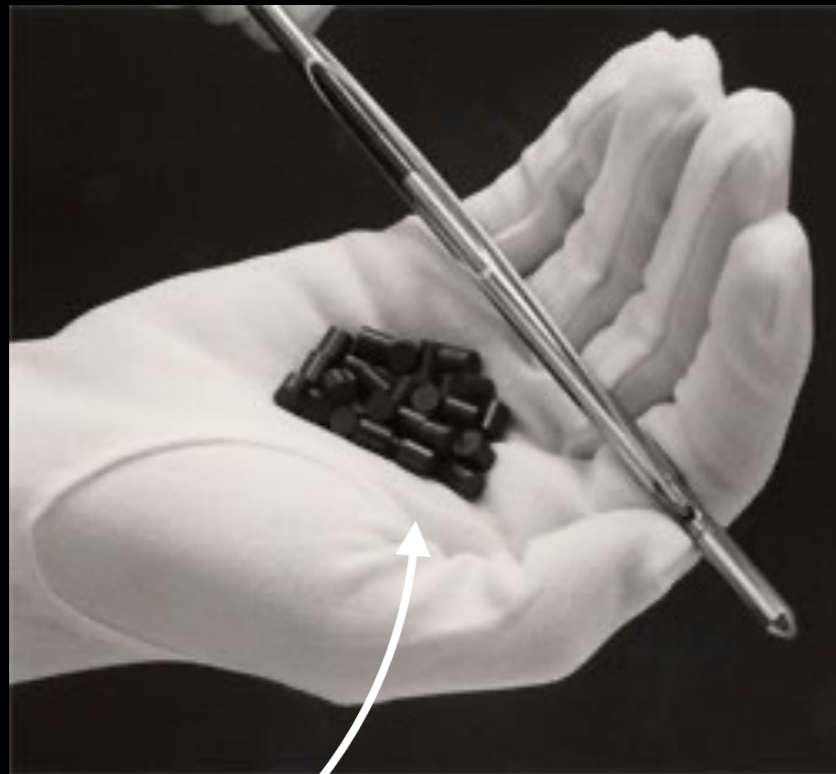


Fuel pellets

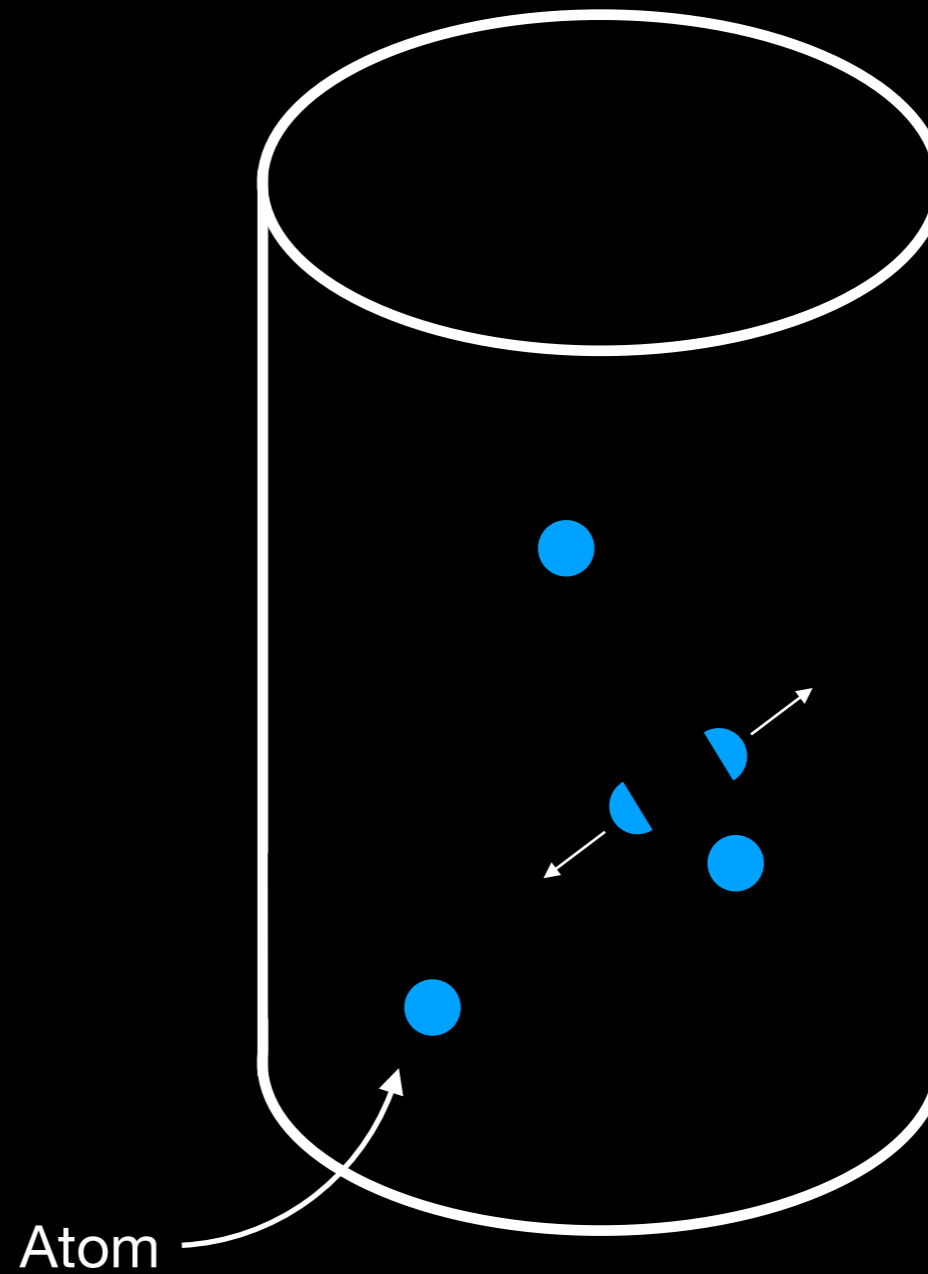


Atom

Why do the fuel pellets get hot?

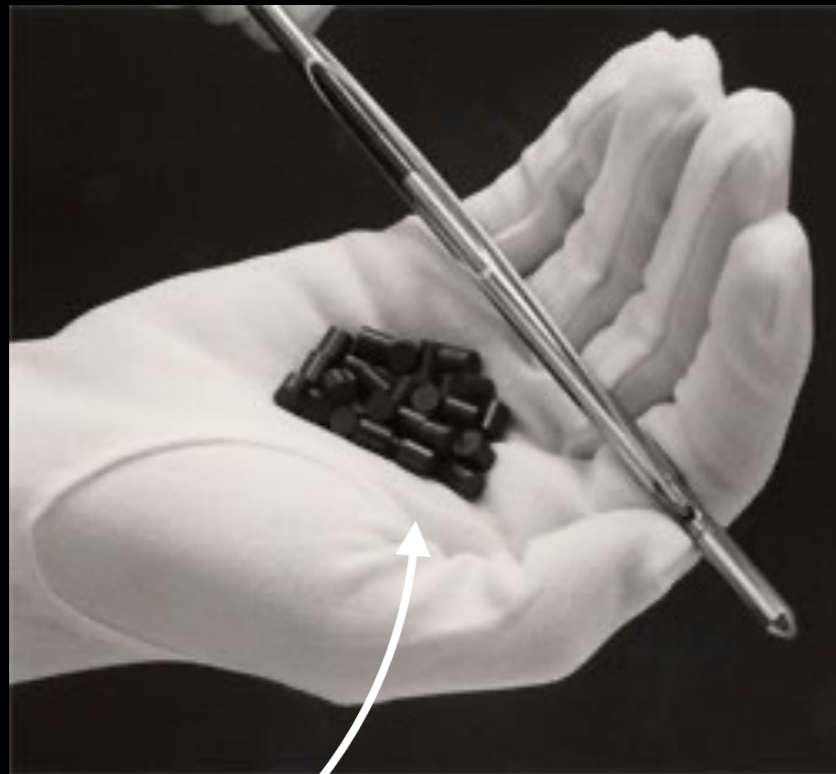


Fuel pellets

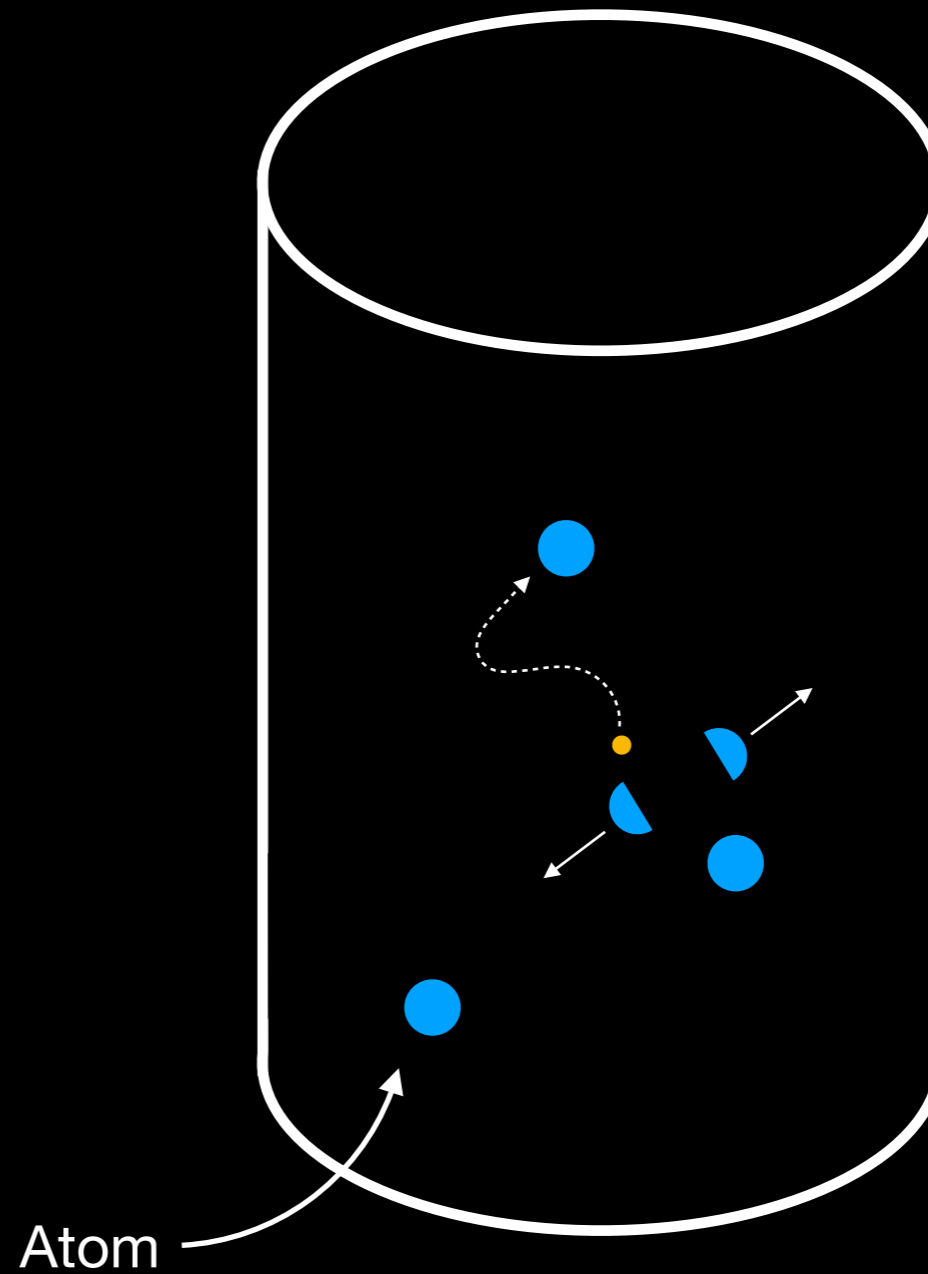


Atom

Why do the fuel pellets get hot?

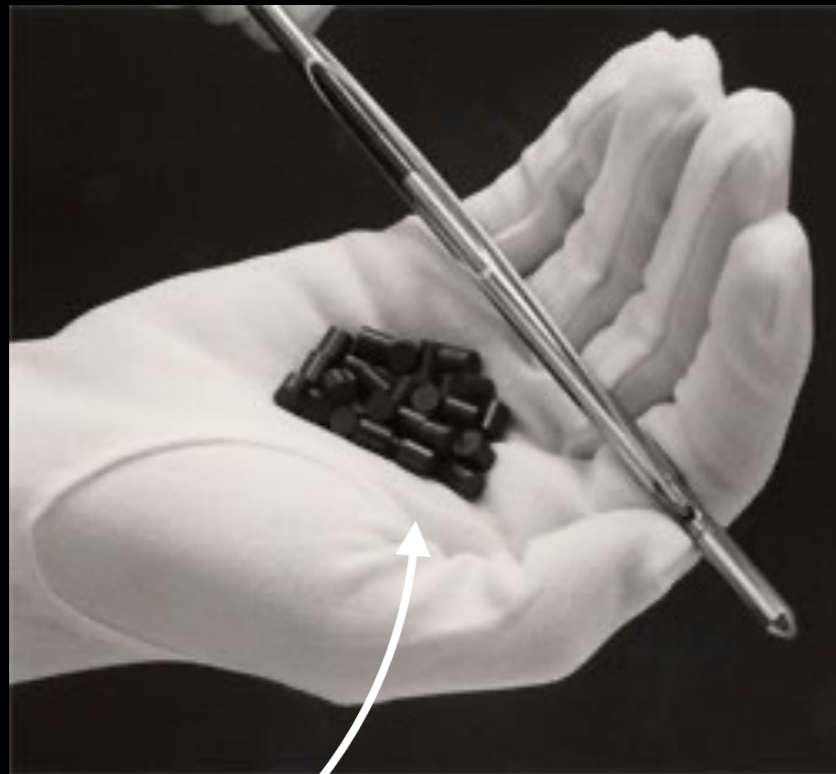


Fuel pellets

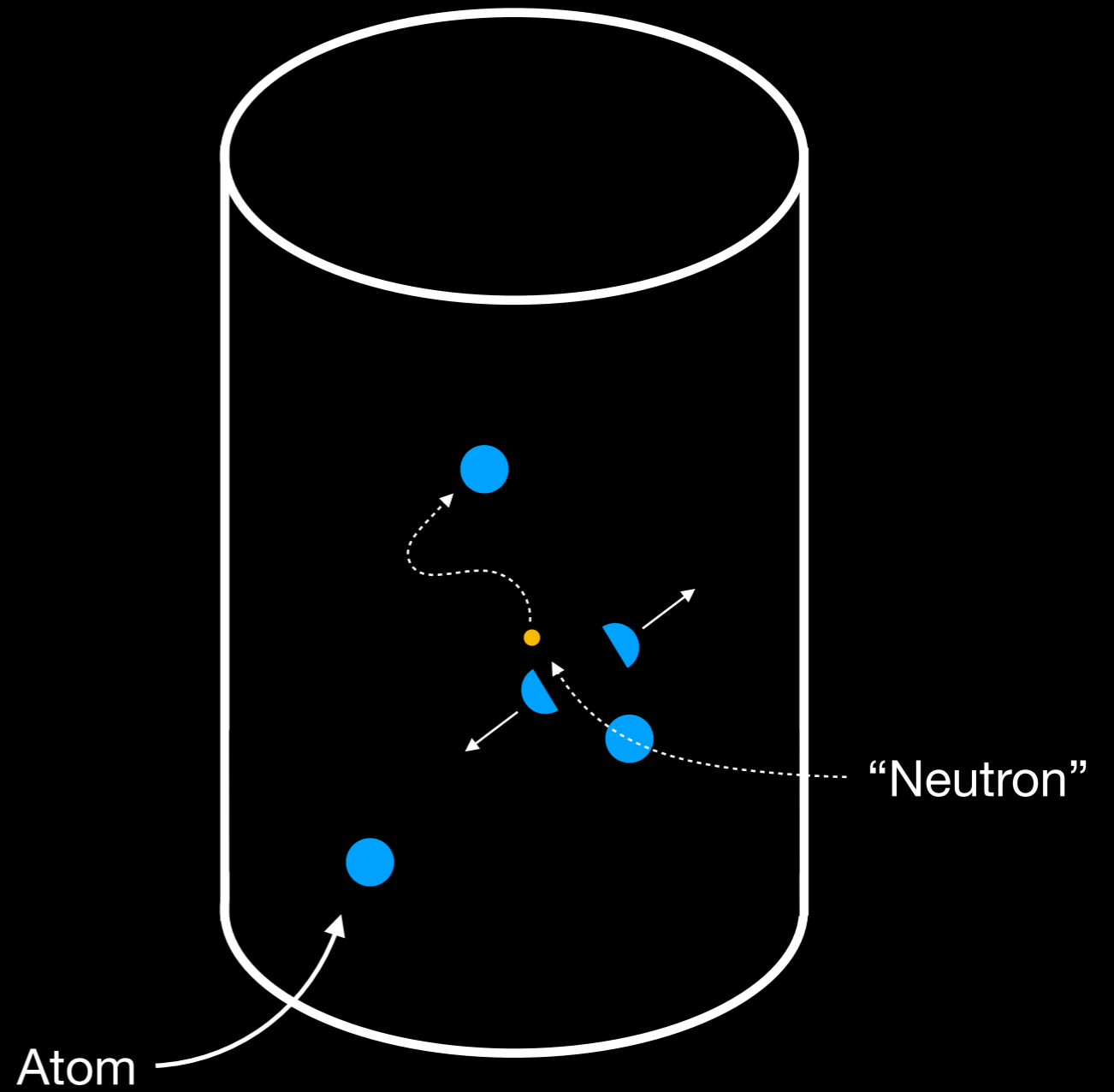


Atom

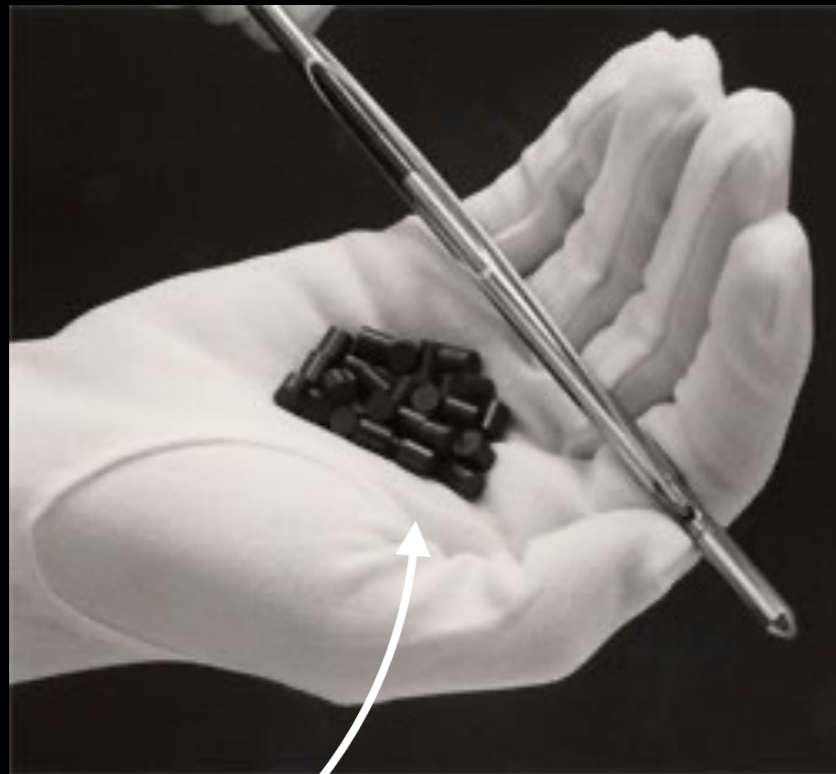
Why do the fuel pellets get hot?



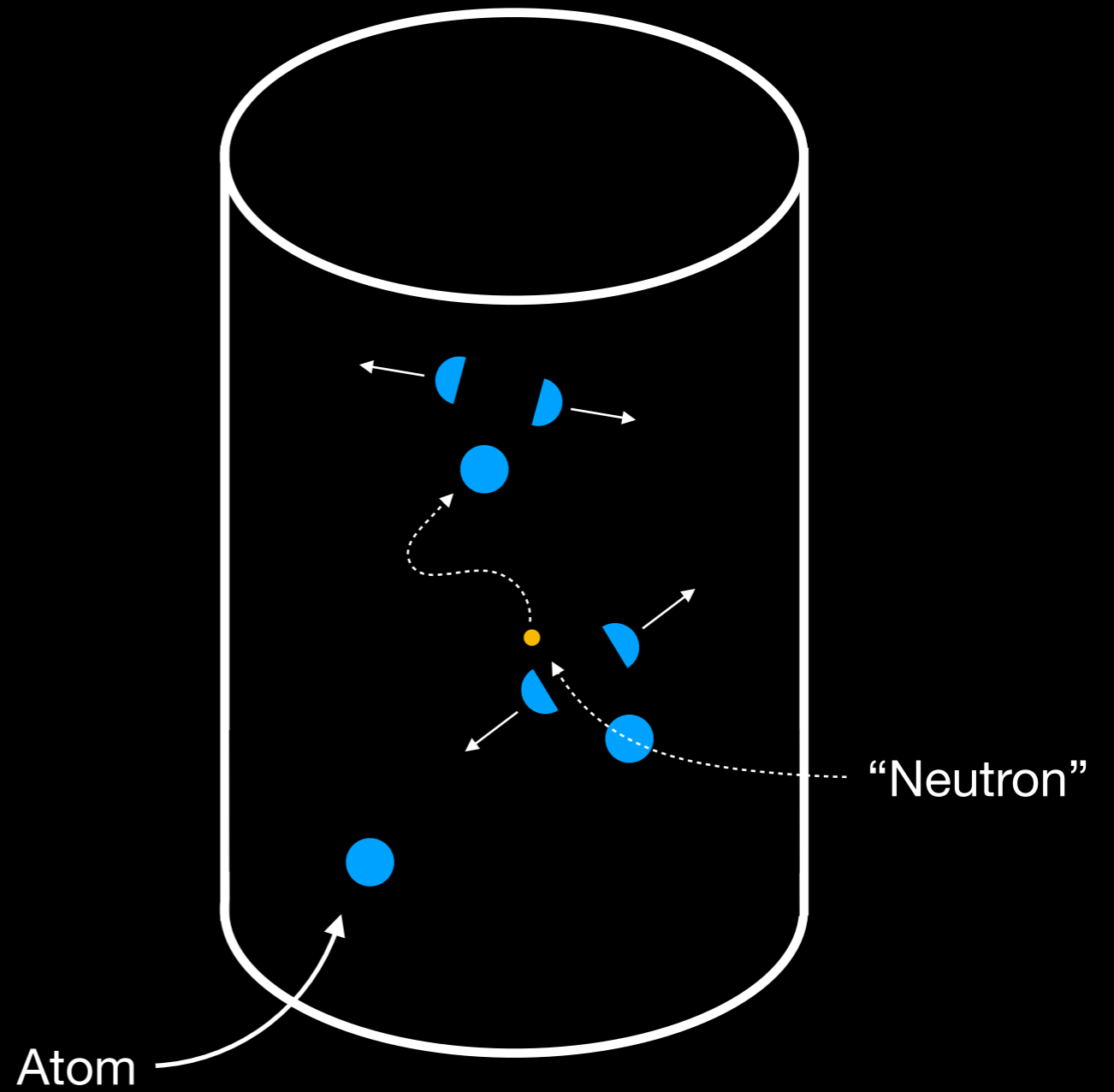
Fuel pellets



Why do the fuel pellets get hot?



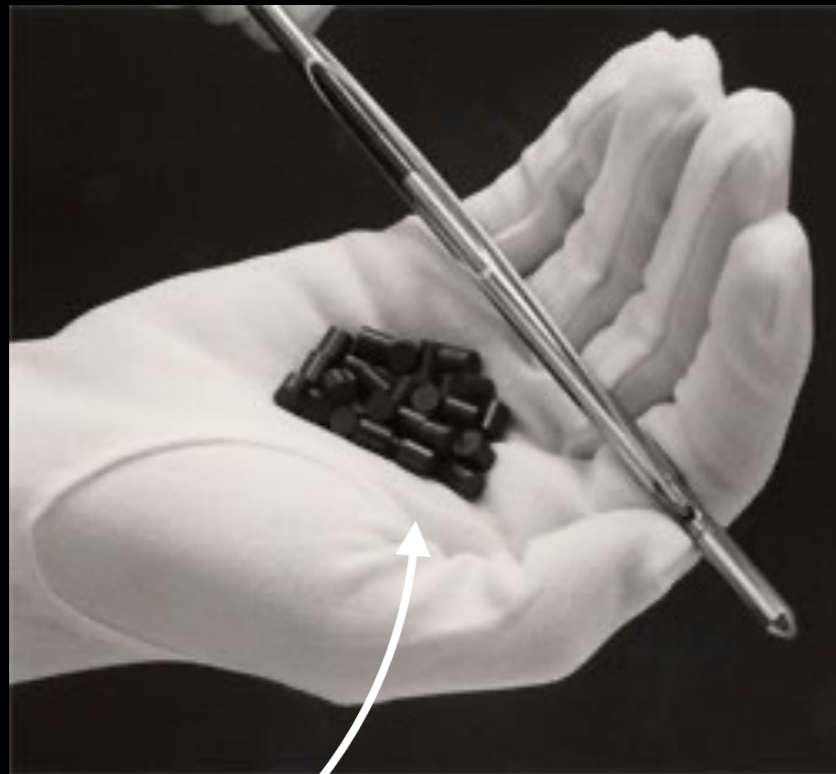
Fuel pellets



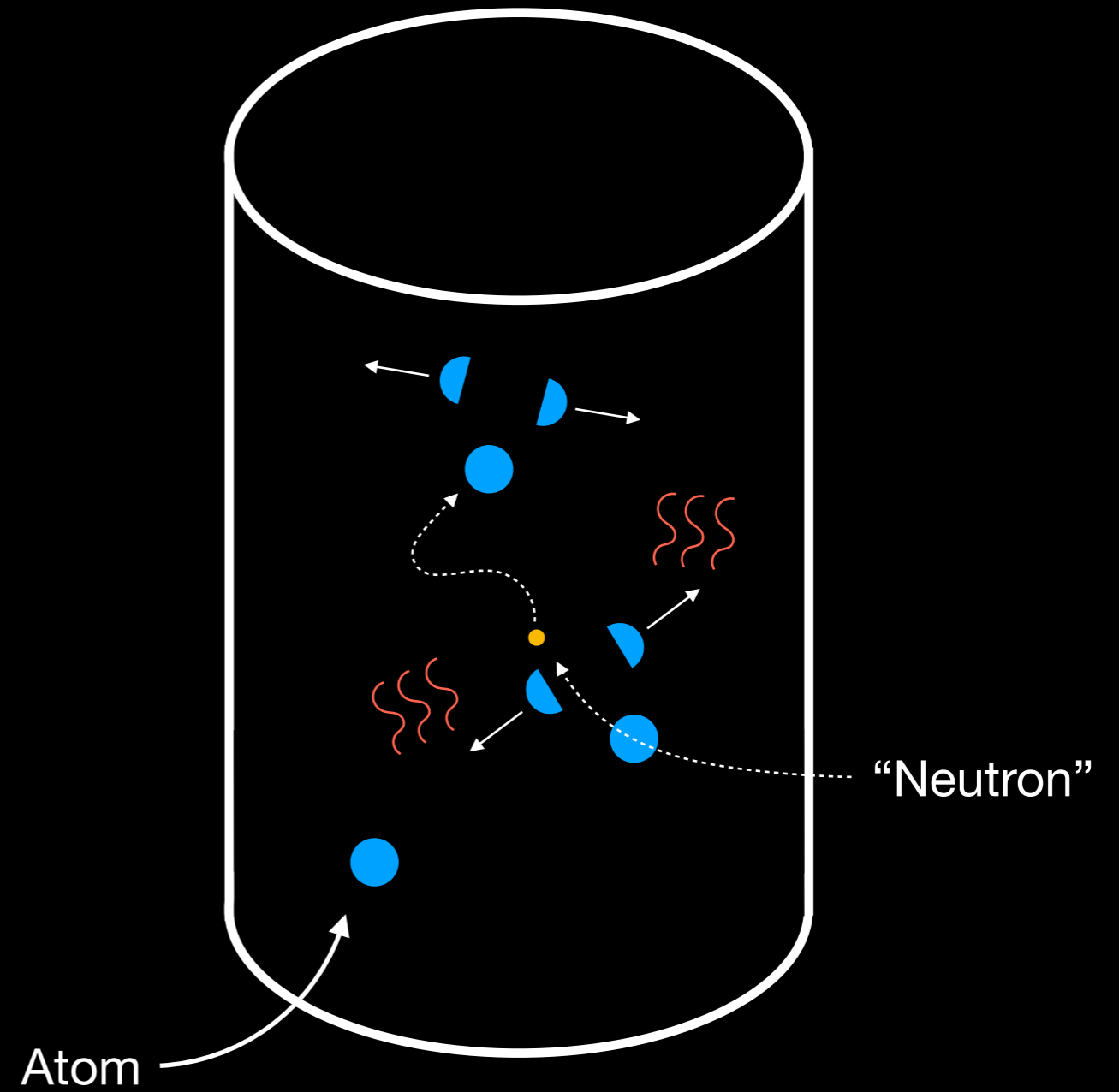
Atom

“Neutron”

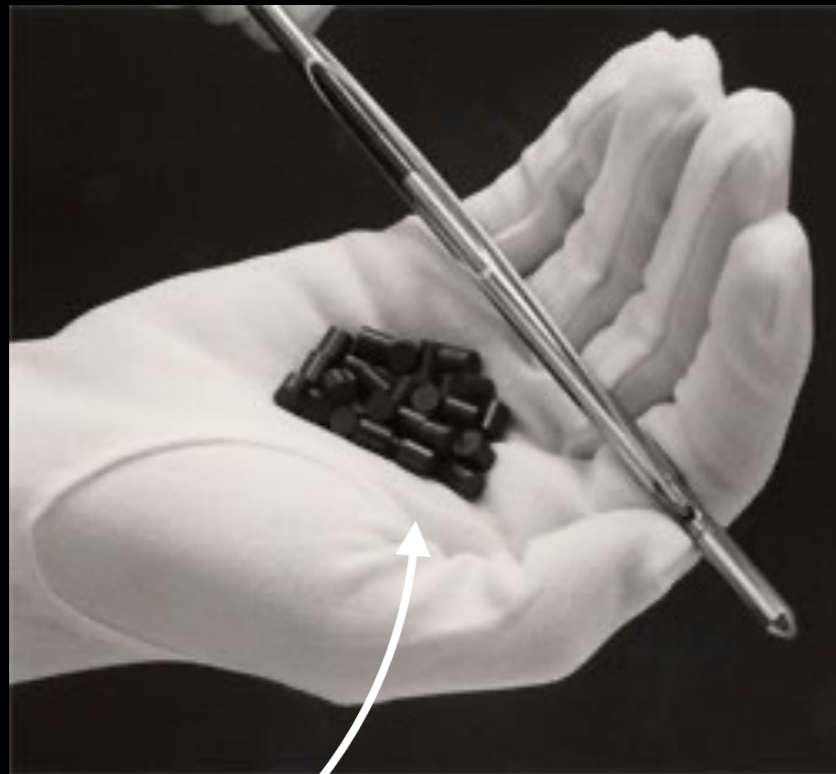
Why do the fuel pellets get hot?



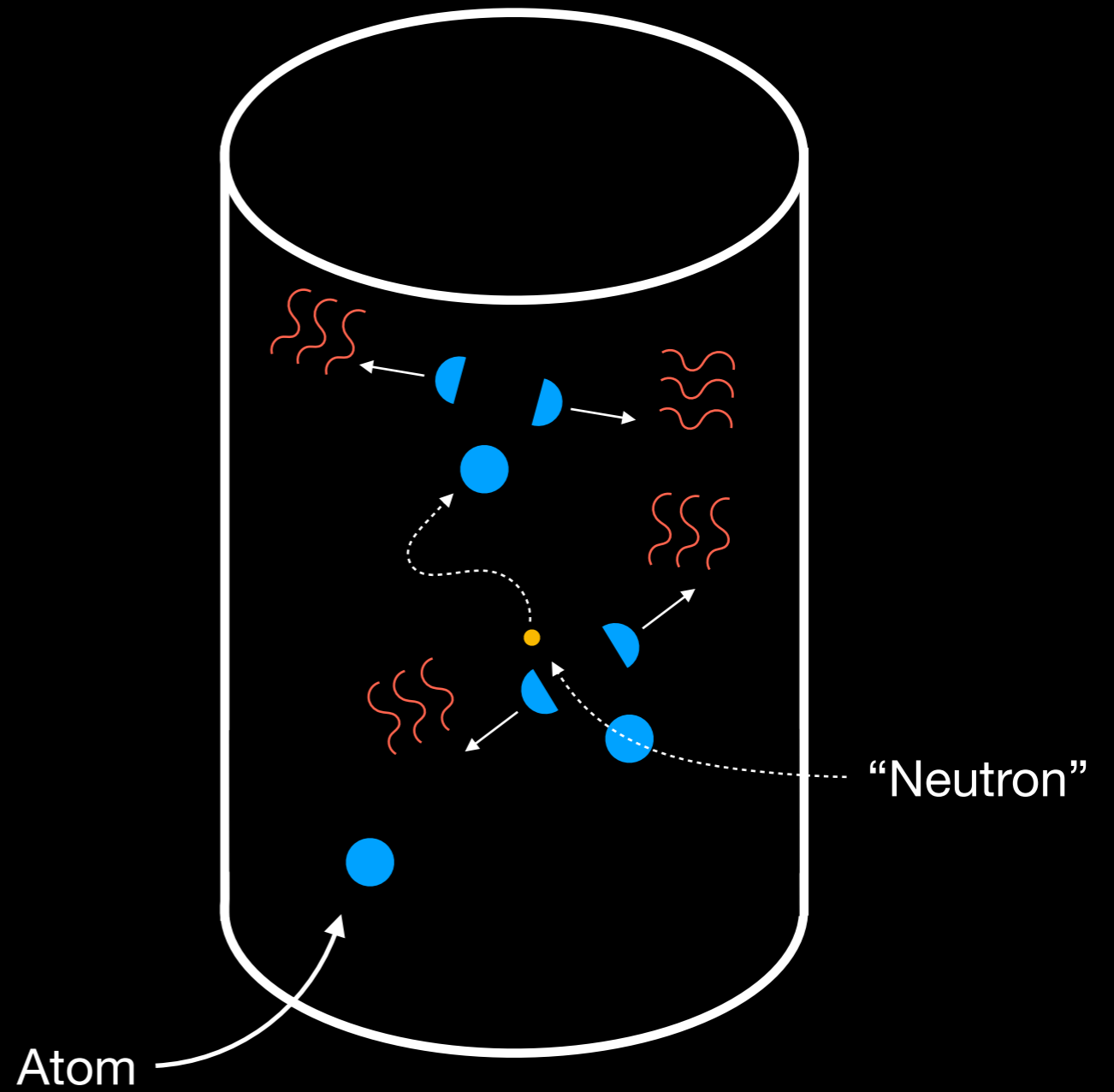
Fuel pellets



Why do the fuel pellets get hot?



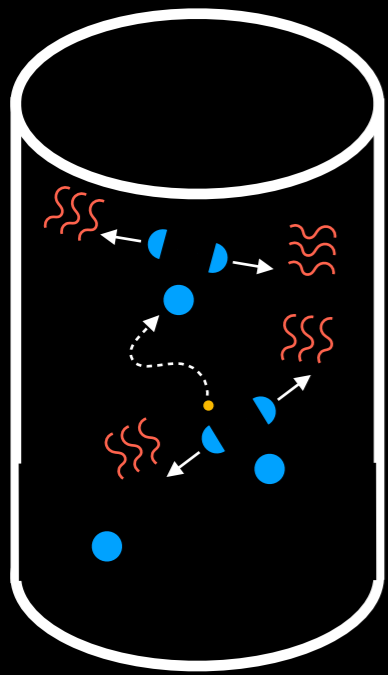
Fuel pellets



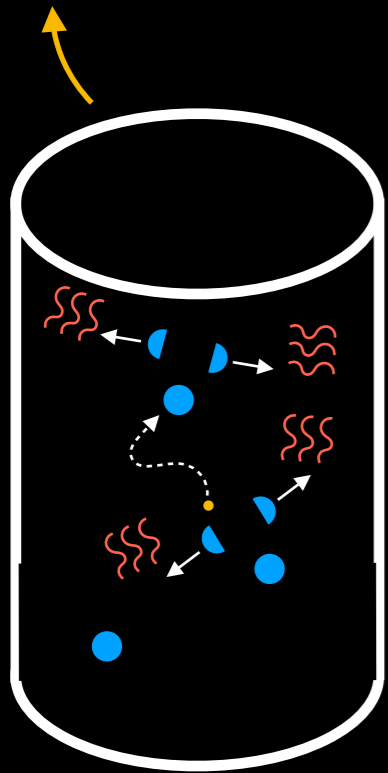
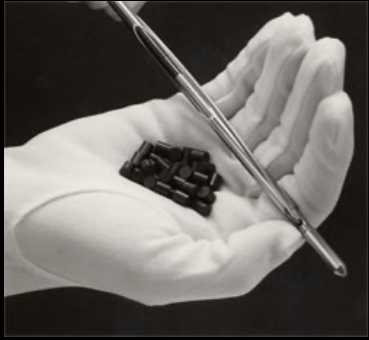
Atom

“Neutron”

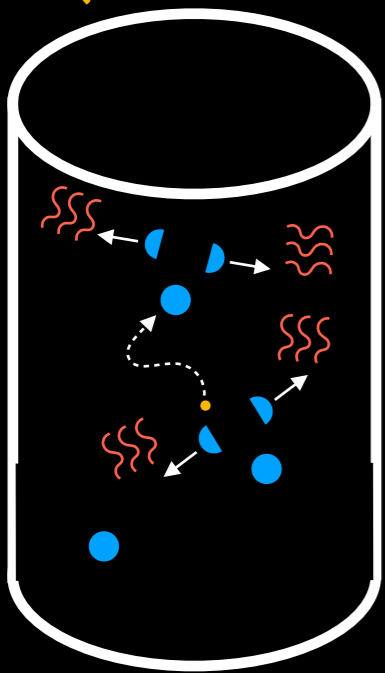
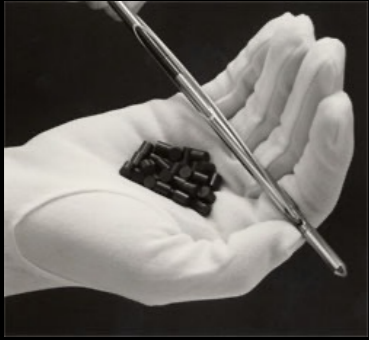
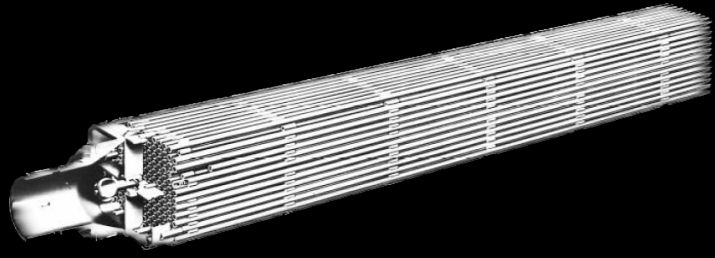
This is where electricity comes from!



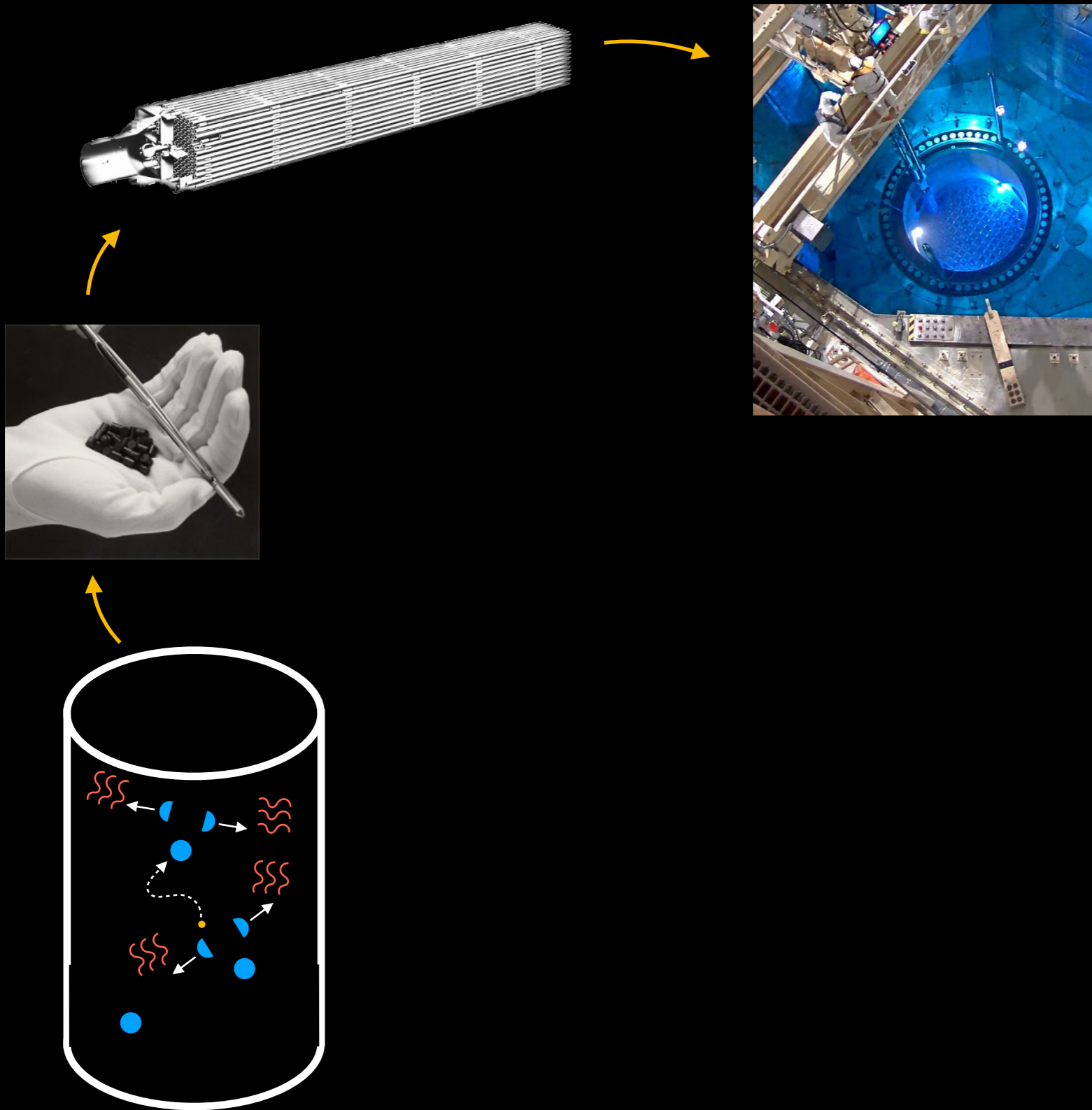
This is where electricity comes from!



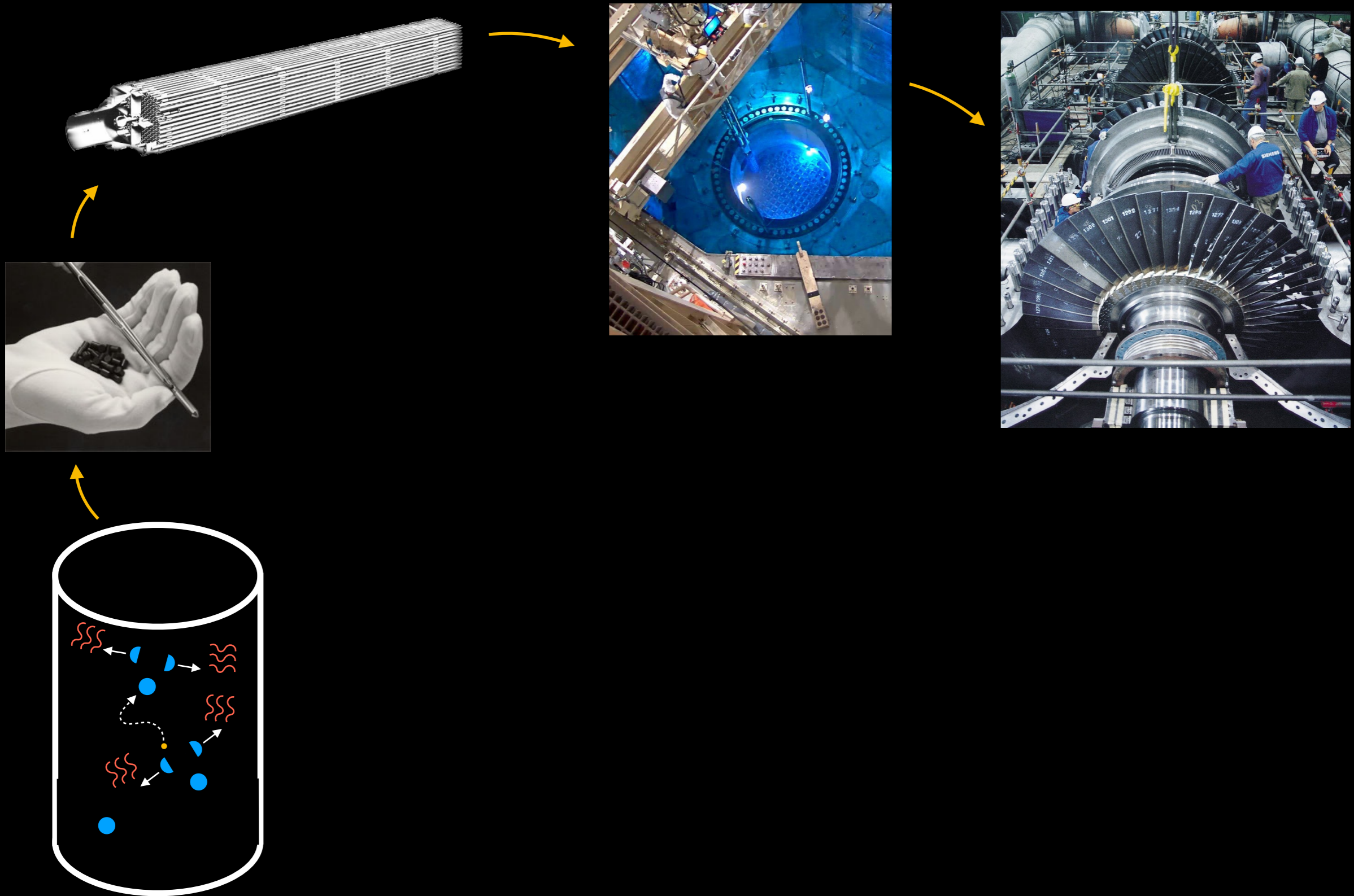
This is where electricity comes from!



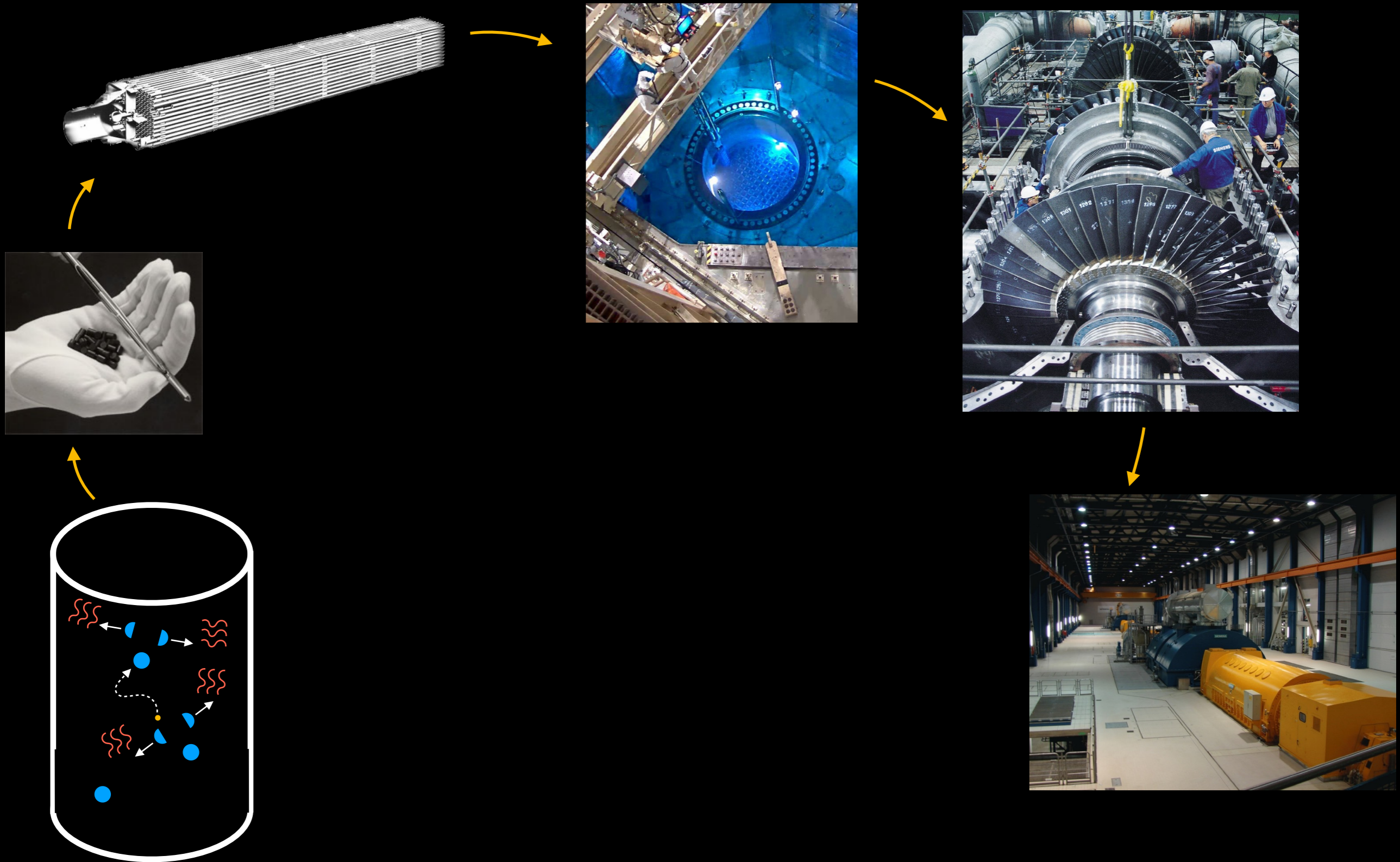
This is where electricity comes from!



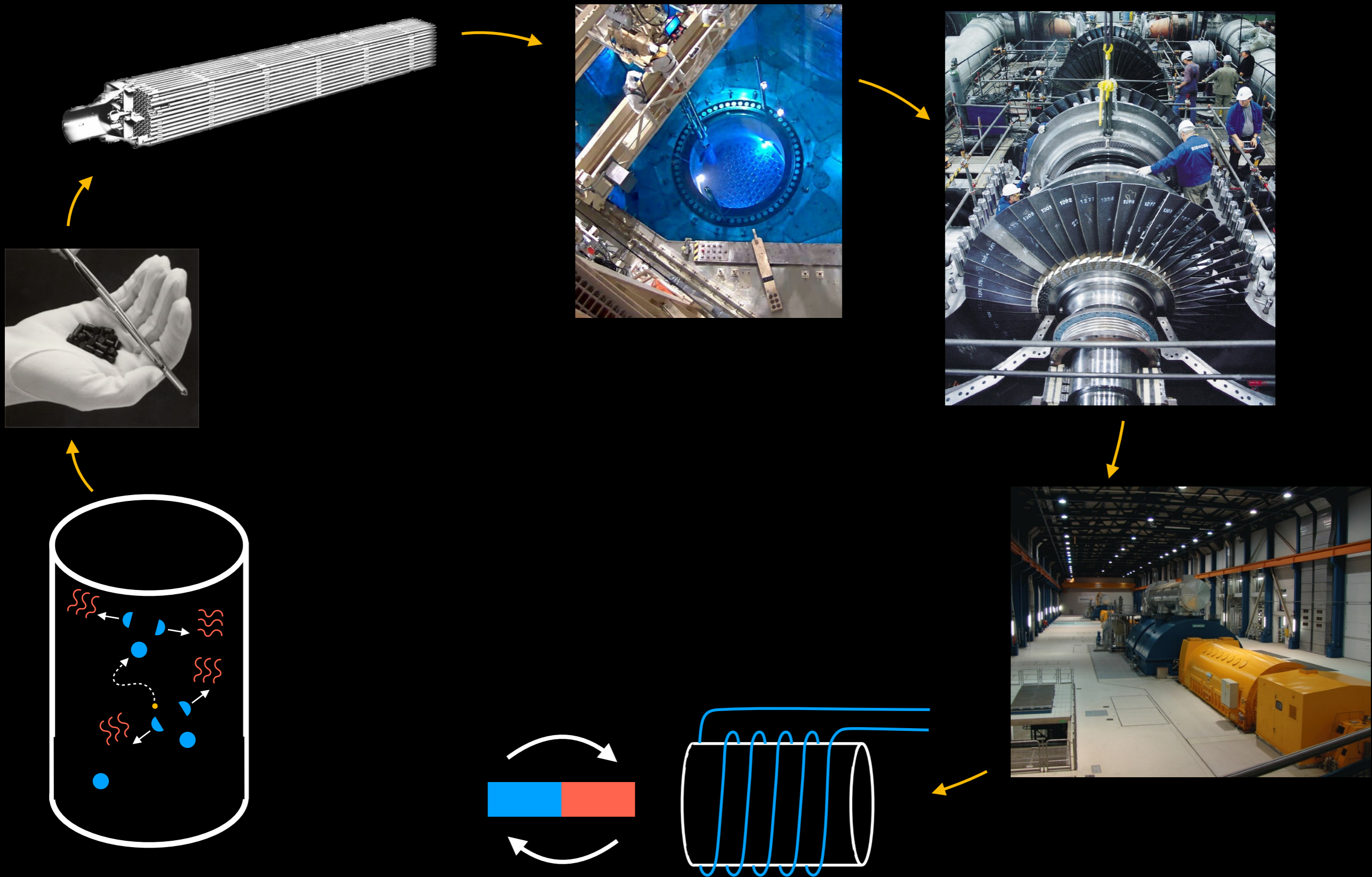
This is where electricity comes from!



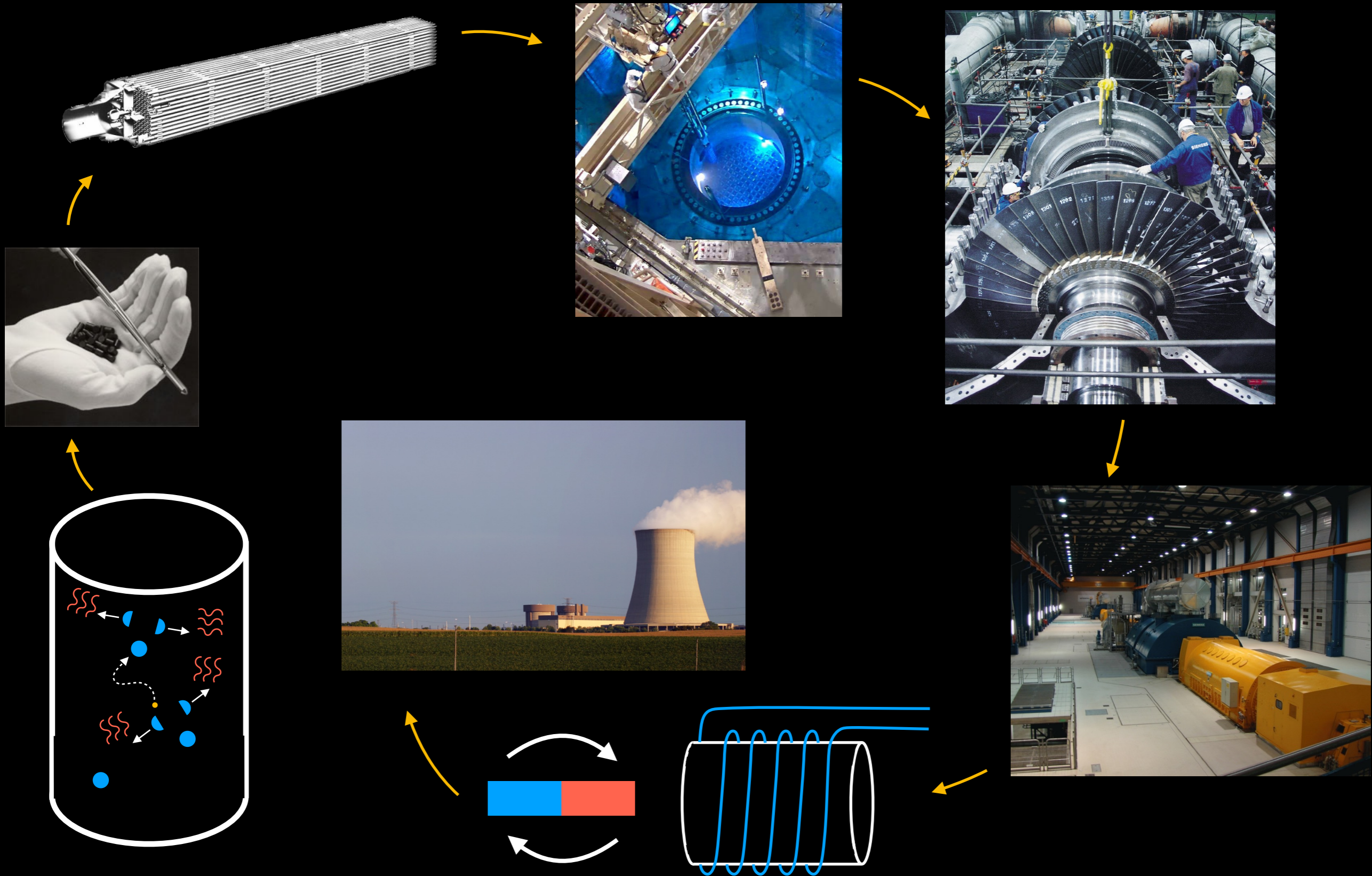
This is where electricity comes from!



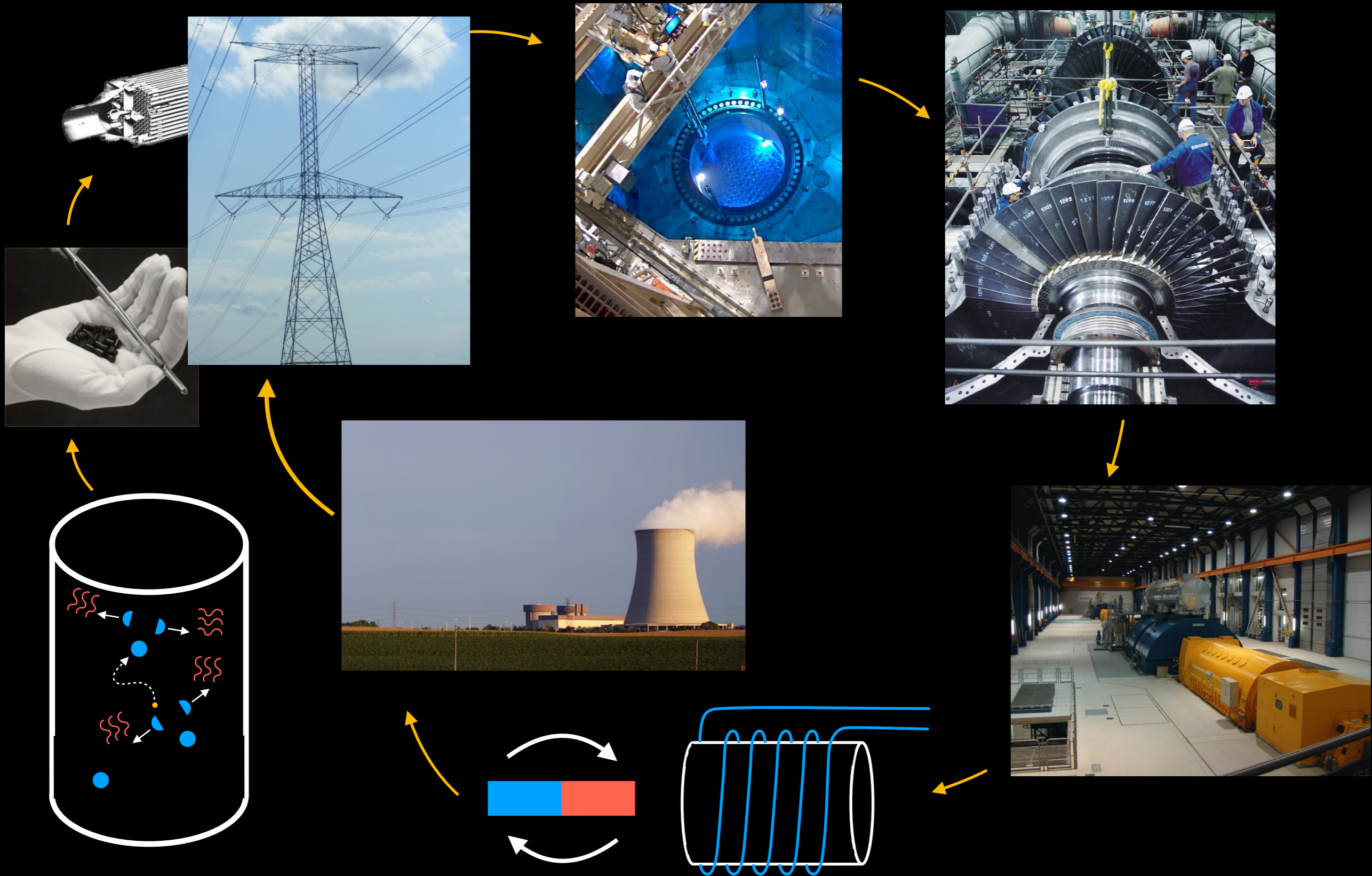
This is where electricity comes from!



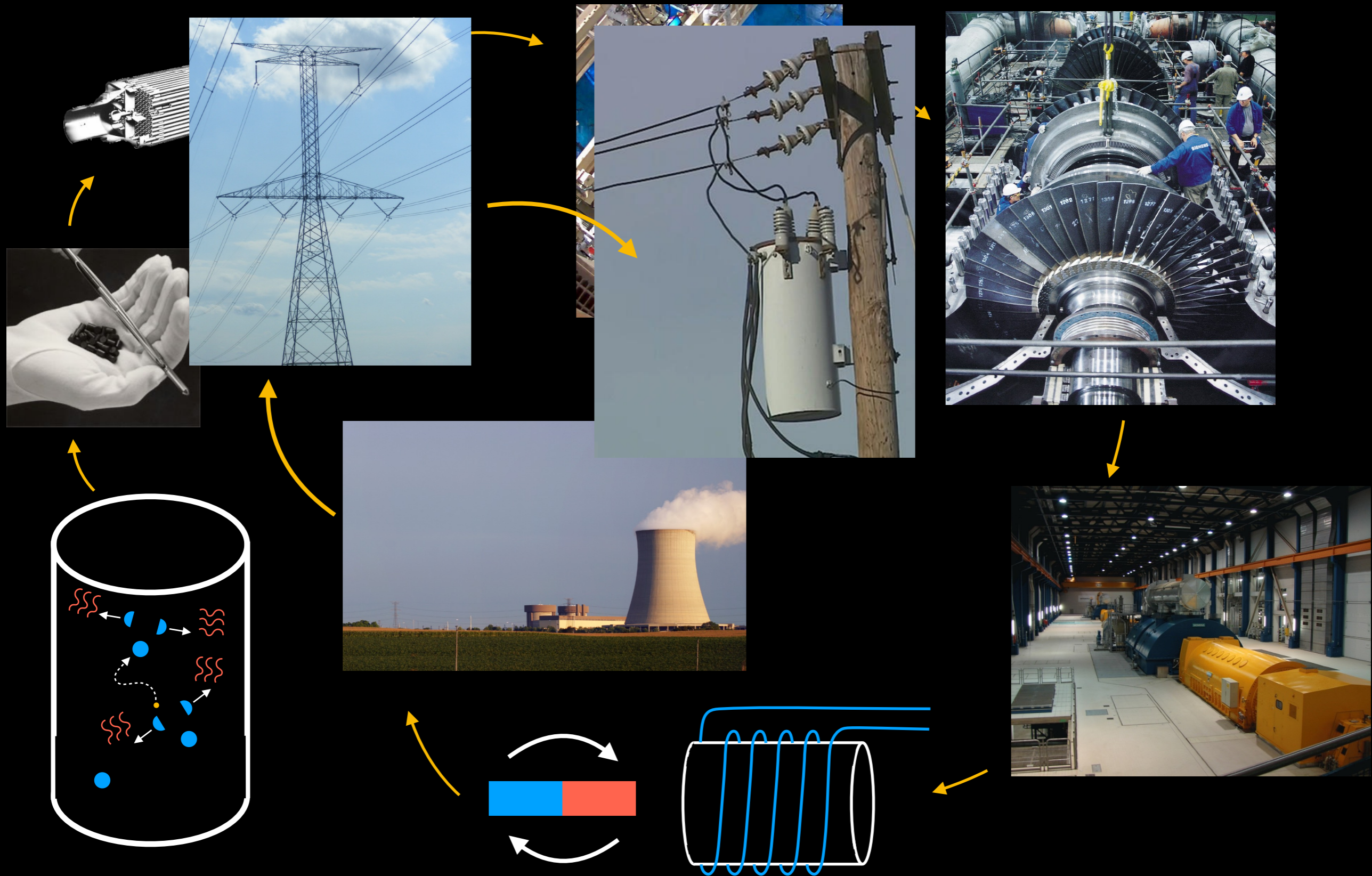
This is where electricity comes from!



This is where electricity comes from!



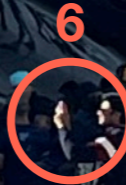
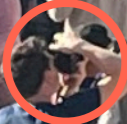
This is where electricity comes from!



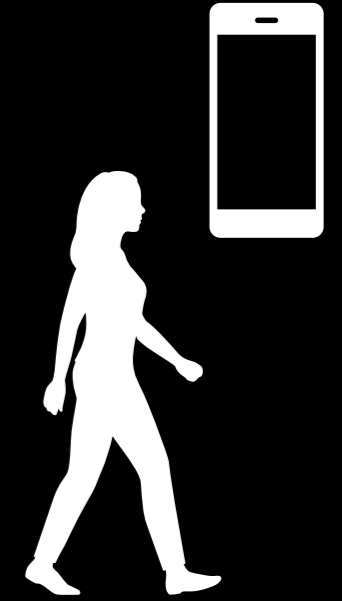
This is where electricity comes from!



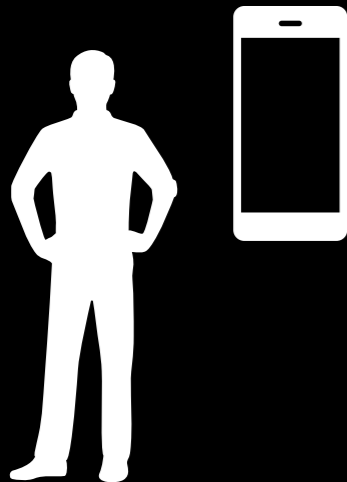
Technology
is everywhere!



What happens when you call your friend?

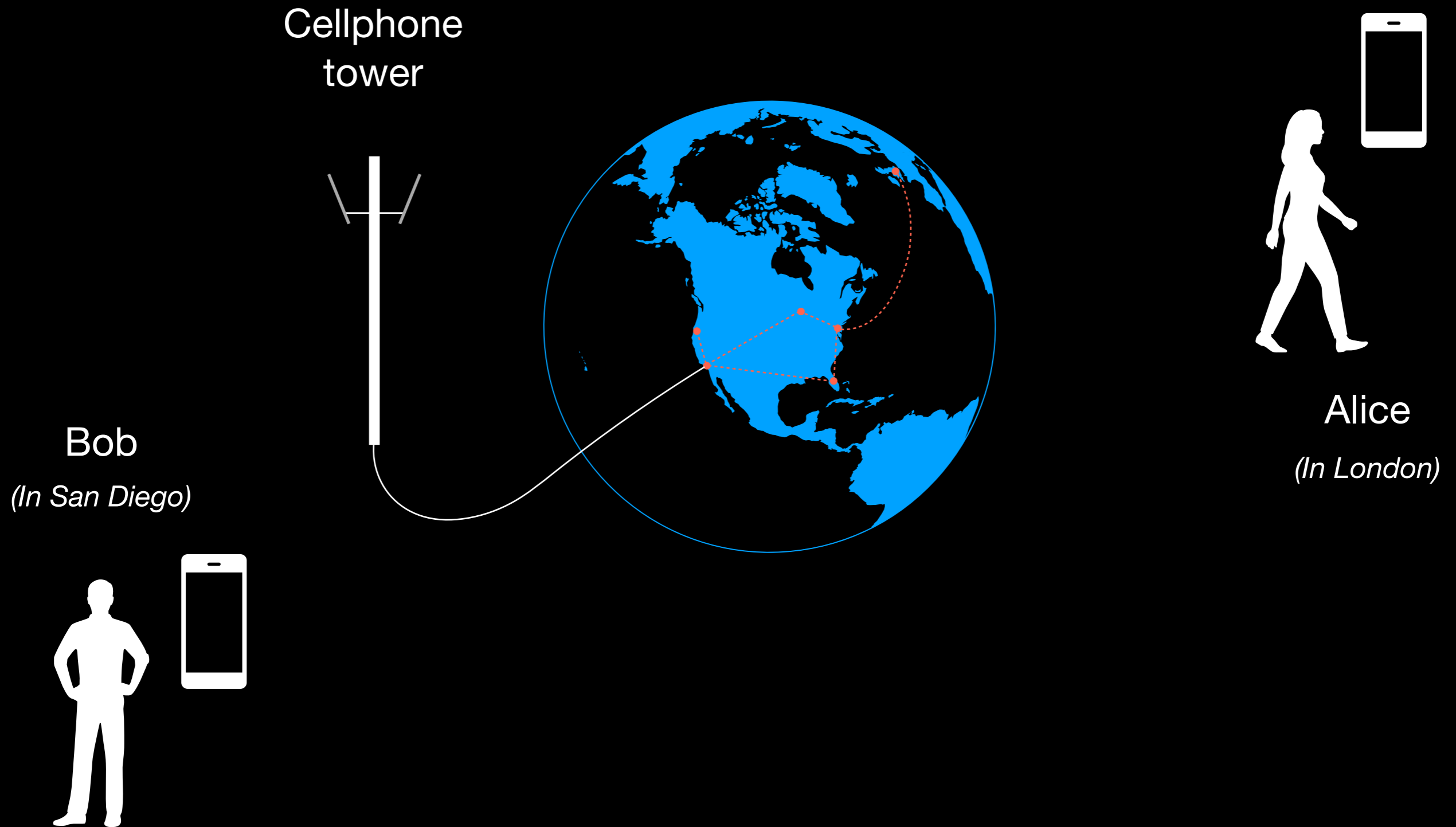


Alice
(In London)



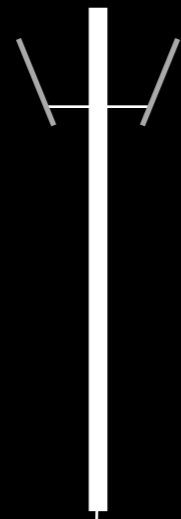
Bob
(In San Diego)

What happens when you call your friend?



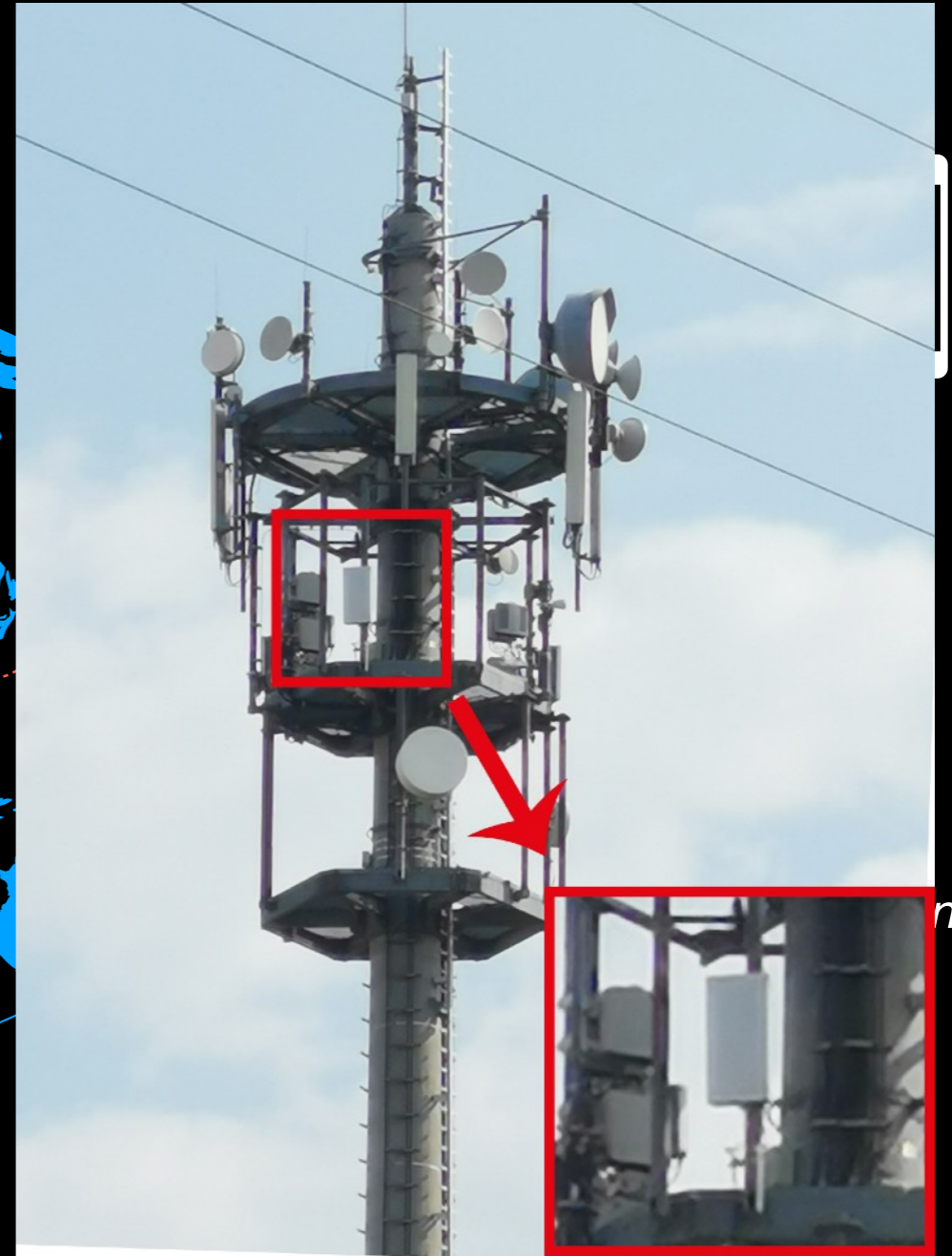
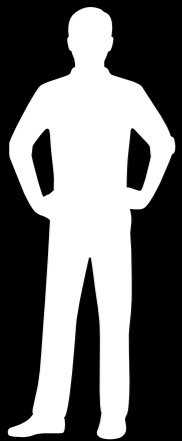
What happens when you call your friend?

Cellphone tower

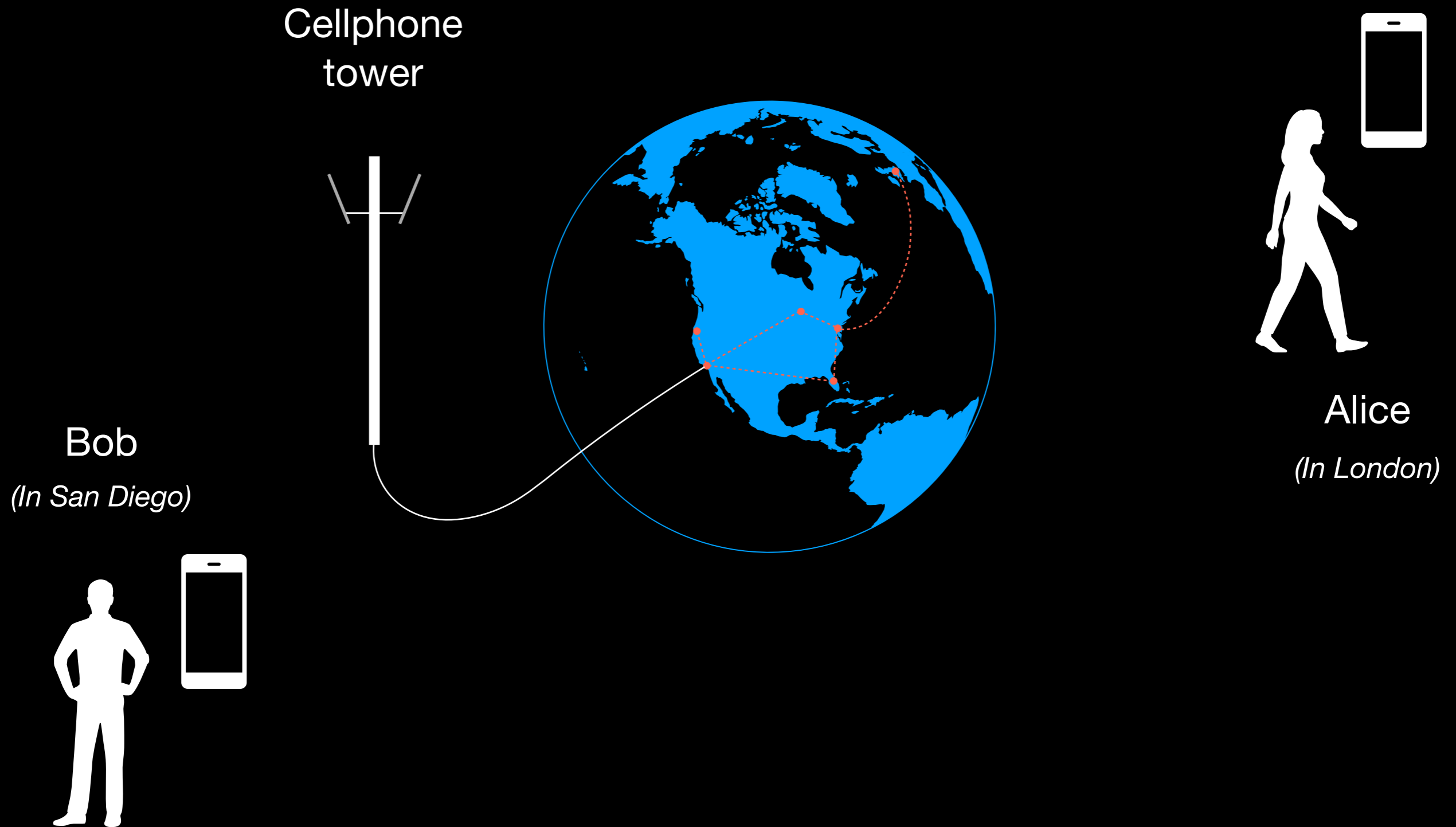


Bob

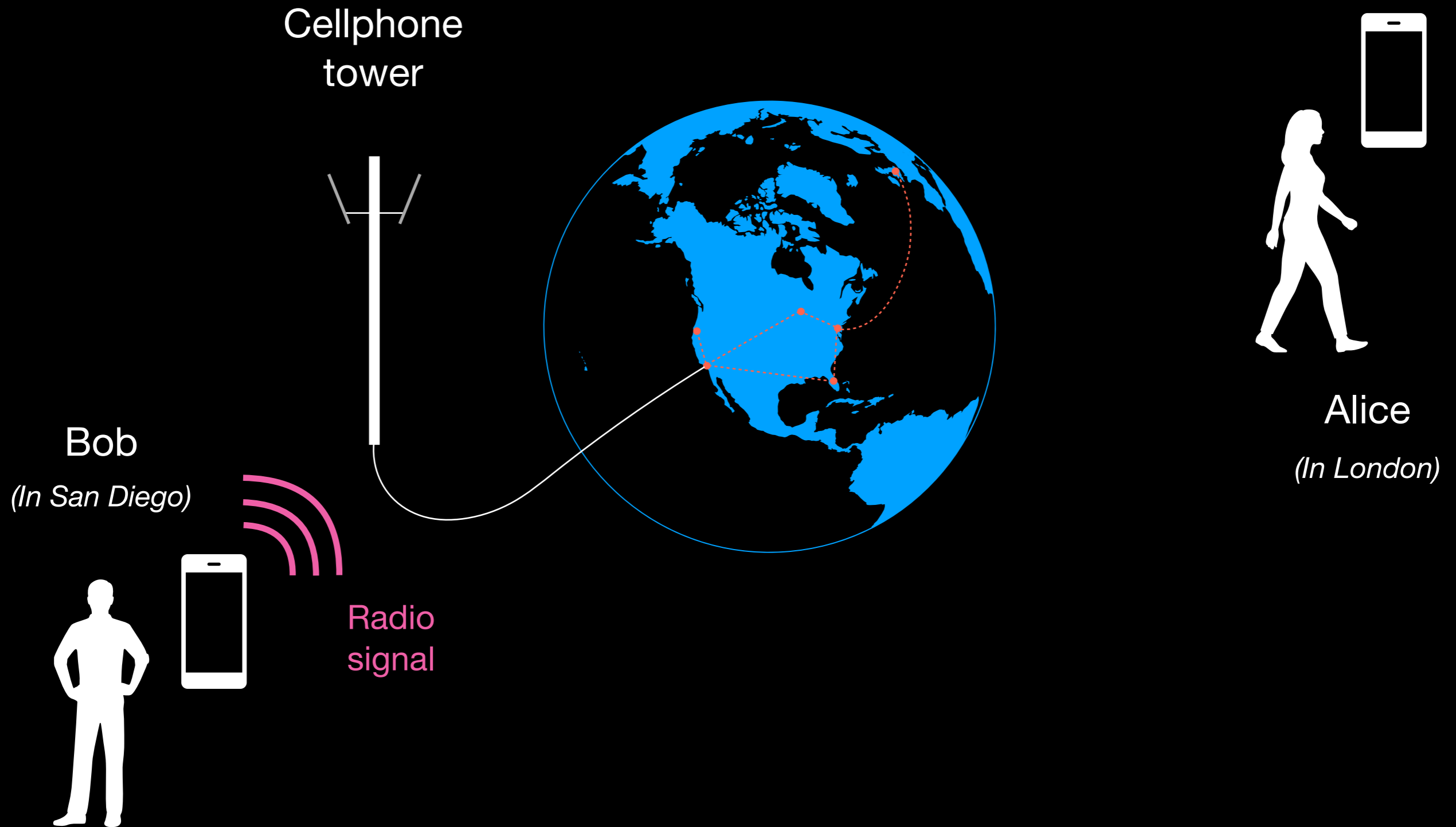
(In San Diego)



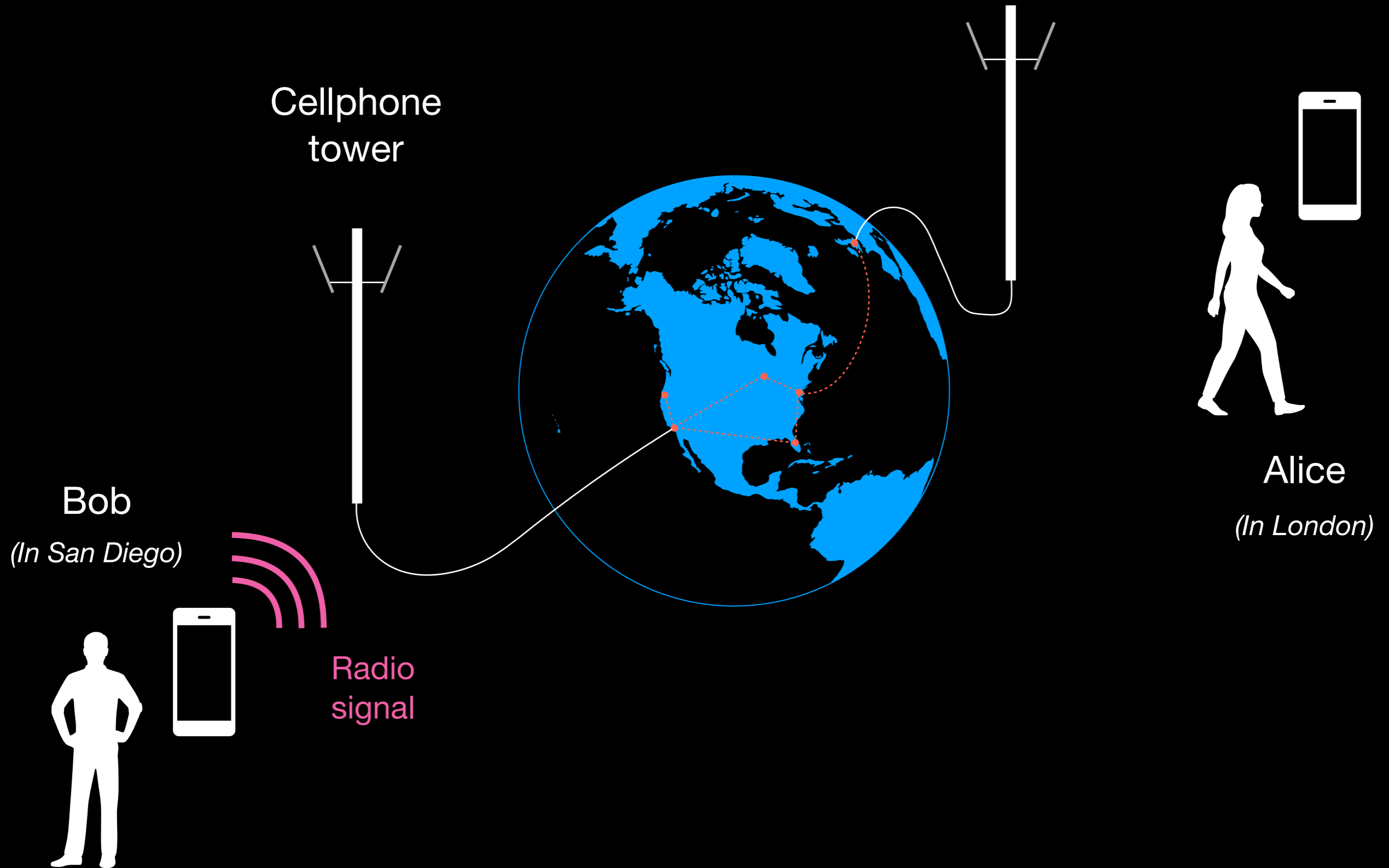
What happens when you call your friend?



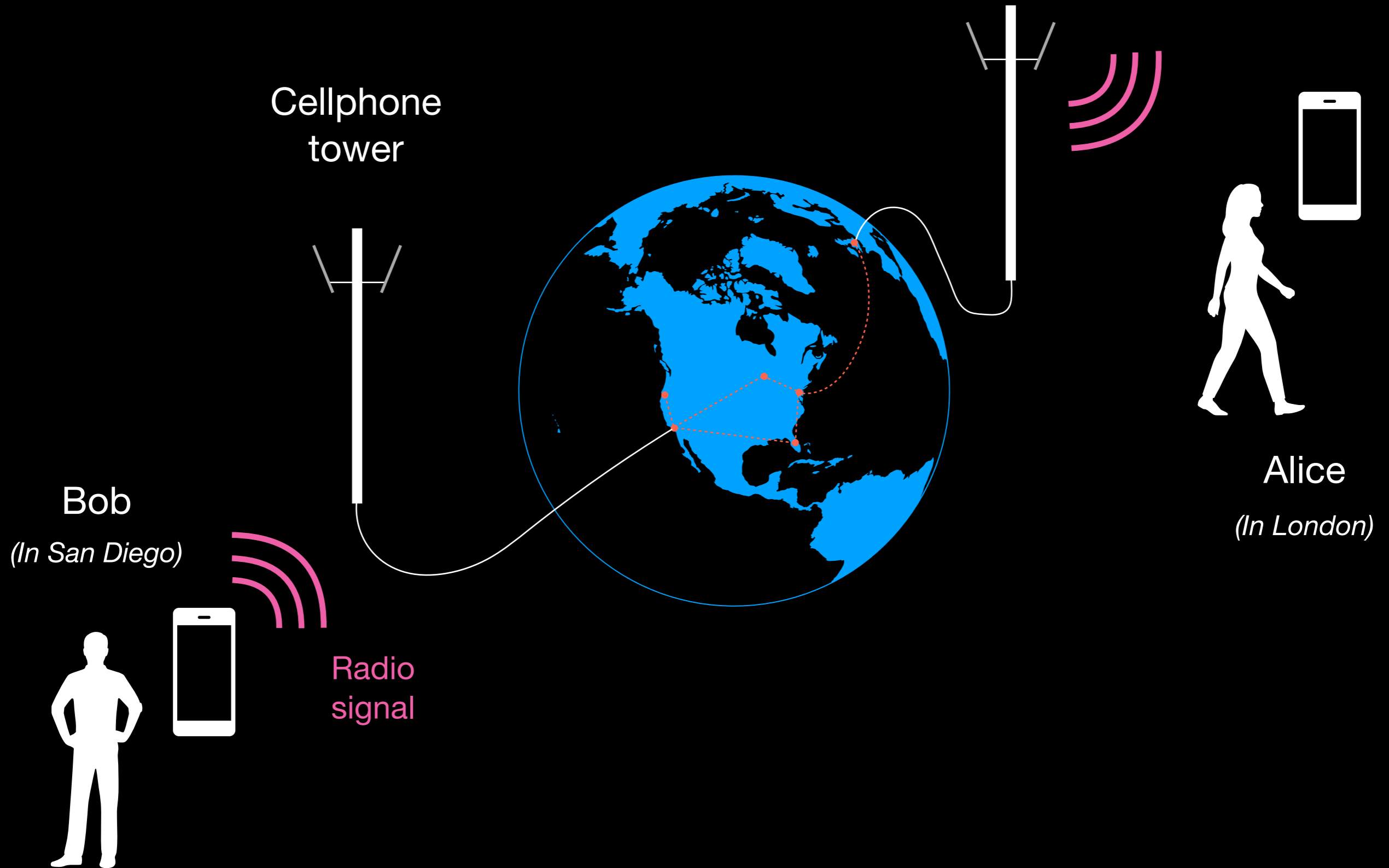
What happens when you call your friend?



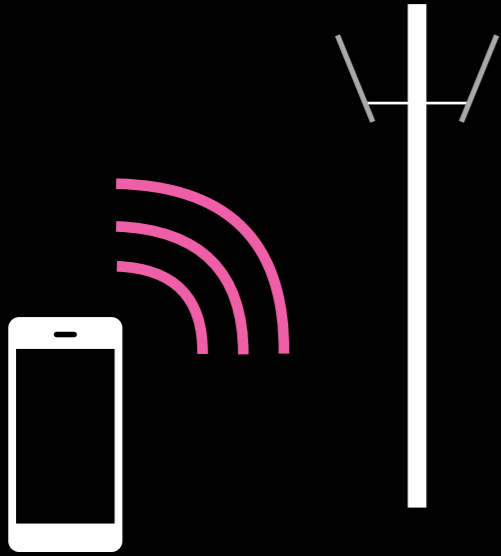
What happens when you call your friend?



What happens when you call your friend?

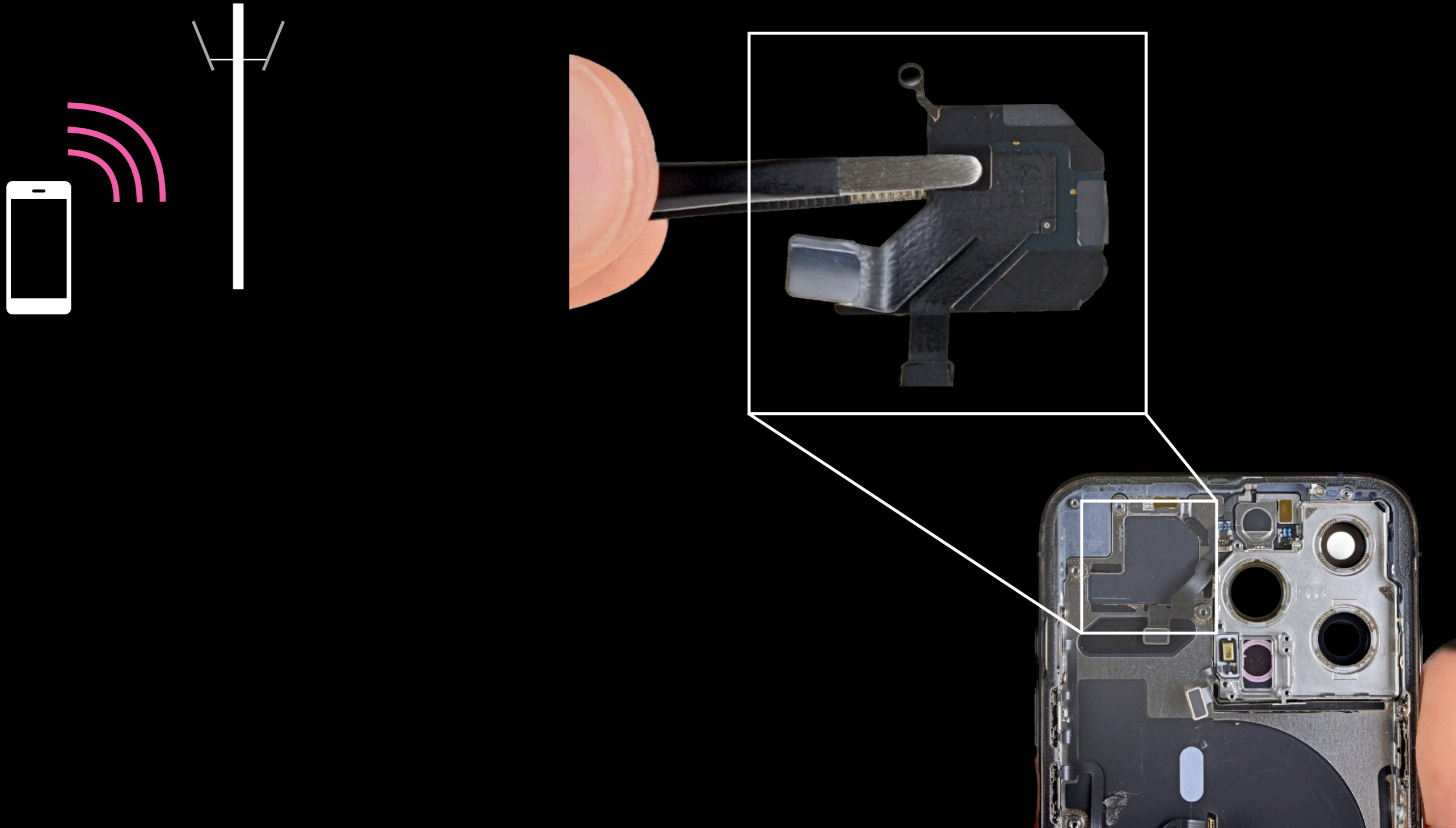


Where does the radio signal come from?



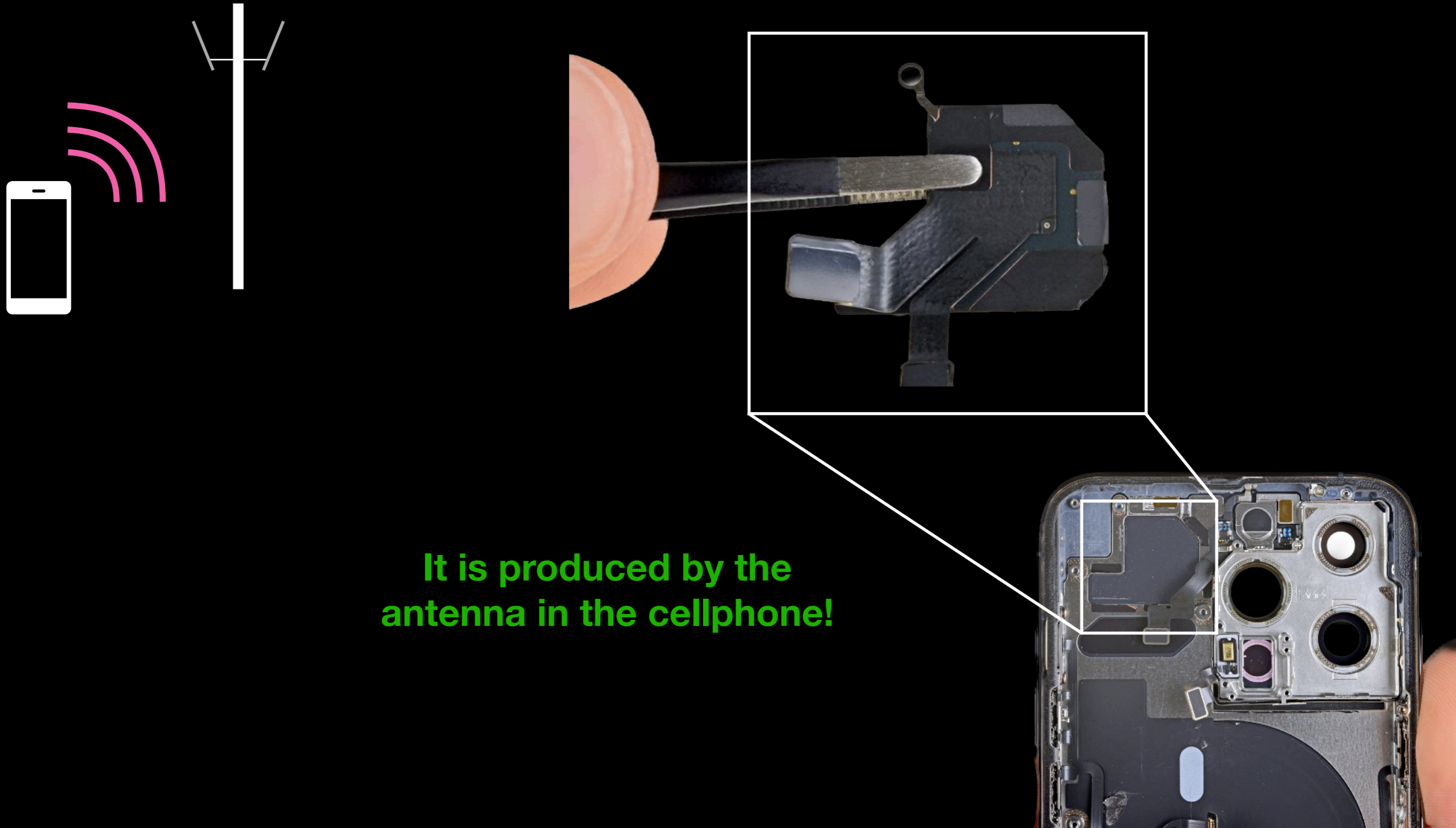
[\[source\]](#)

Where does the radio signal come from?



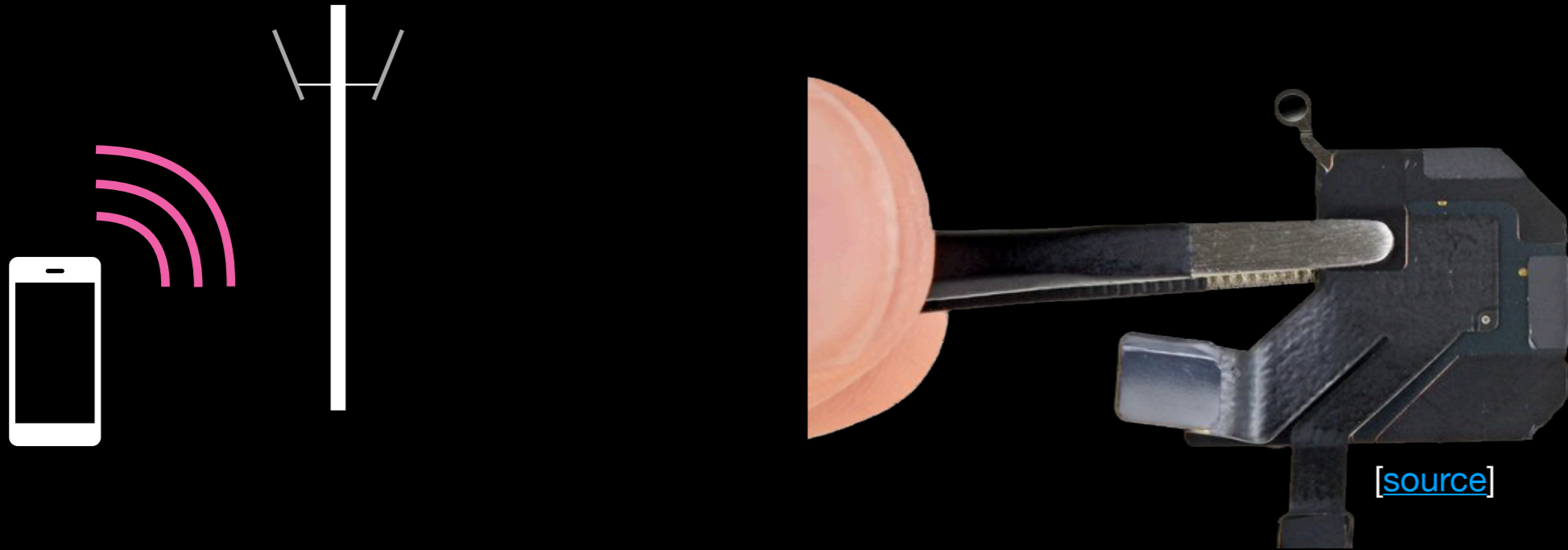
[source]

Where does the radio signal come from?

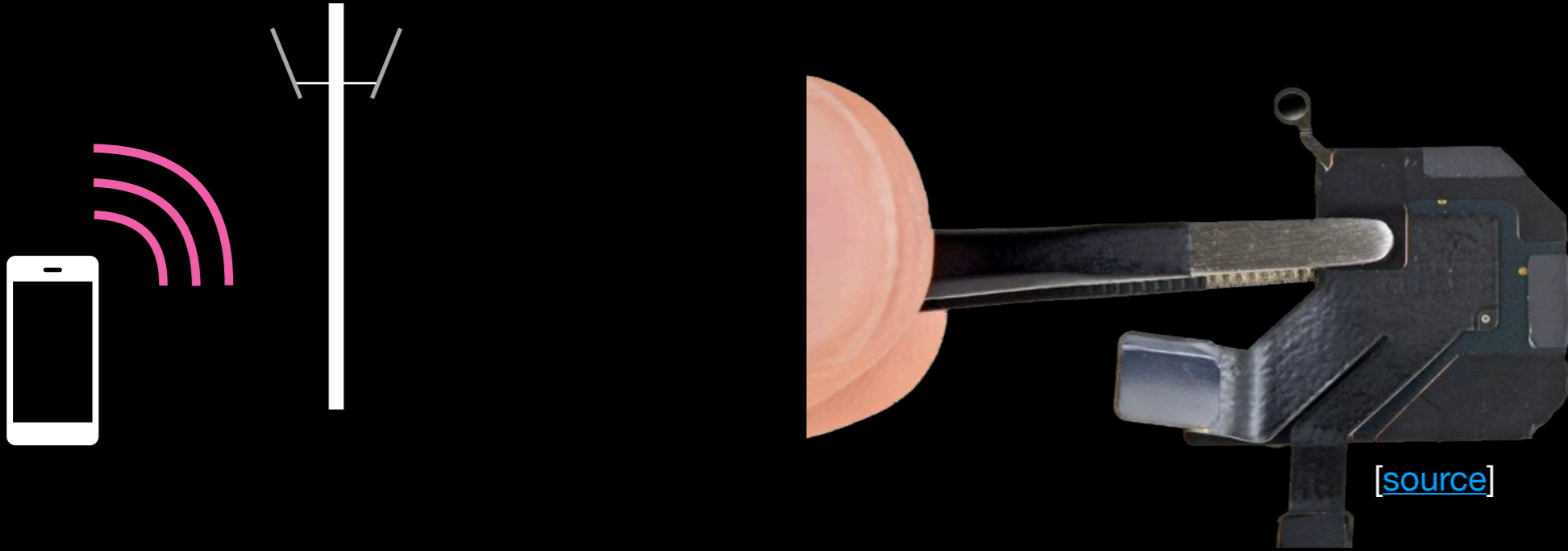


It is produced by the antenna in the cellphone!

How does the antenna work?

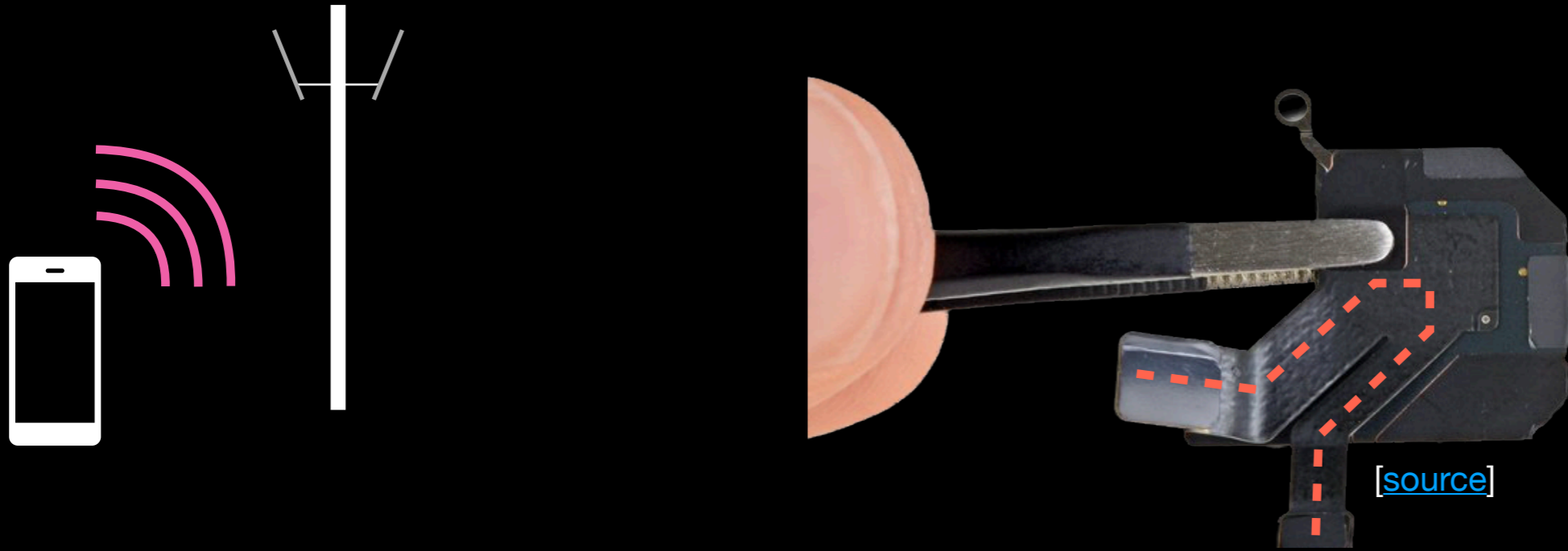


How does the antenna work?



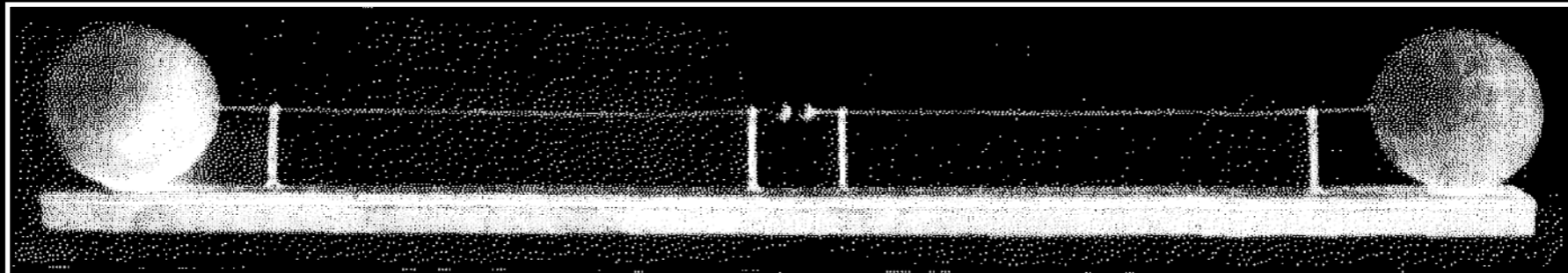
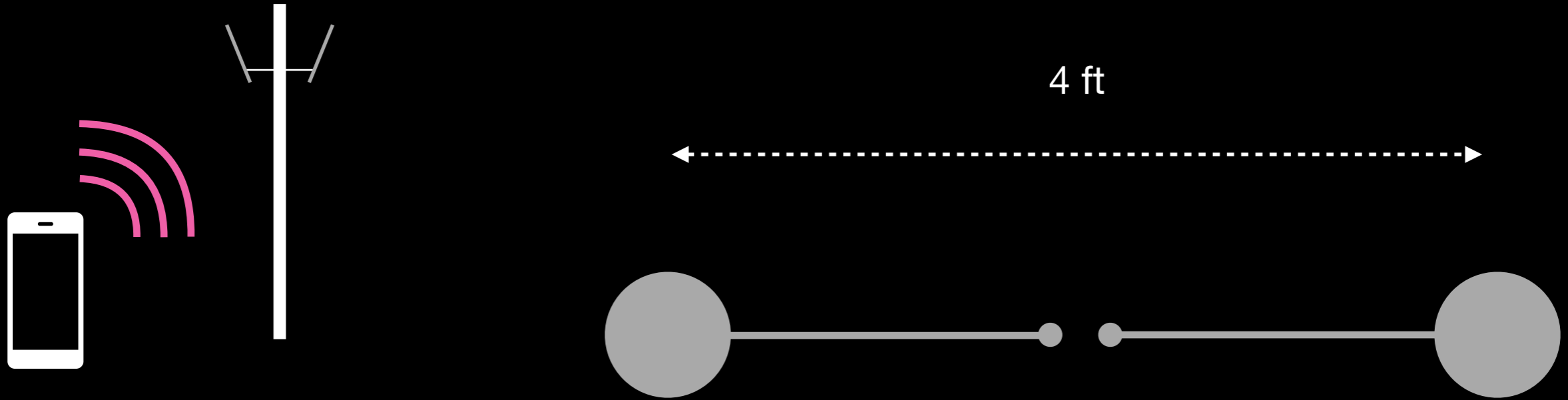
The antenna is just a piece of thin wire!

How does the antenna work?

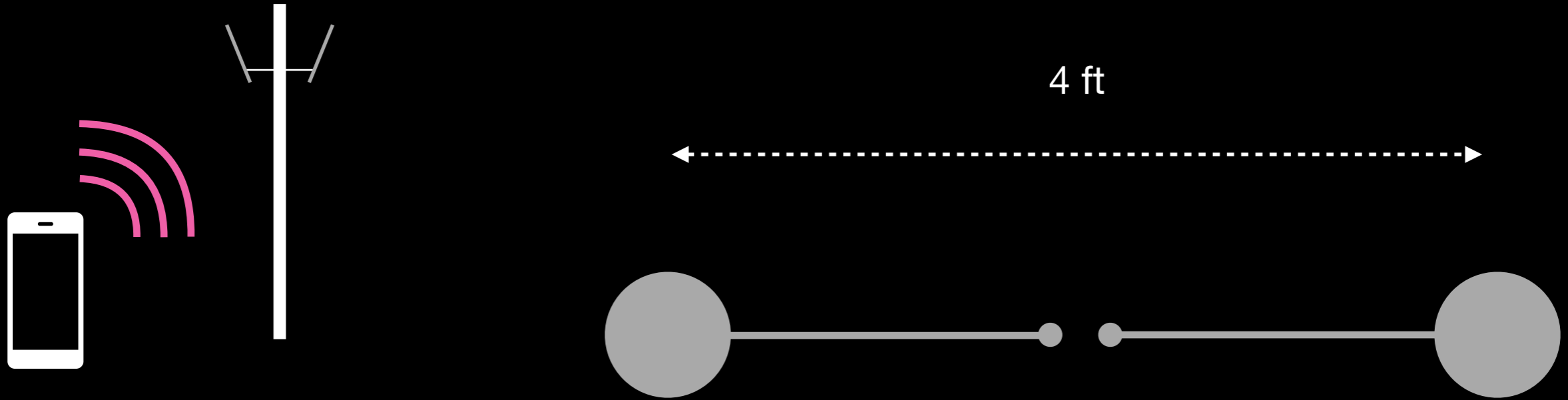


The antenna is just a piece of thin wire!

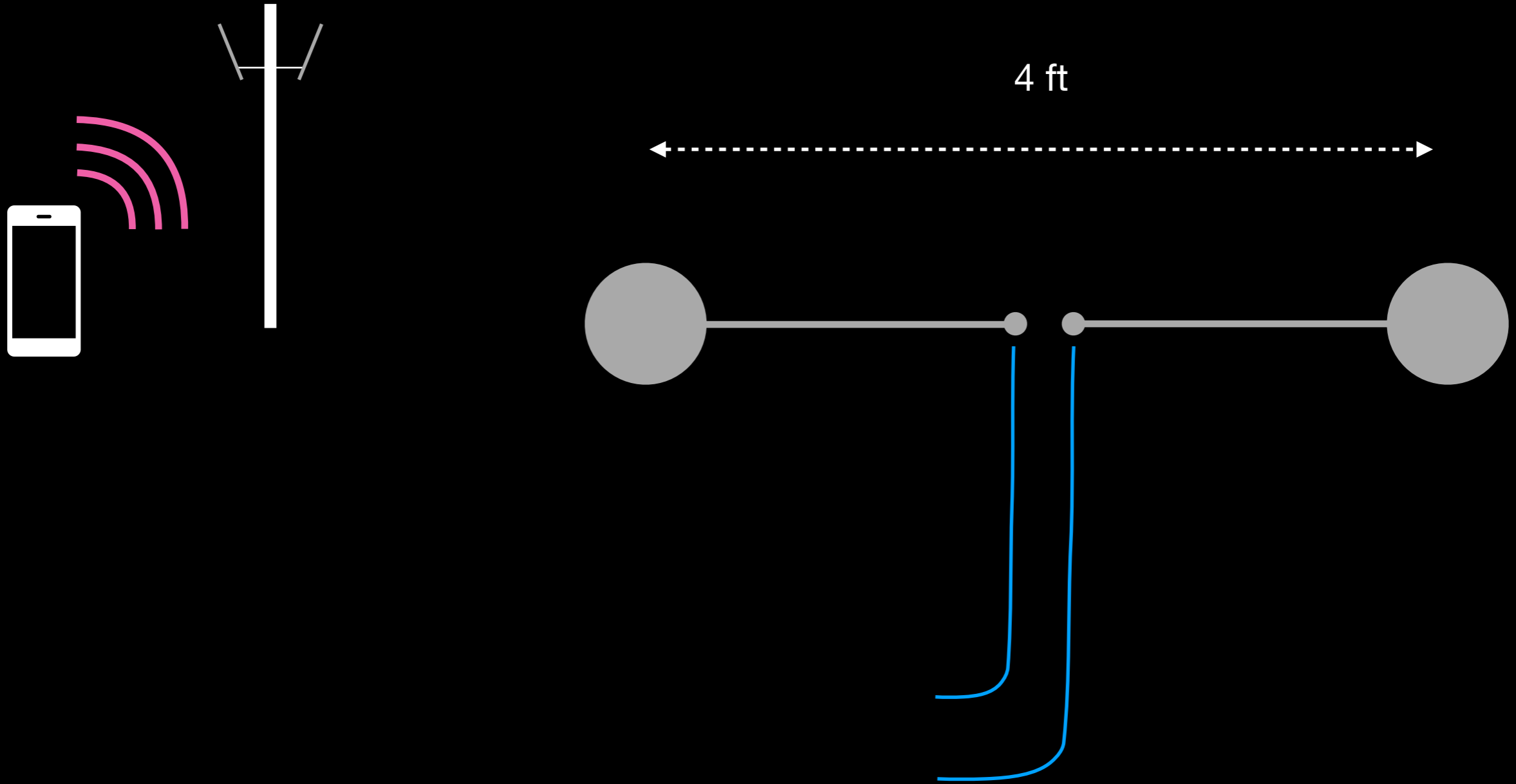
The first antenna ever constructed



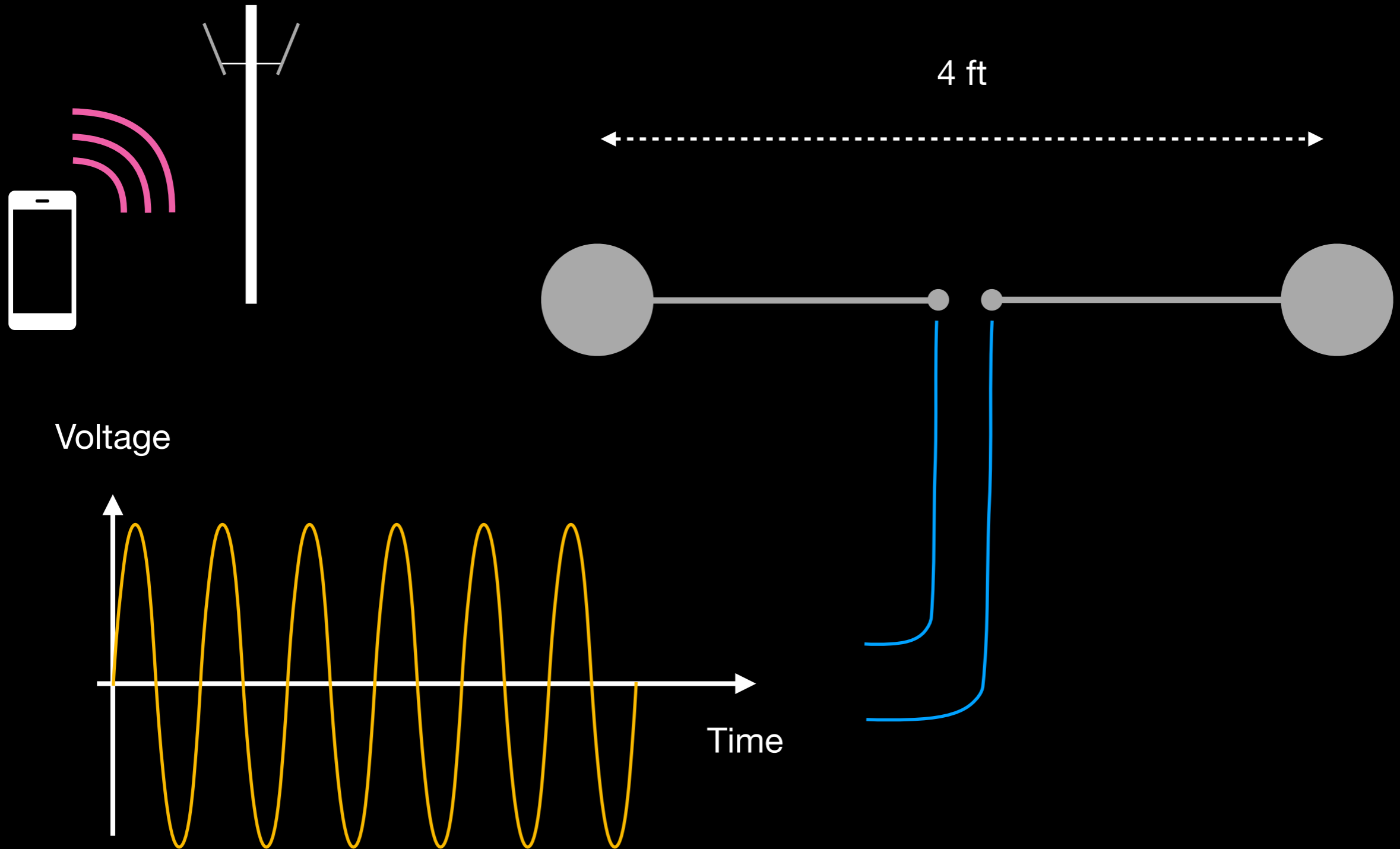
The first antenna ever constructed



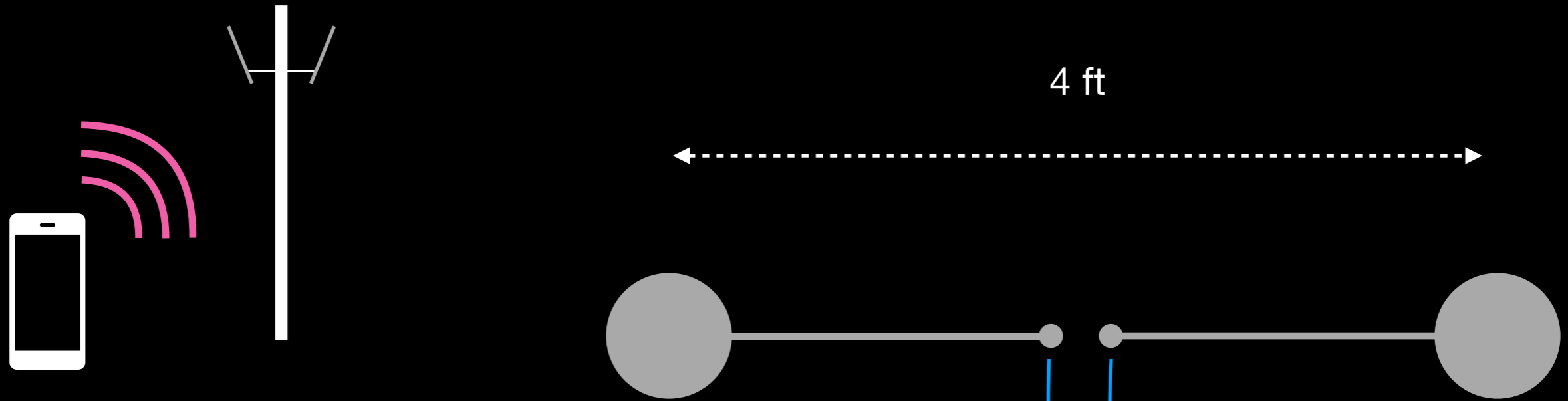
The first antenna ever constructed



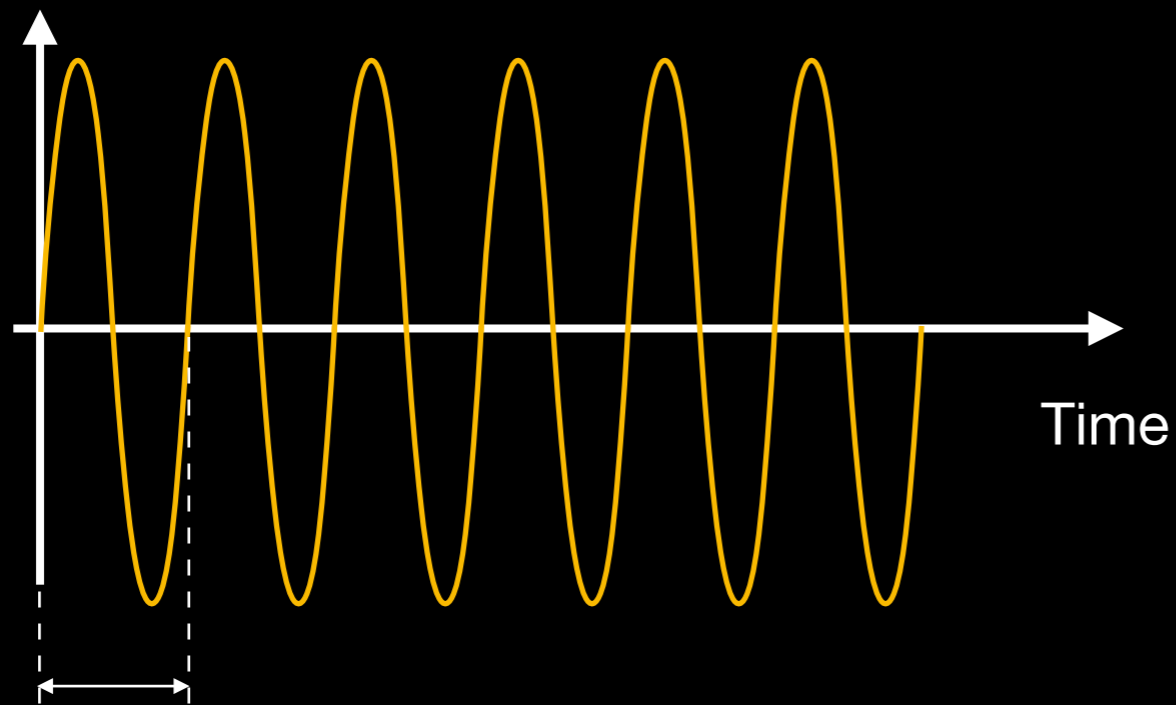
The first antenna ever constructed



The first antenna ever constructed

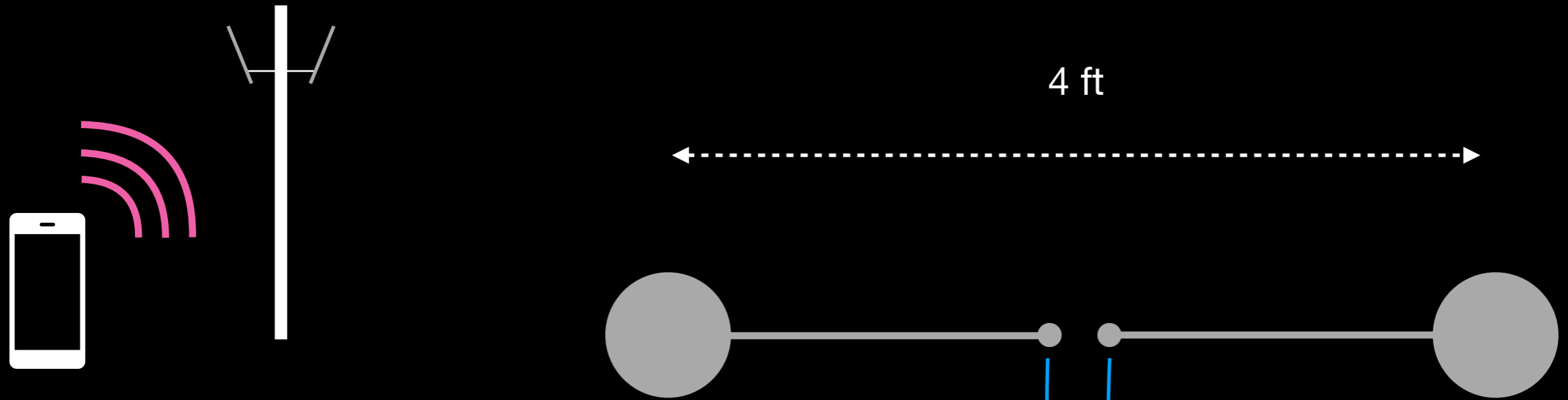


Voltage

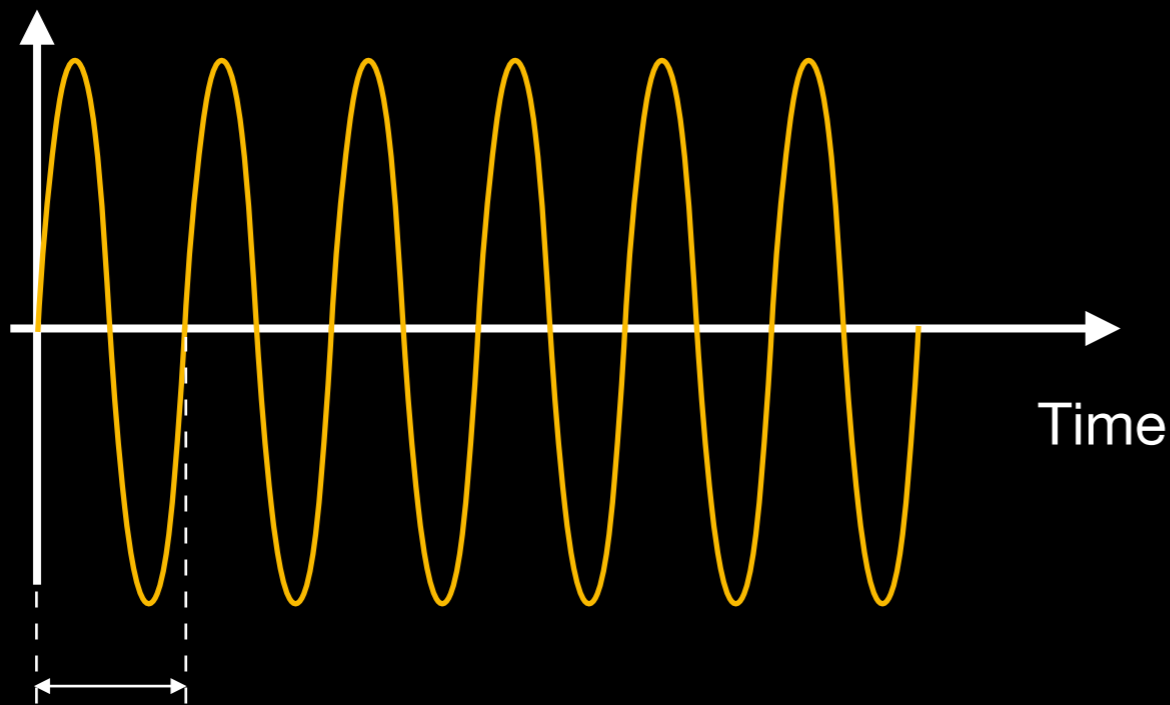


1 billionth of a second

The first antenna ever constructed



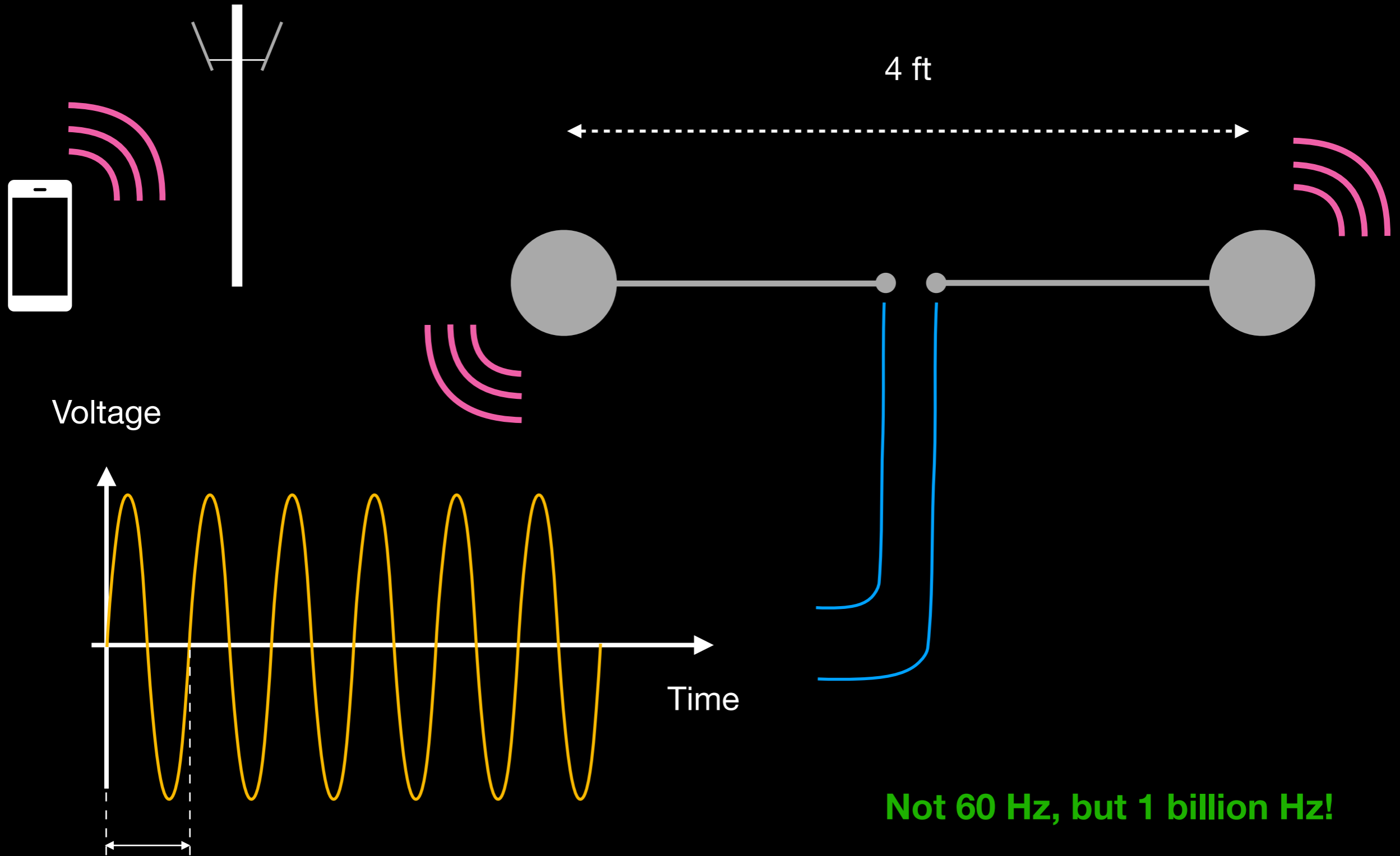
Voltage



1 billionth of a second

Not 60 Hz, but 1 billion Hz!

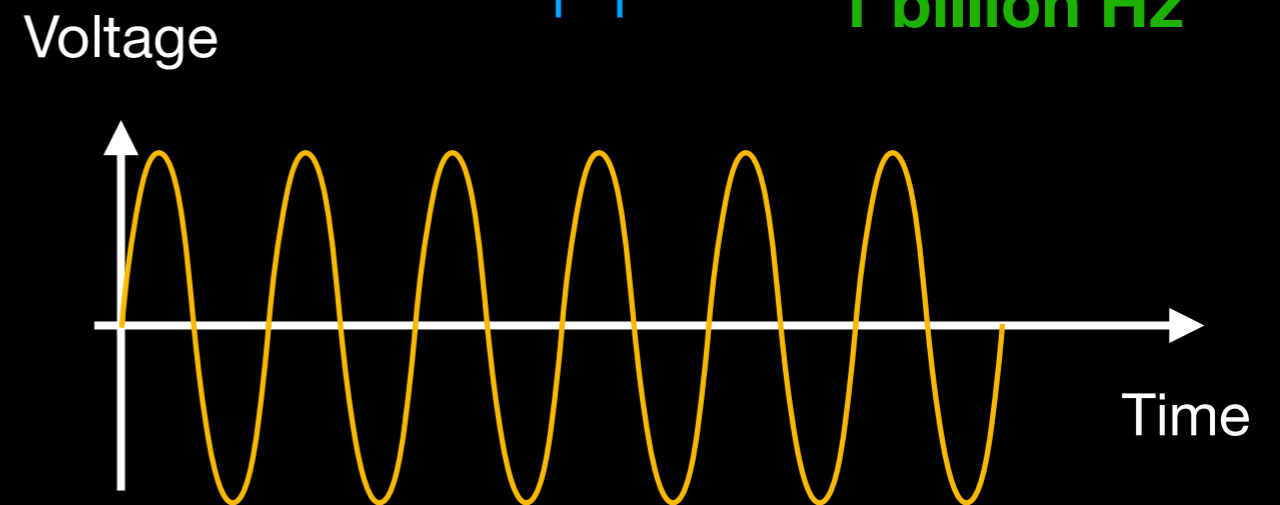
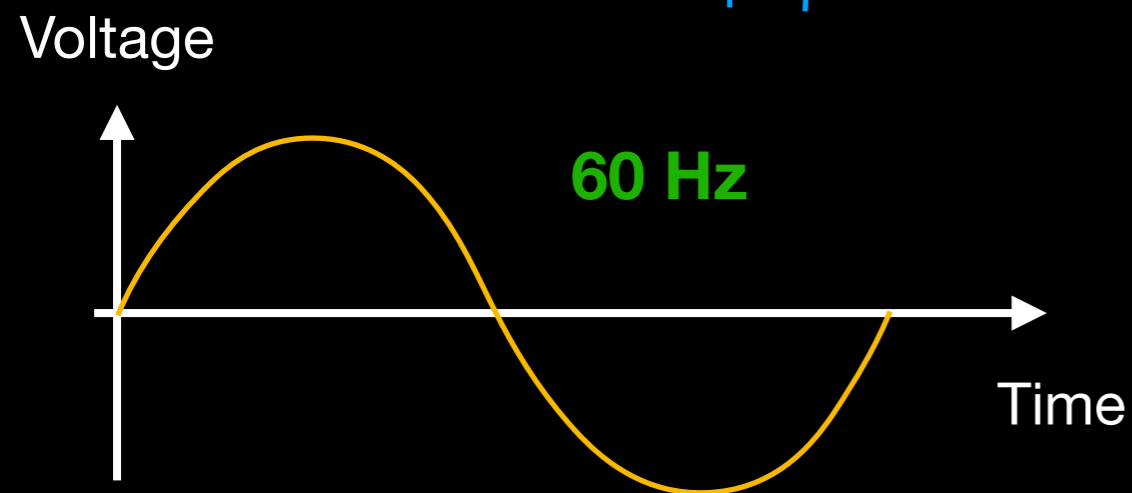
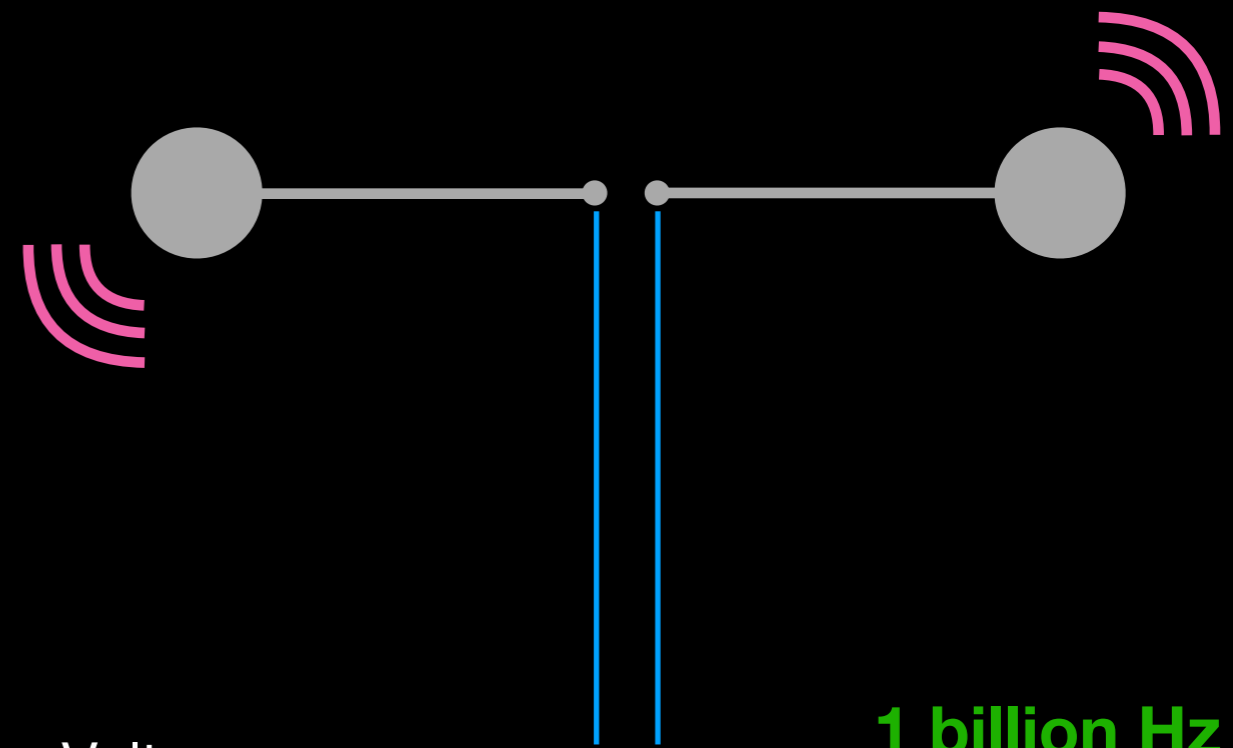
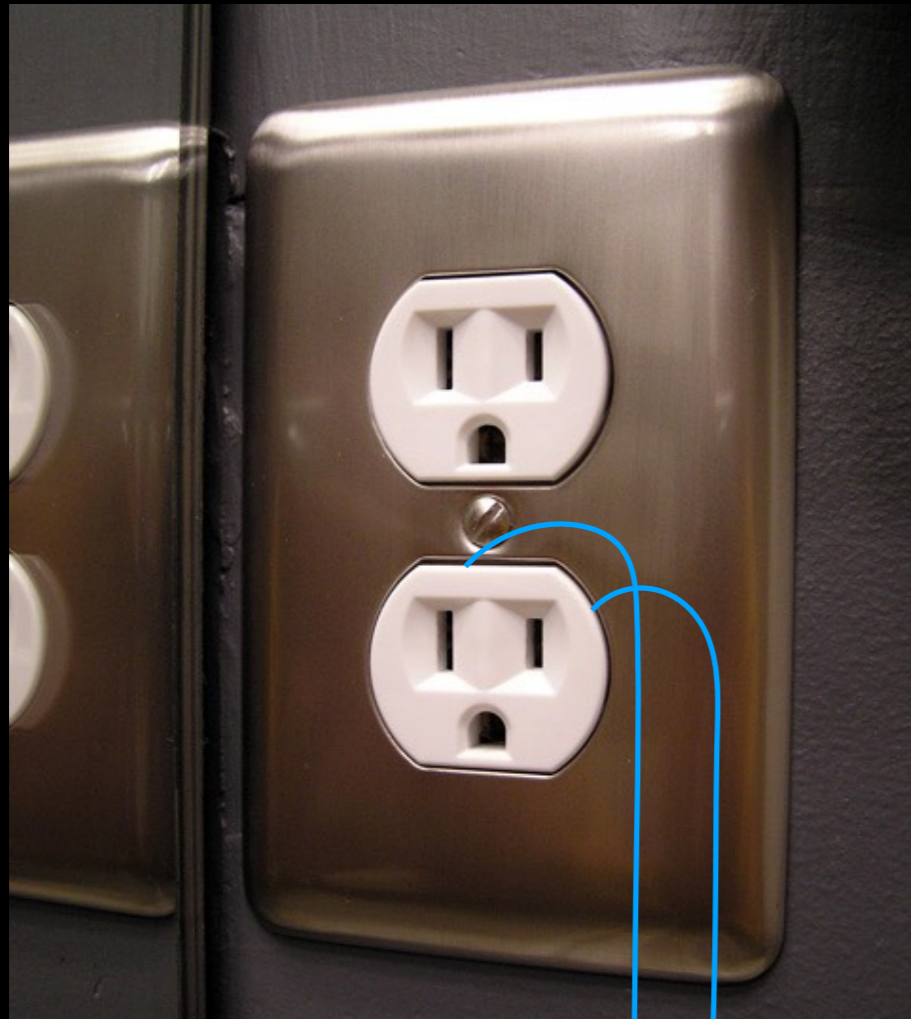
The first antenna ever constructed



Not 60 Hz, but 1 billion Hz!

1 billionth of a second

Identical, yet different?



Today, we know a lot about how the world works

Today, we know a lot about how the world works

“Electricity flows easily through thin metallic wires.”

Today, we know a lot about how the world works

“Electricity flows easily through thin metallic wires.”

“Rapidly oscillating electricity produces radio waves.”

Today, we know a lot about how the world works

“Electricity flows easily through thin metallic wires.”

“Rapidly oscillating electricity produces radio waves.”

Our world works because we know a lot about it

Today, we know a lot about how the world works

“Electricity flows easily through thin metallic wires.”

“Rapidly oscillating electricity produces radio waves.”

Our world works because we know a lot about it

“Without electricity, trains, planes, phones, elevators, A/Cs are impossible!”

Today, we know a lot about how the world works

“Electricity flows easily through thin metallic wires.”

“Rapidly oscillating electricity produces radio waves.”

Our world works because we know a lot about it

“Without electricity, trains, planes, phones, elevators, A/Cs are impossible!”

That's why the ancient Greeks did not have radios!

Today, we know a lot about how the world works

“Electricity flows easily through thin metallic wires.”

“Rapidly oscillating electricity produces radio waves.”

Our world works because we know a lot about it

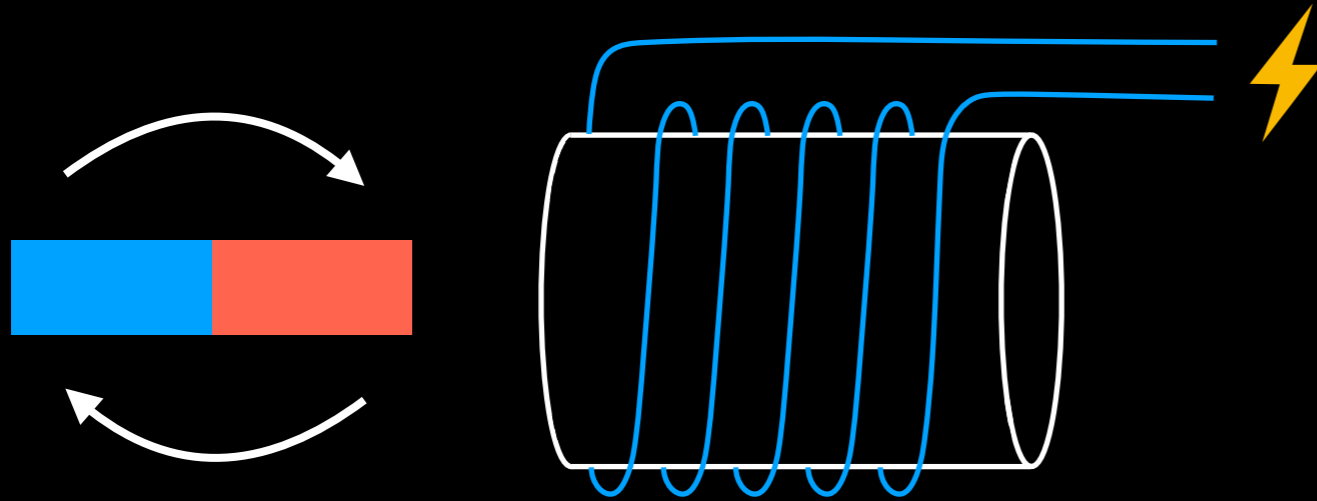
“Without electricity, trains, planes, phones, elevators, A/Cs are impossible!”

That's why the ancient Greeks did not have radios!

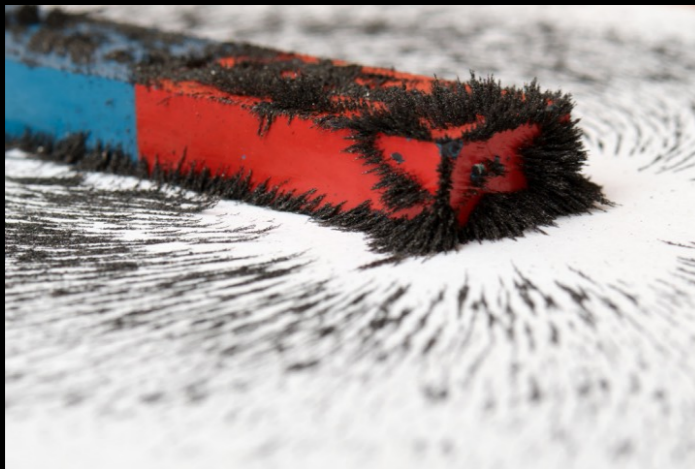
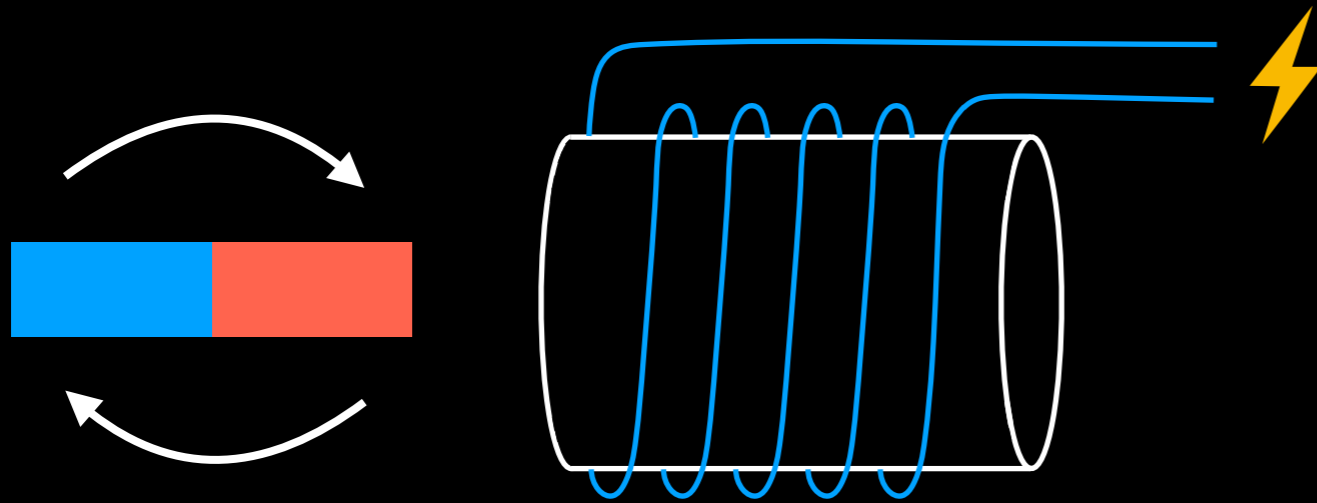
They did not even know radios were possible!

None of this is obvious!

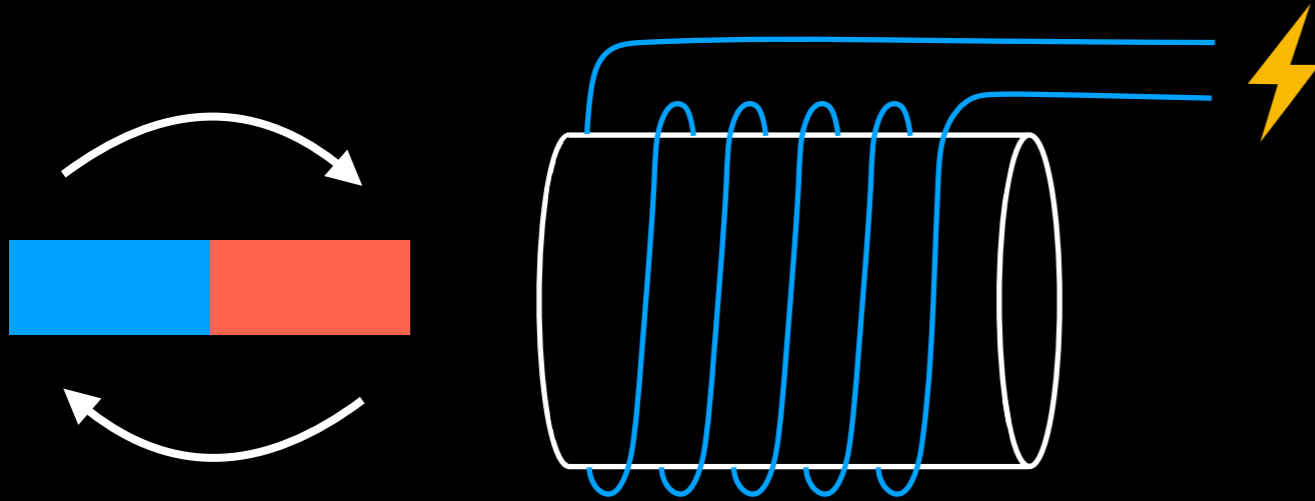
None of this is obvious!



None of this is obvious!

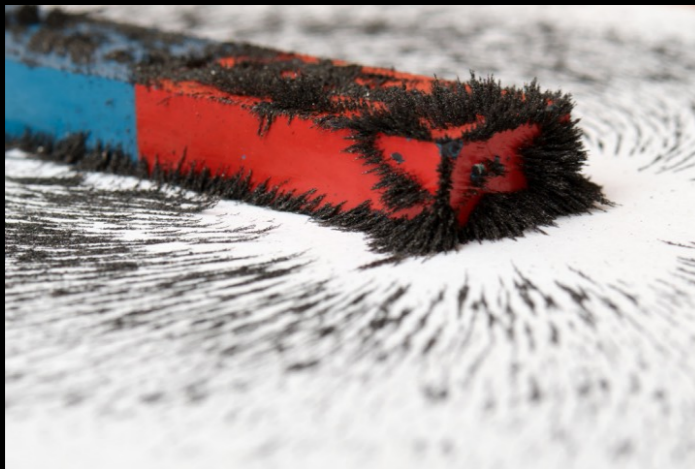
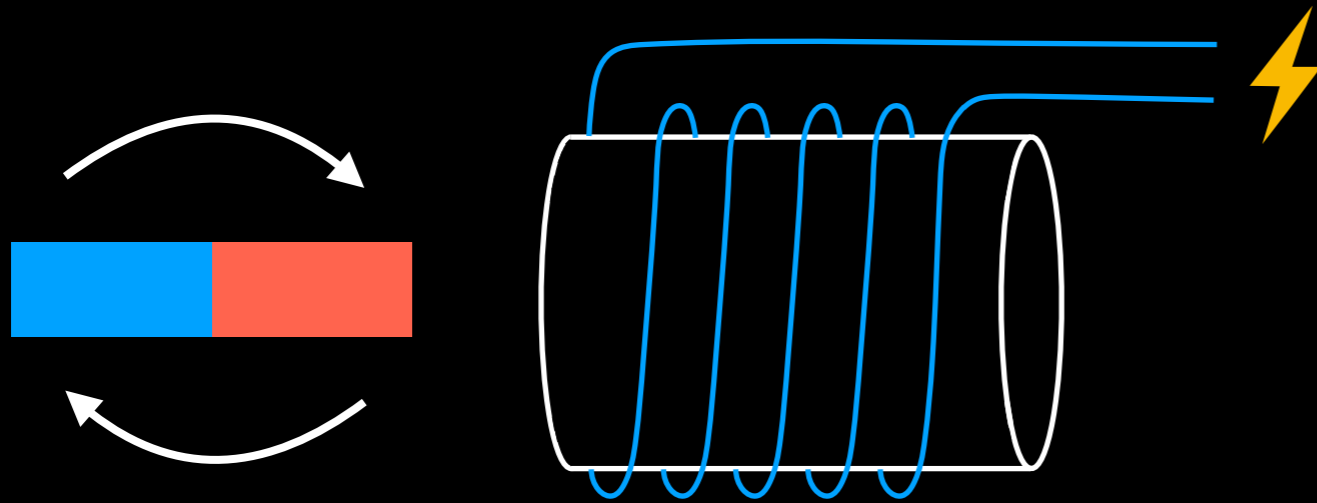


None of this is obvious!



How wild is that?!

None of this is obvious!



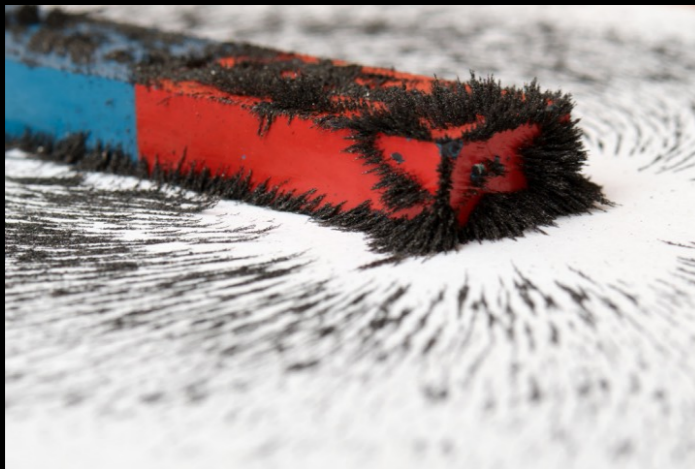
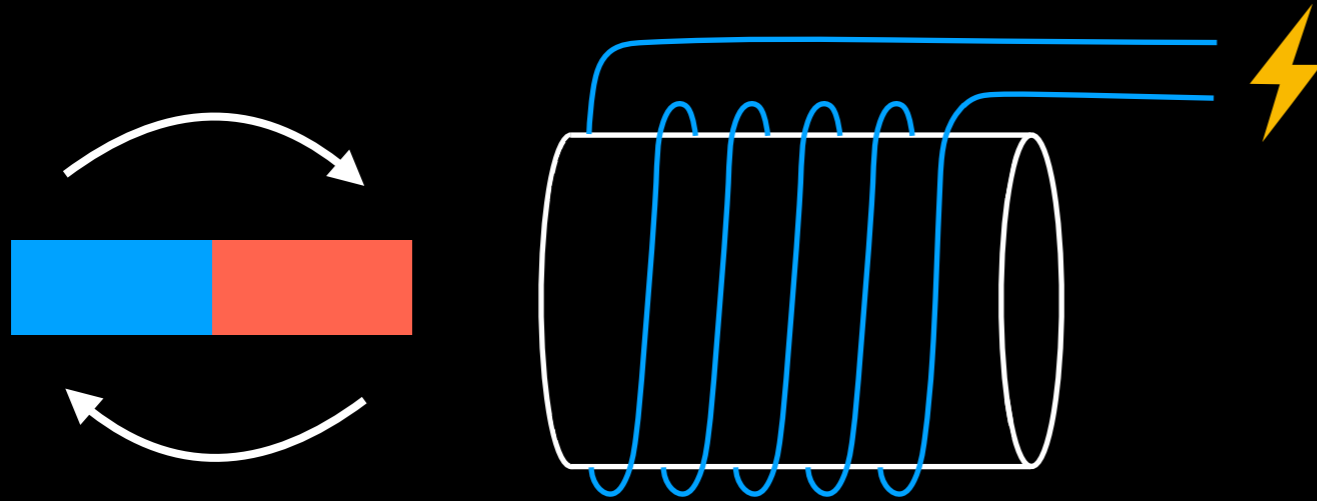
How wild is that?!

Fridge magnet



Hair dryer

None of this is obvious!

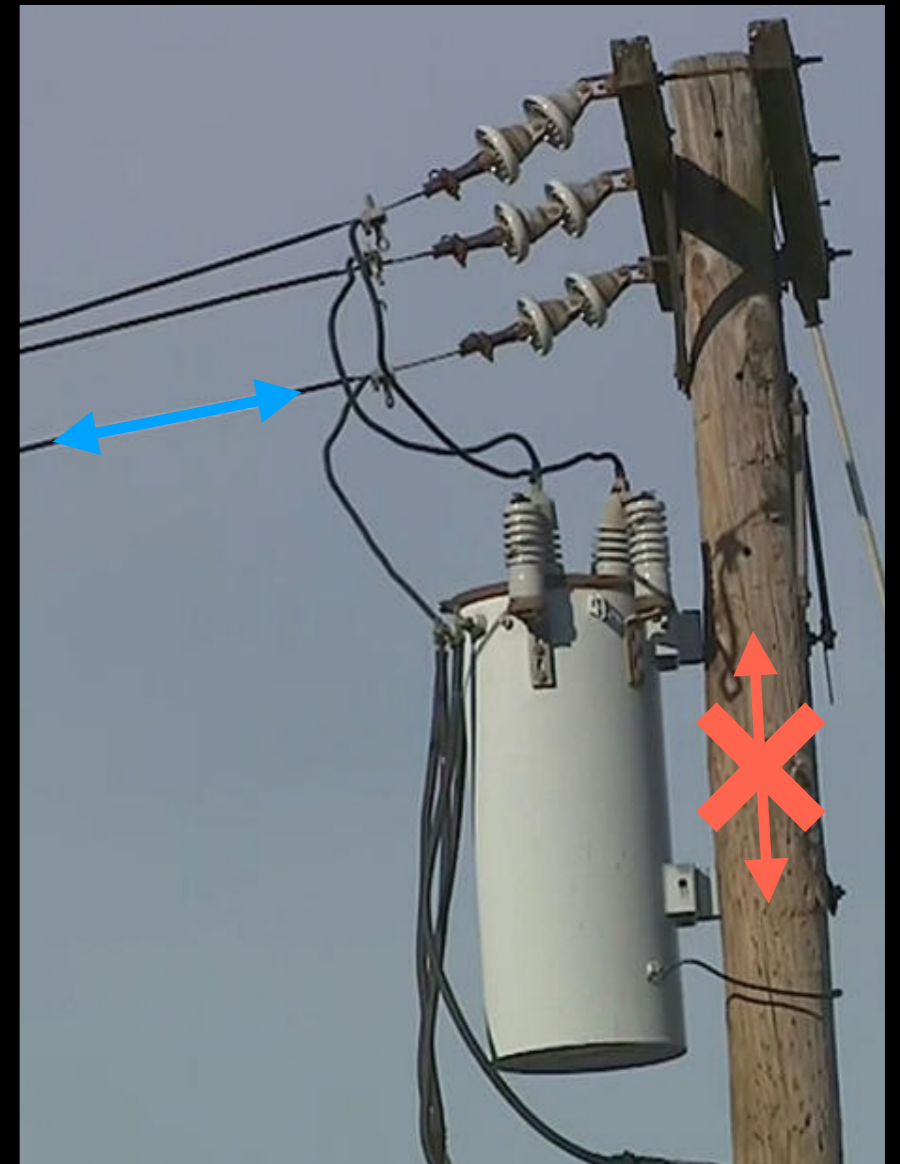


How wild is that?!

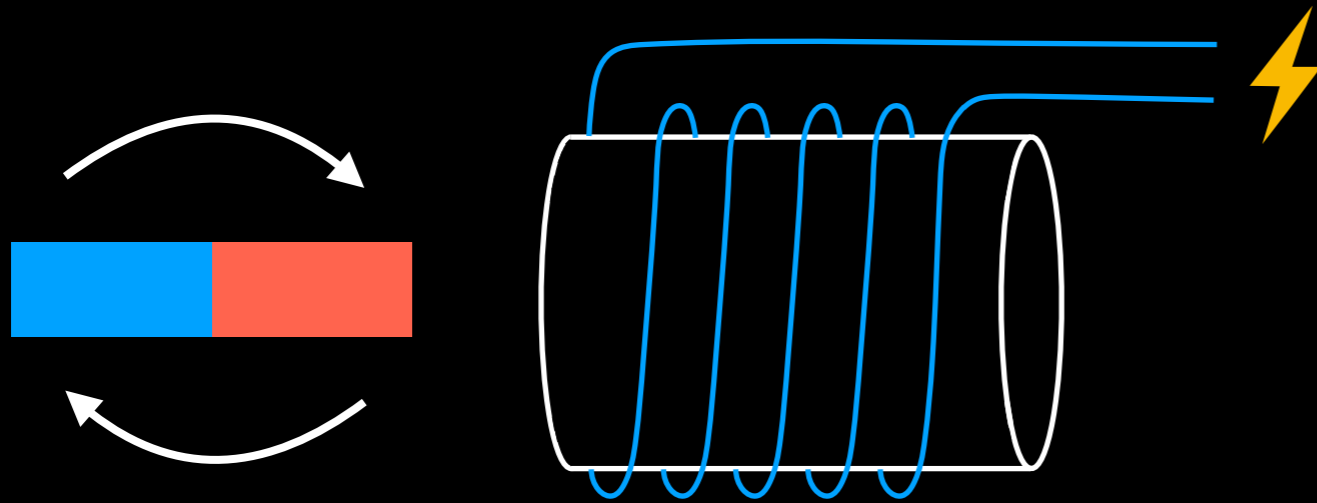
Fridge magnet



Hair dryer



None of this is obvious!



How wild is that?!

Fridge magnet

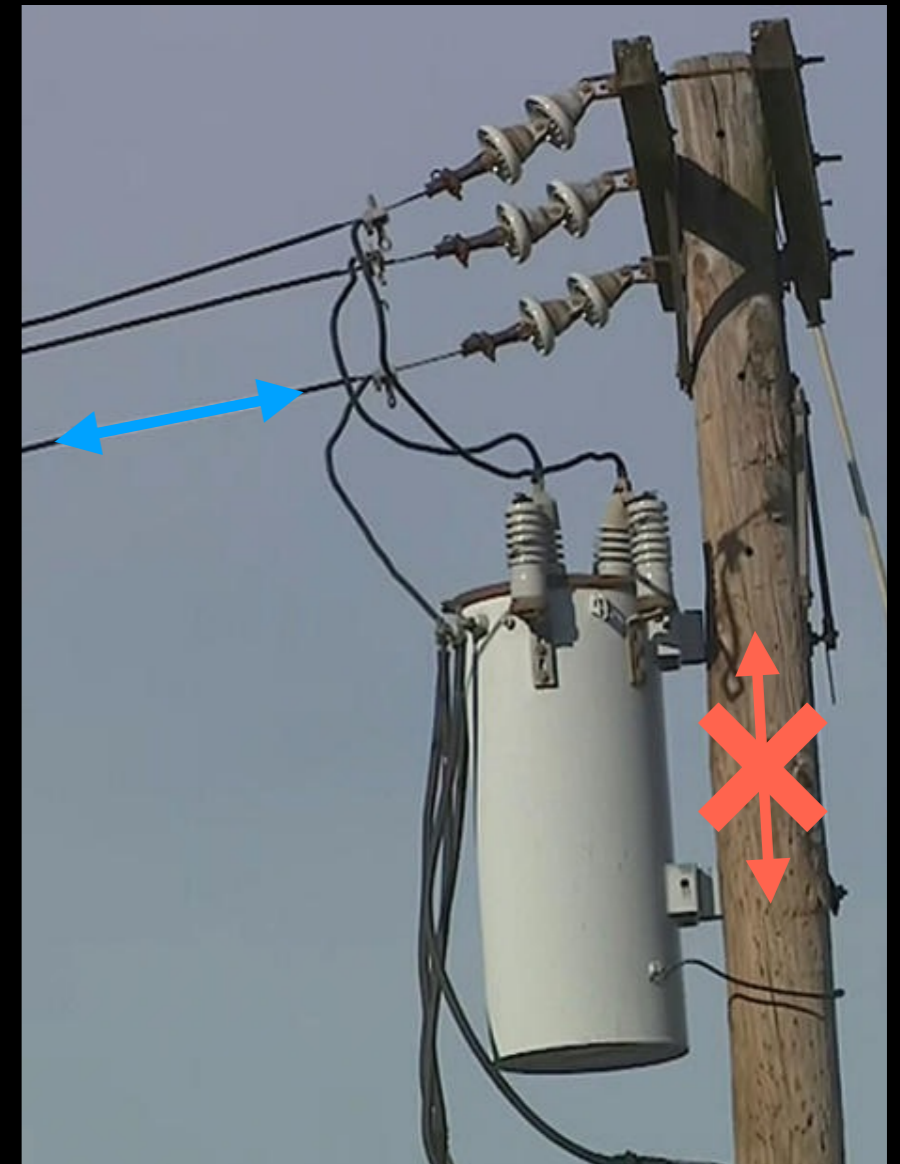


Hair dryer

Thin metal wires

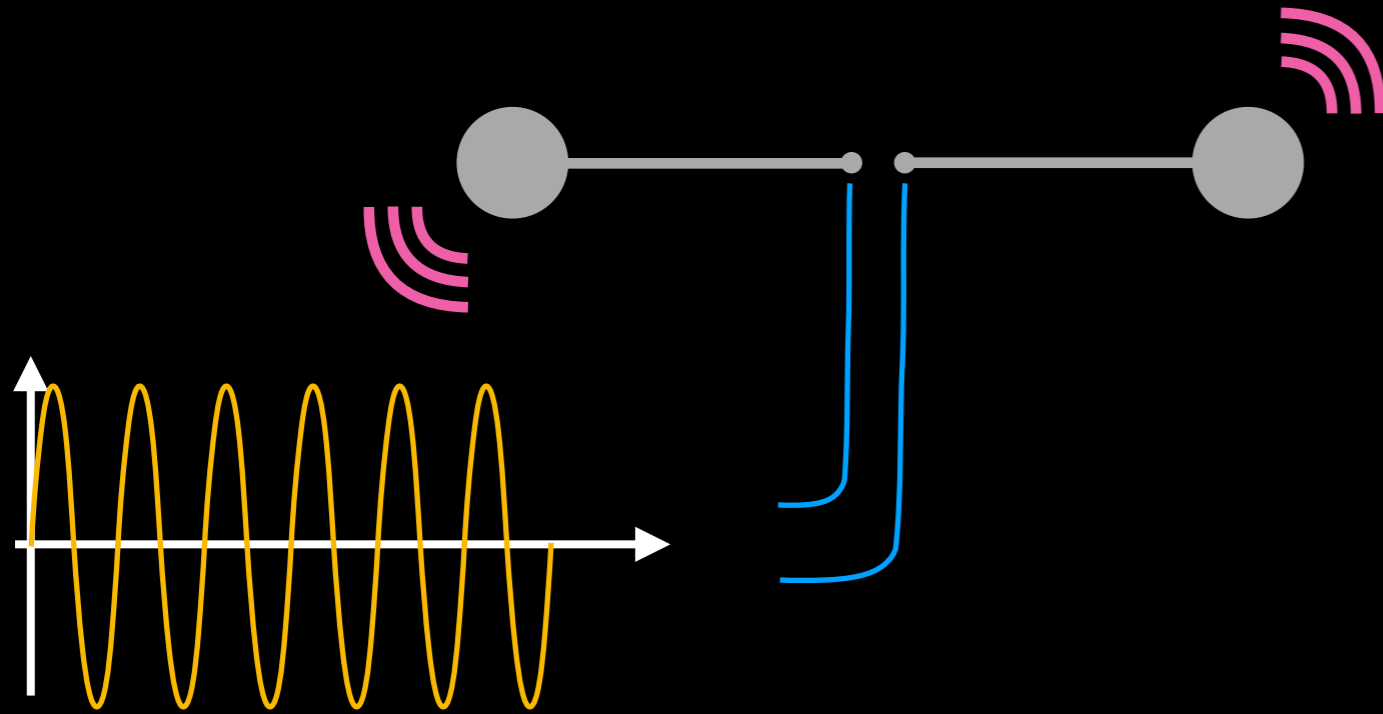


Thick wooden pole

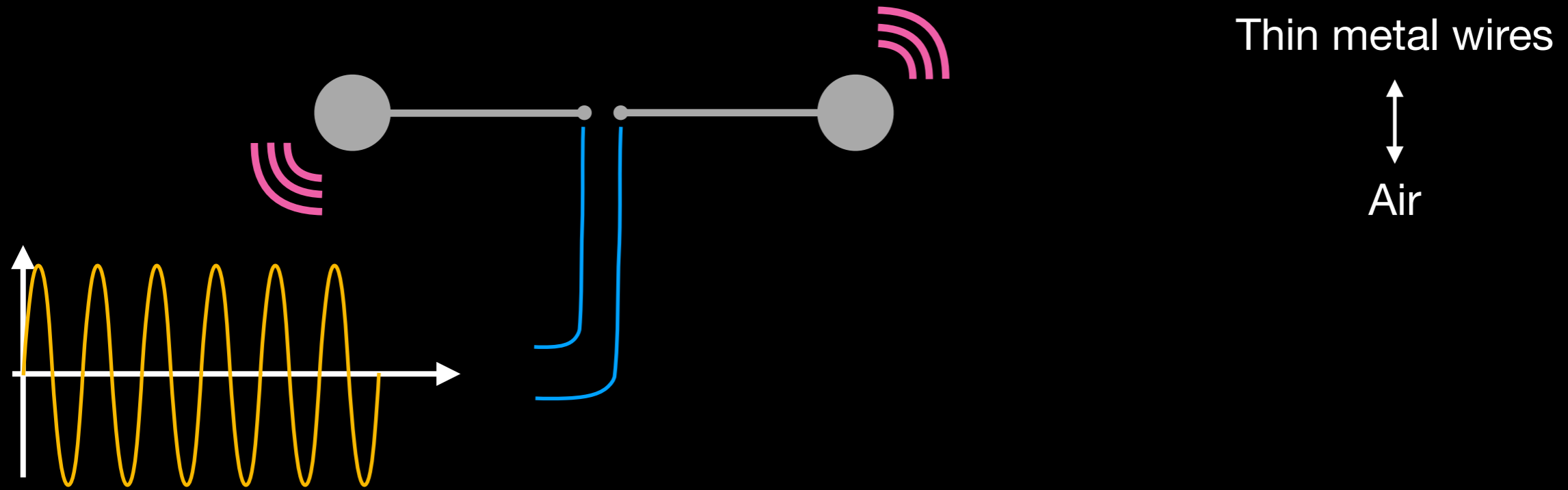


None of this is obvious!

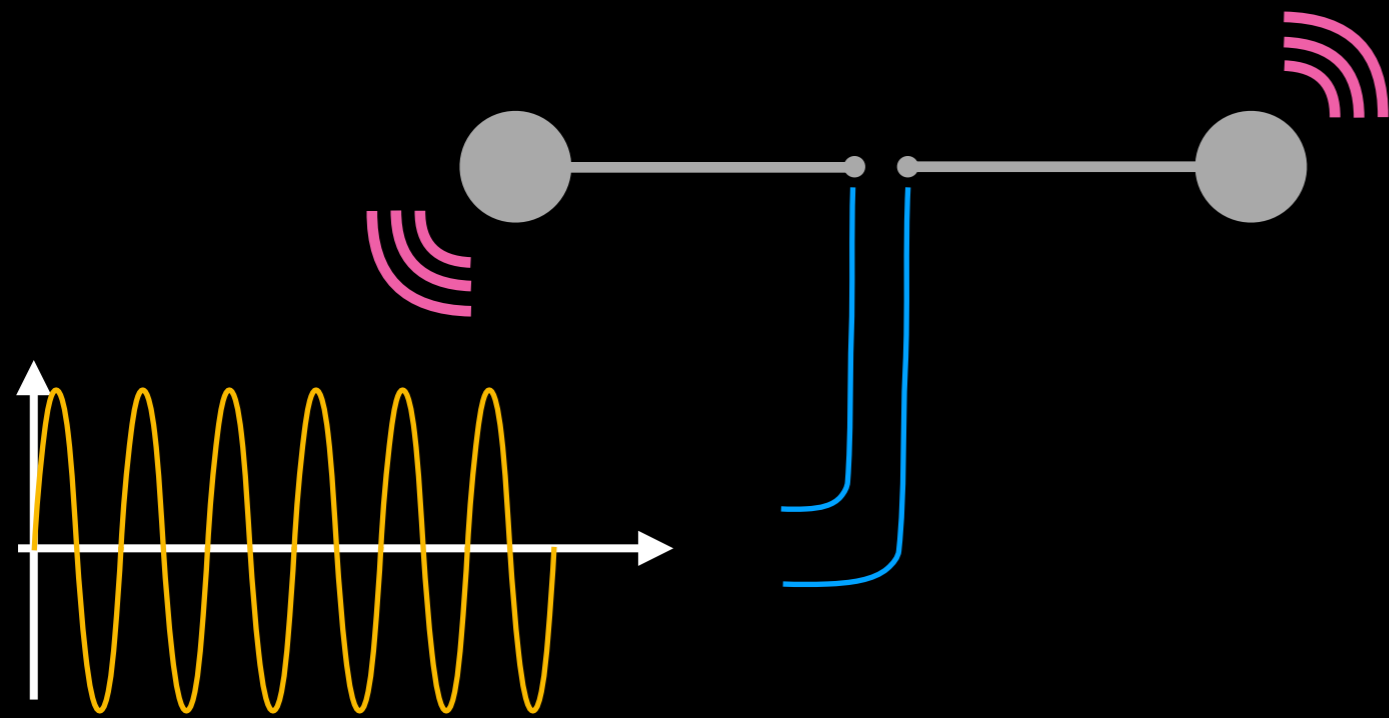
None of this is obvious!



None of this is obvious!

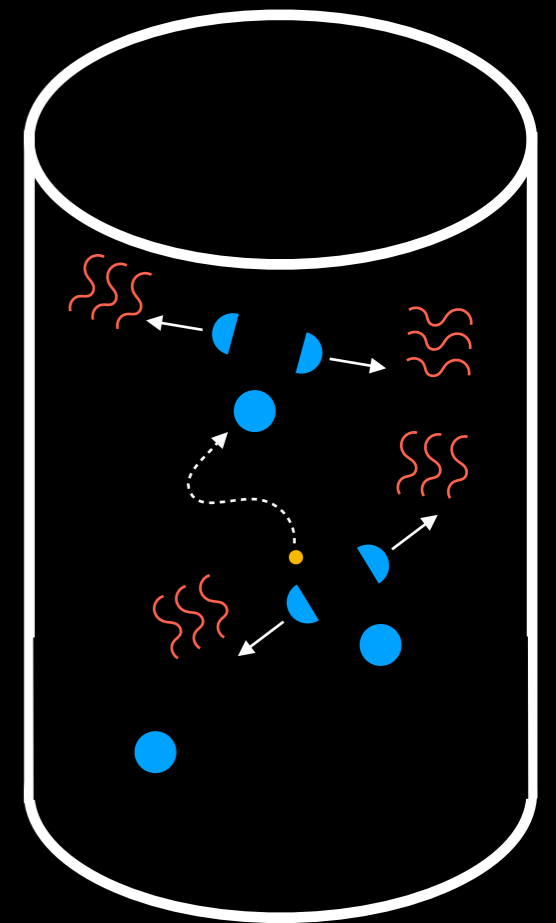
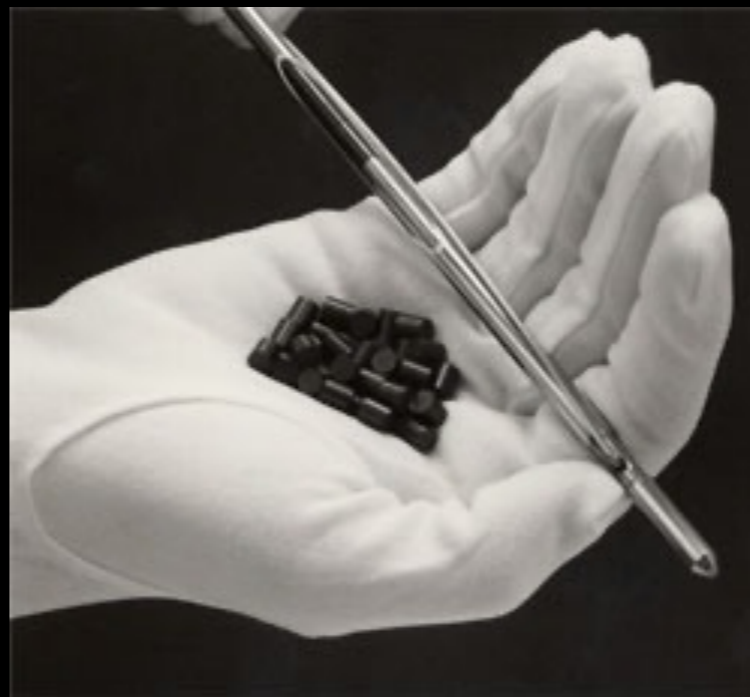


None of this is obvious!

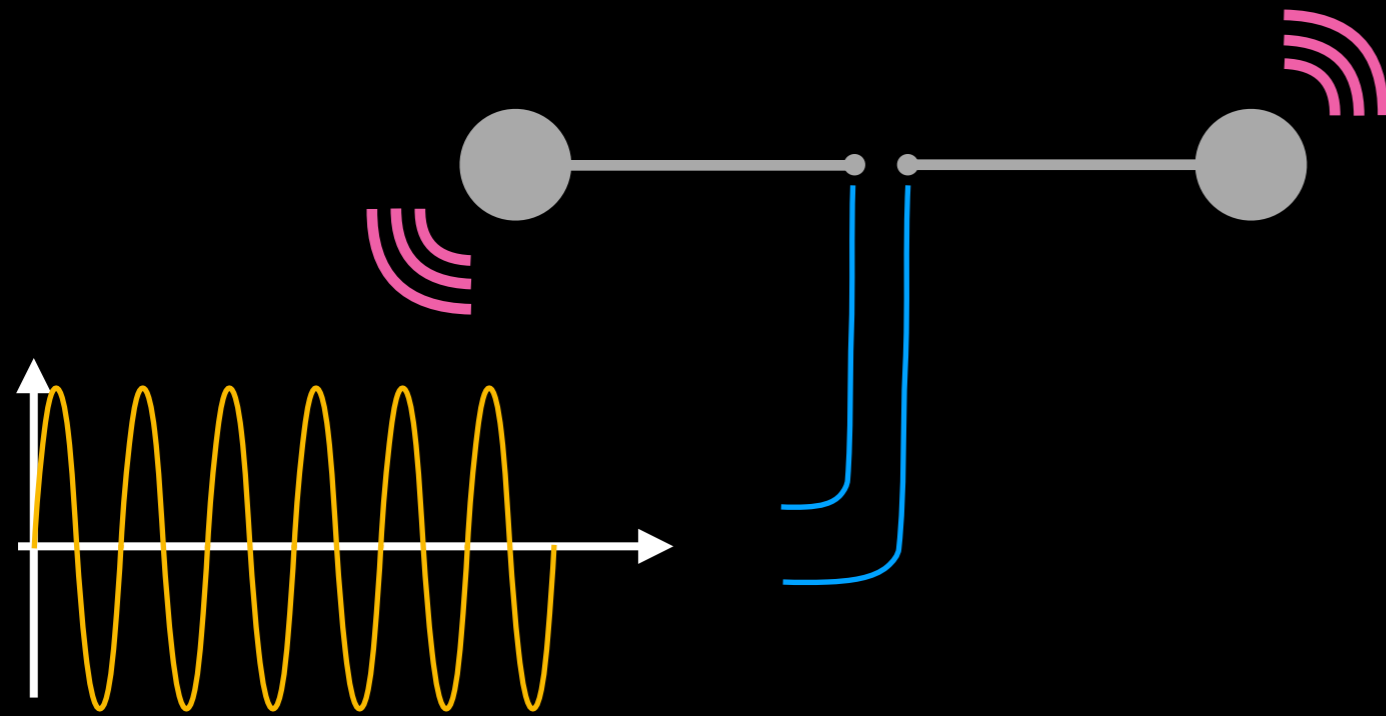


Thin metal wires

↕
Air



None of this is obvious!

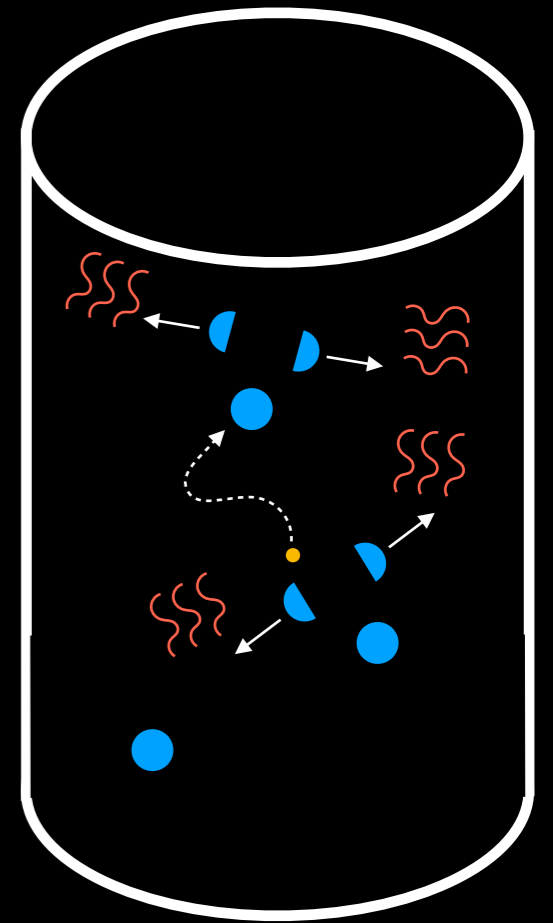
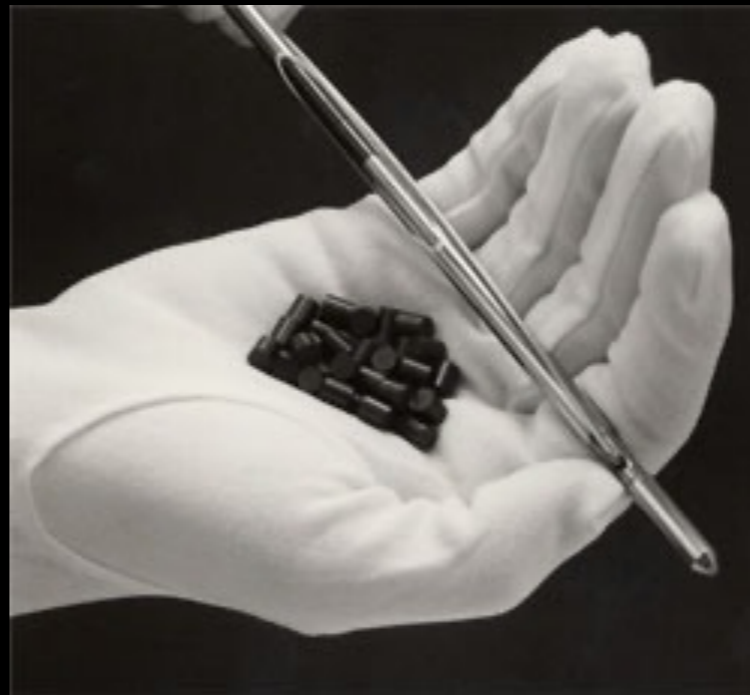


Thin metal wires

↕
Air

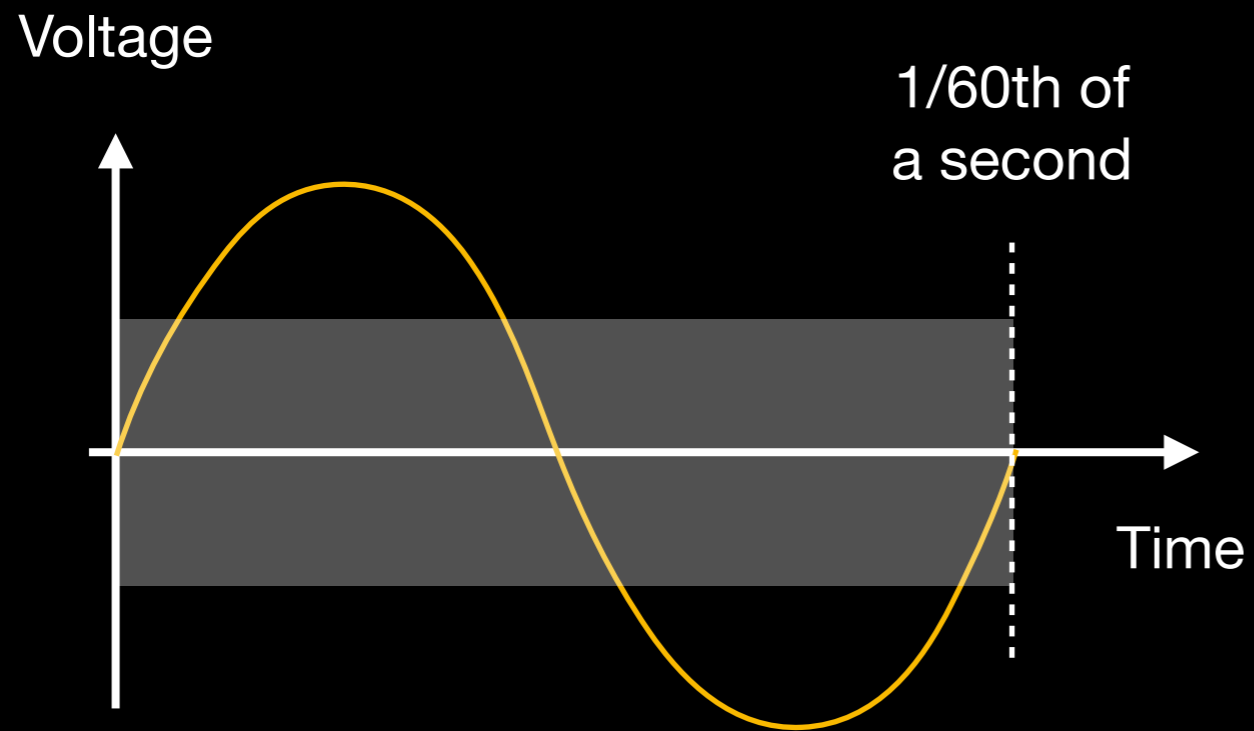
Black "rocks"

↕
Heat



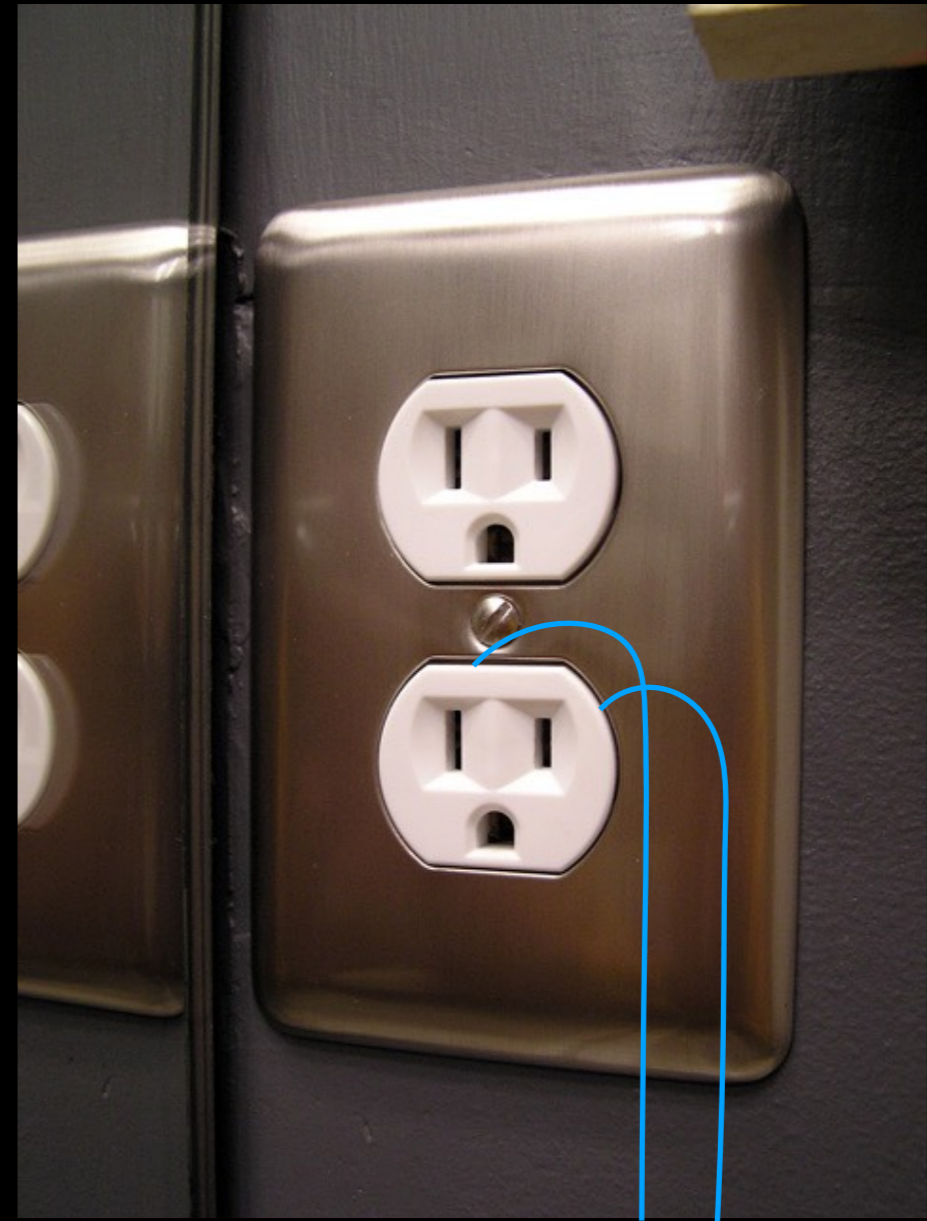
Everything was discovered!

Everything was discovered!



Hertz

“120 V / 60 Hz”



Everything was discovered!

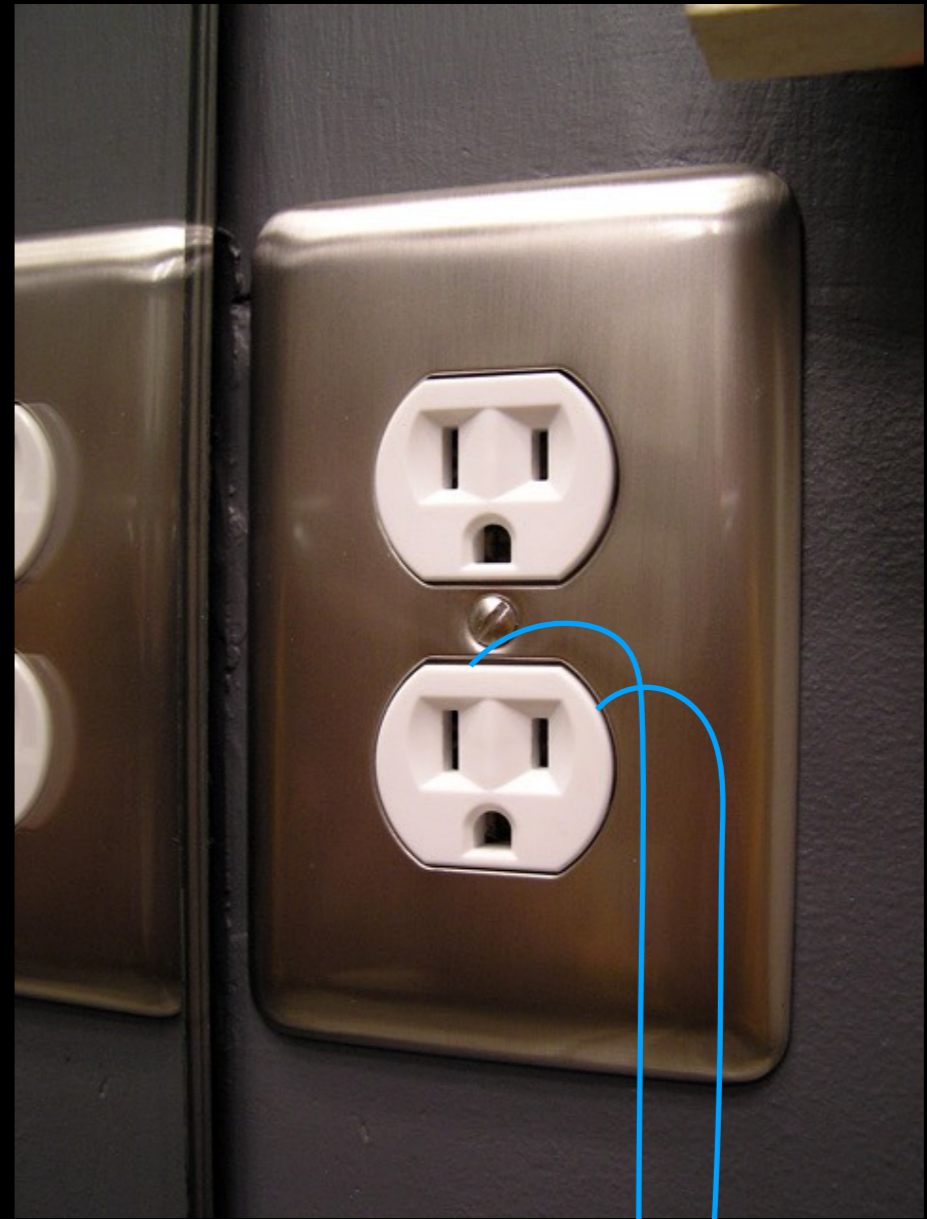


Heinrich Hertz (1880s)

me

“120 V / 60 Hz”

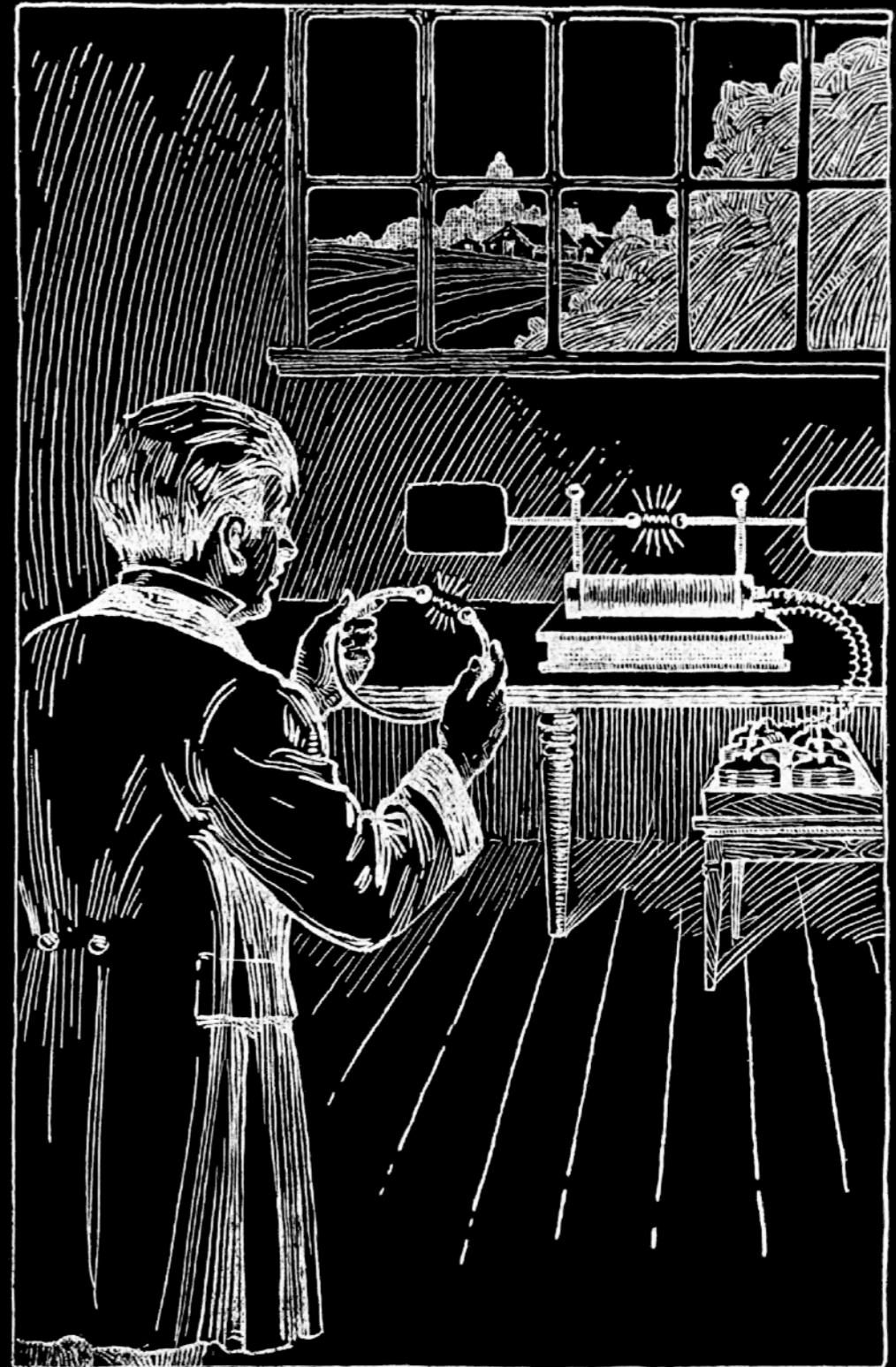
Hertz



Everything was discovered!



Heinrich Hertz (1880s)



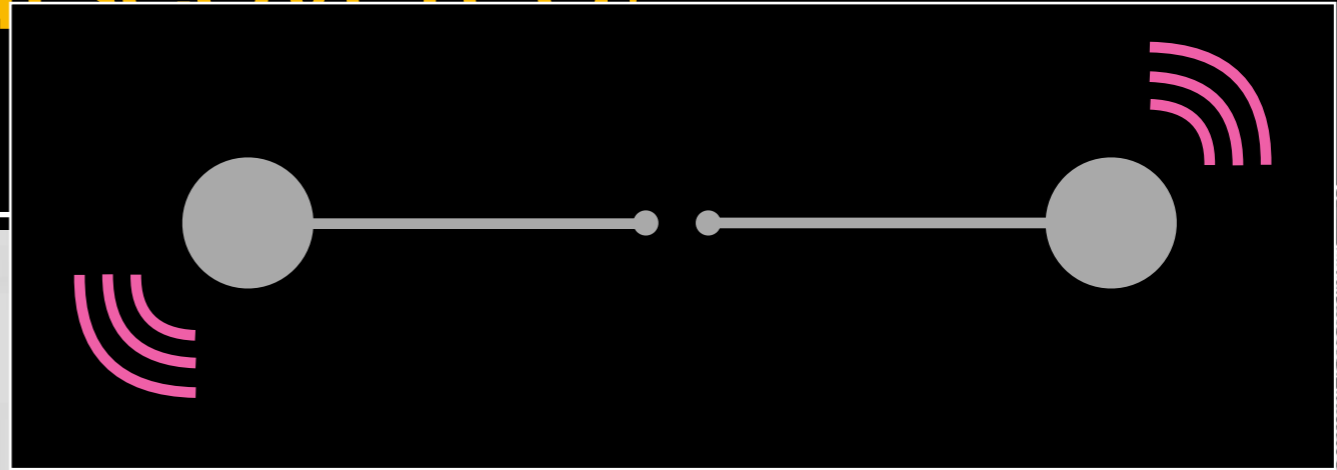
Hertz

me

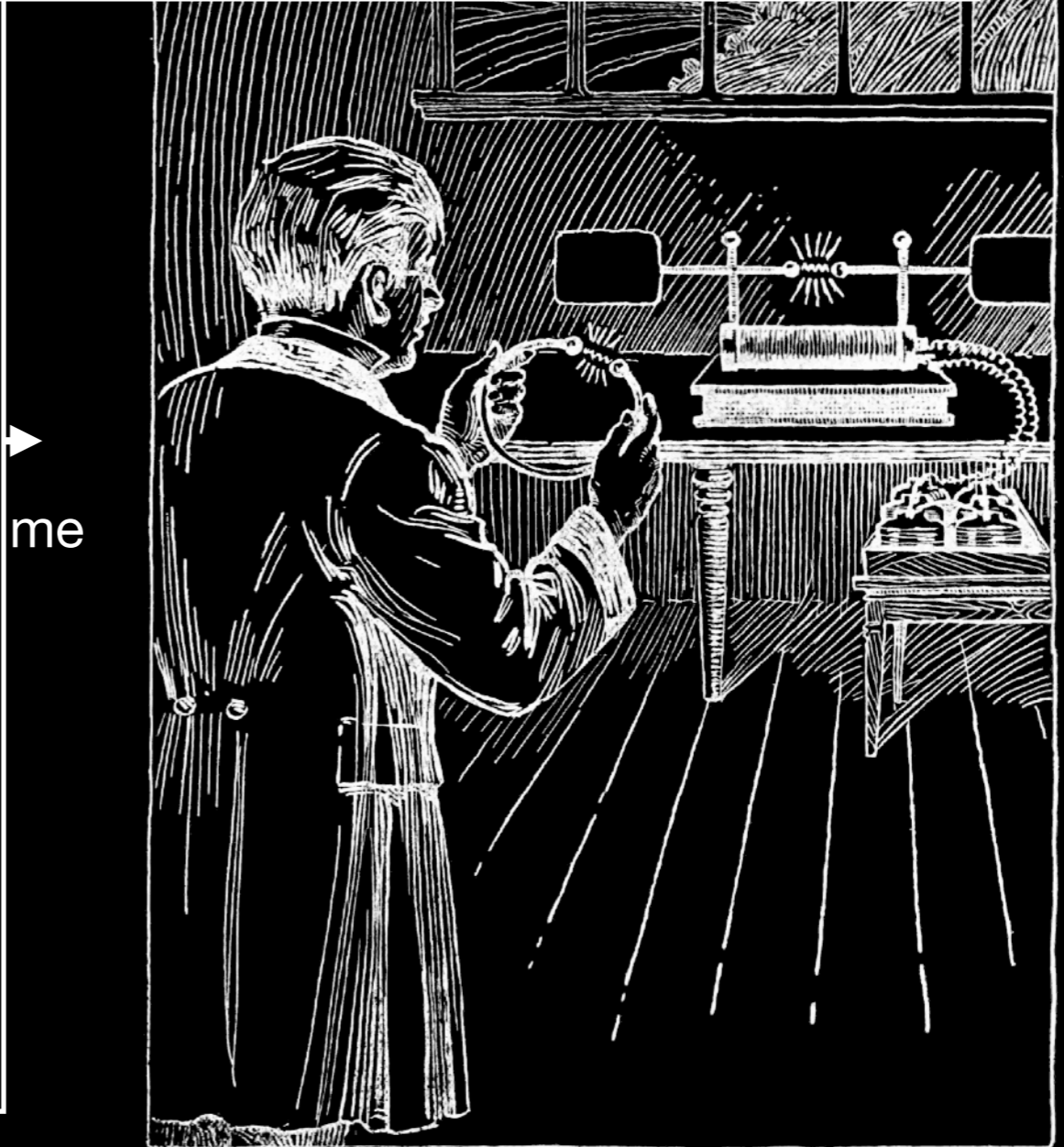
Everything was discovered!



Heinrich Hertz (1880s)

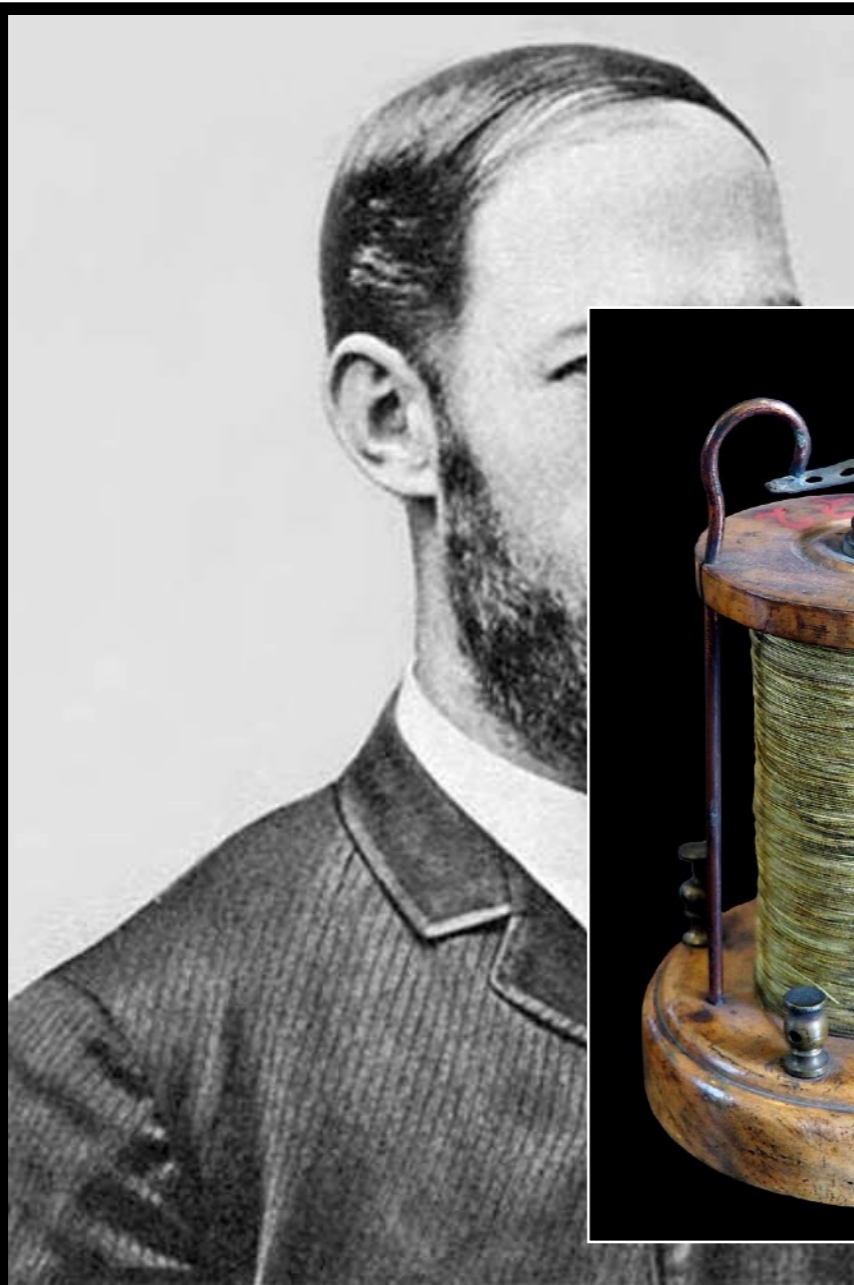


Hertz

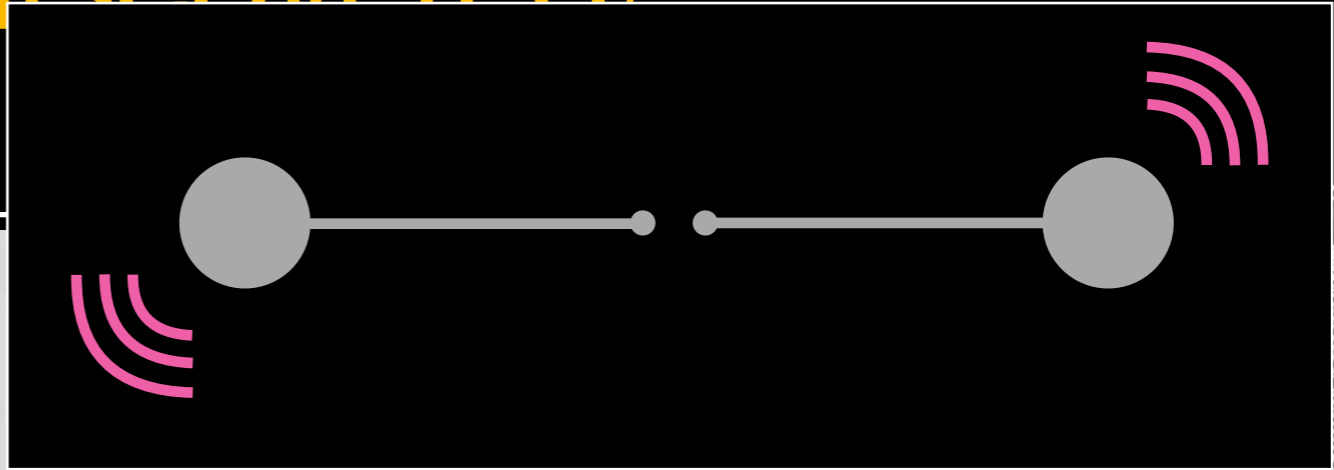


me

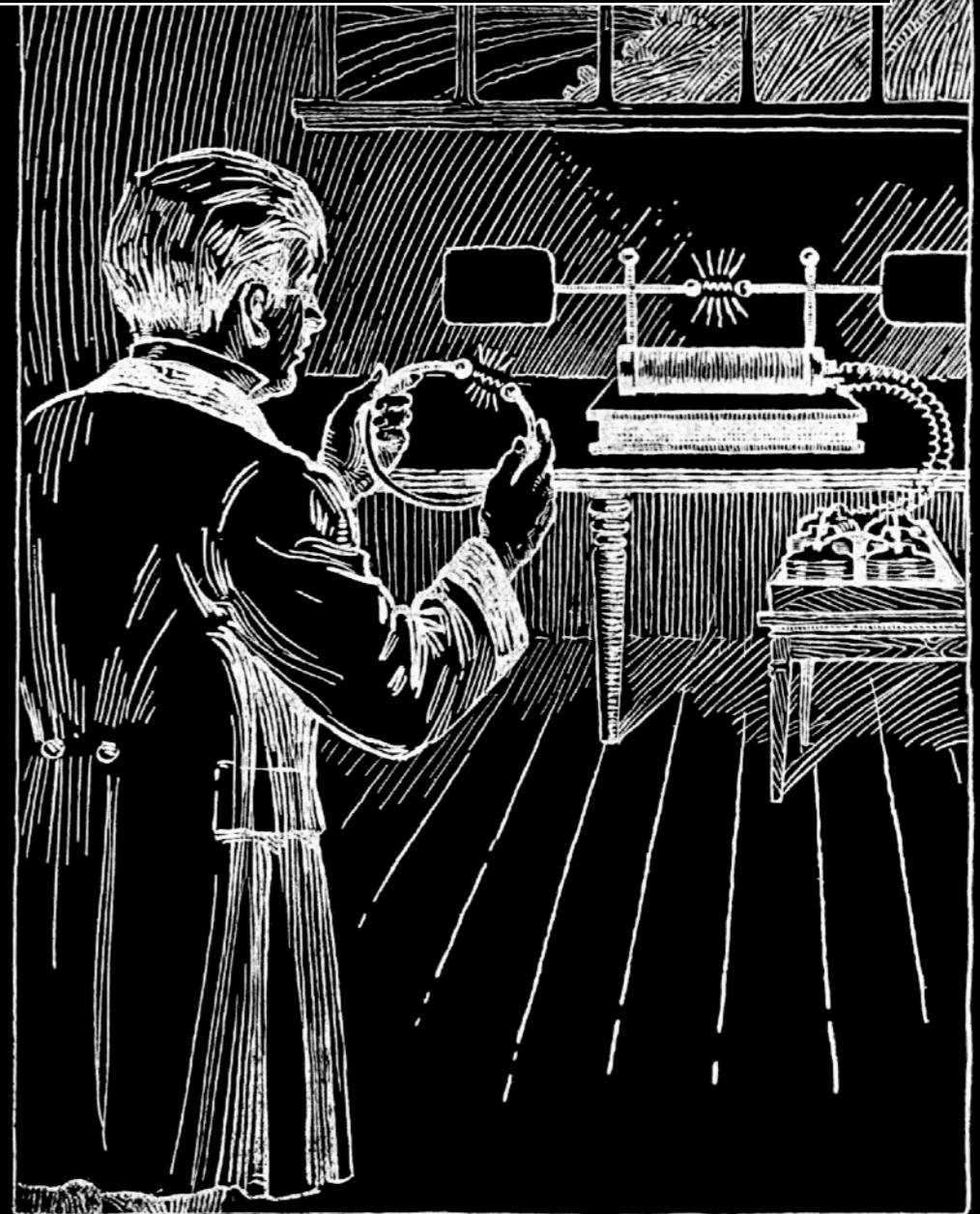
Everything was discovered!



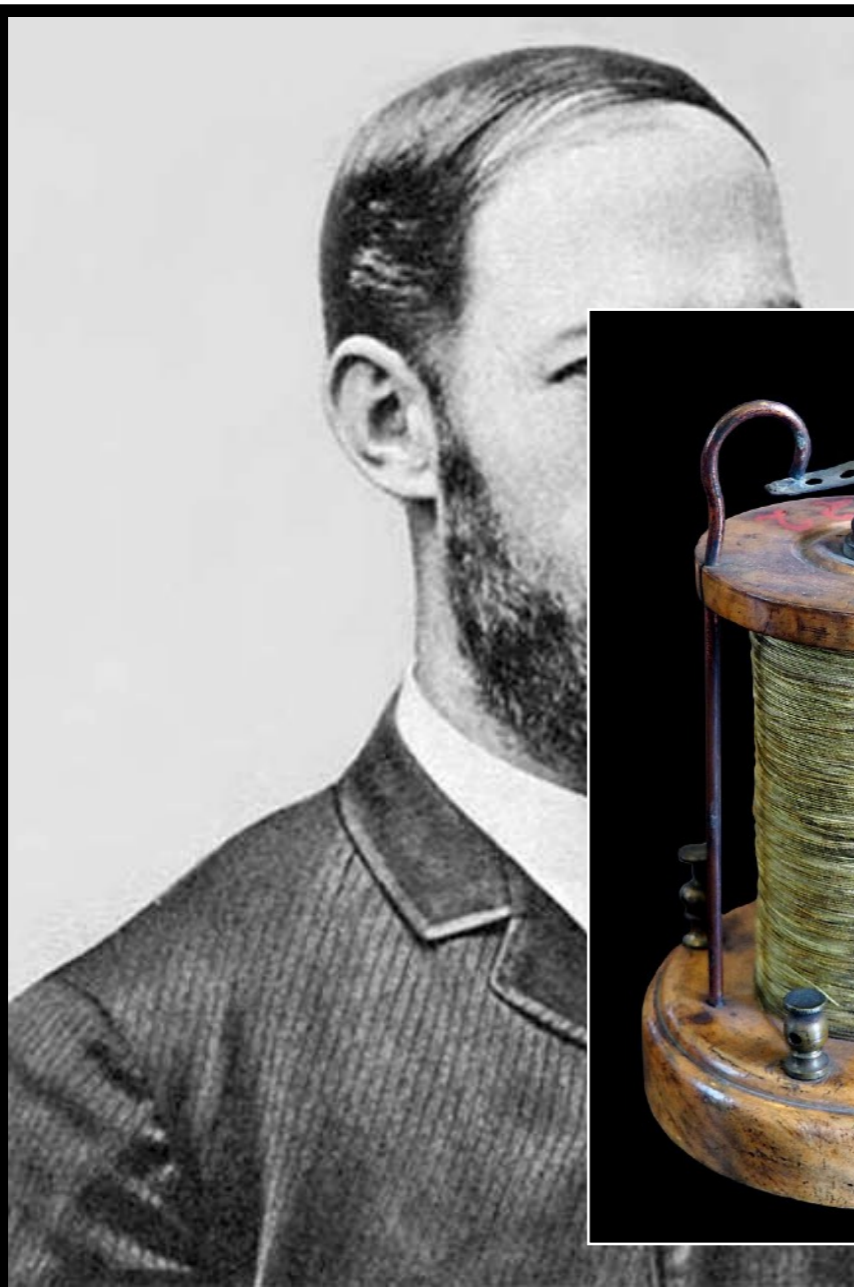
Heinrich Hertz (1880s)



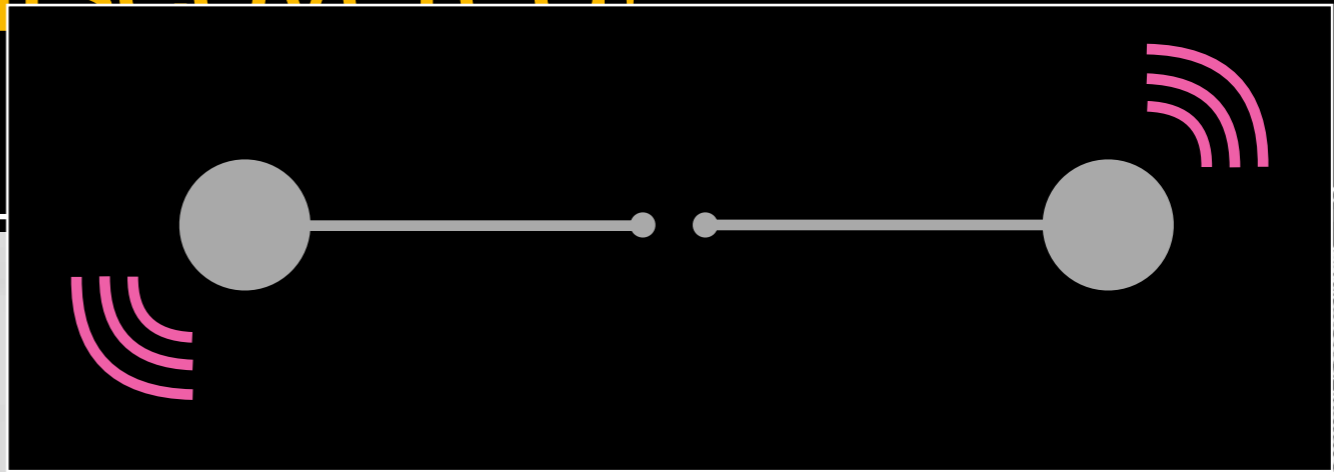
Hertz



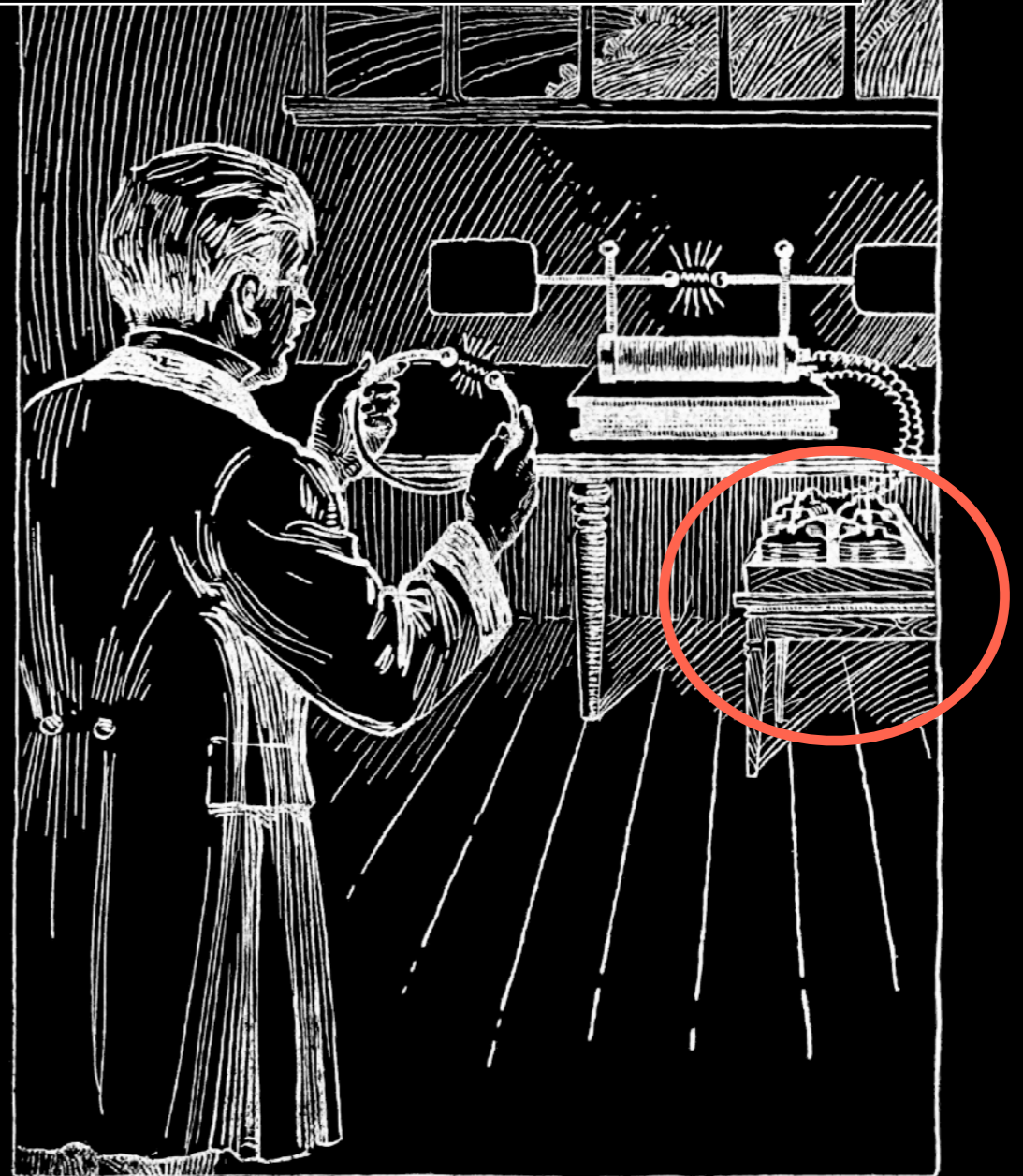
Everything was discovered!



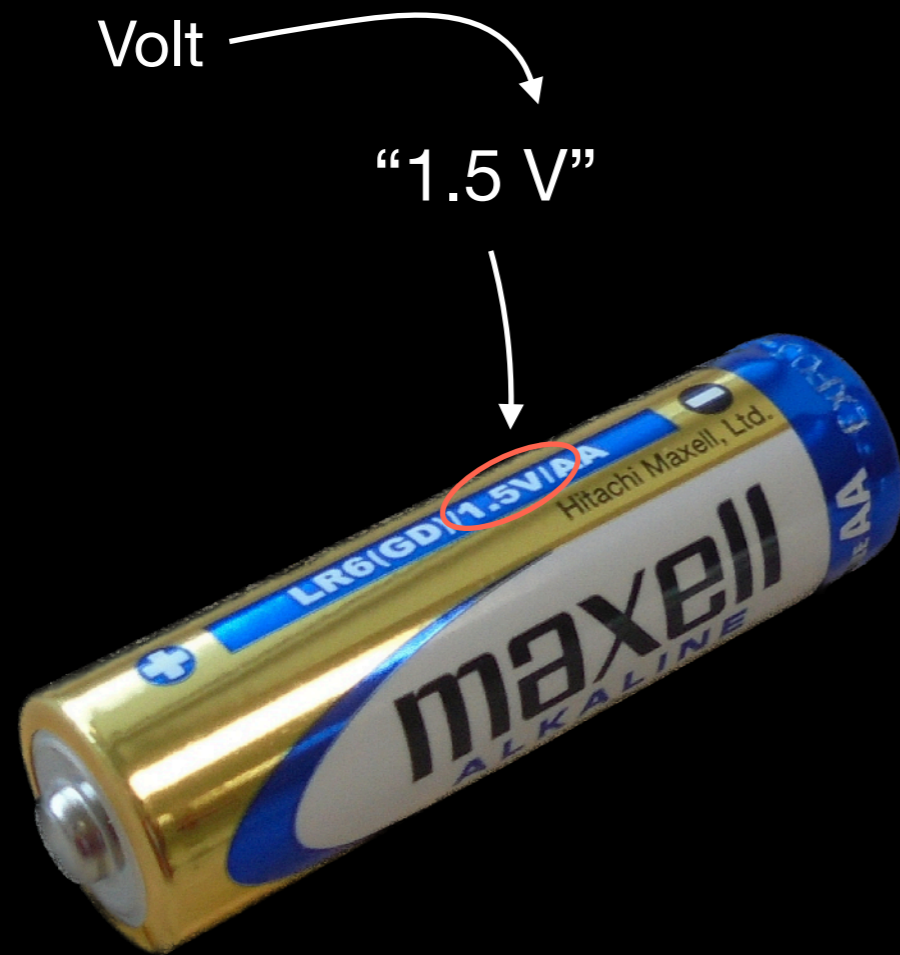
Heinrich Hertz (1880s)



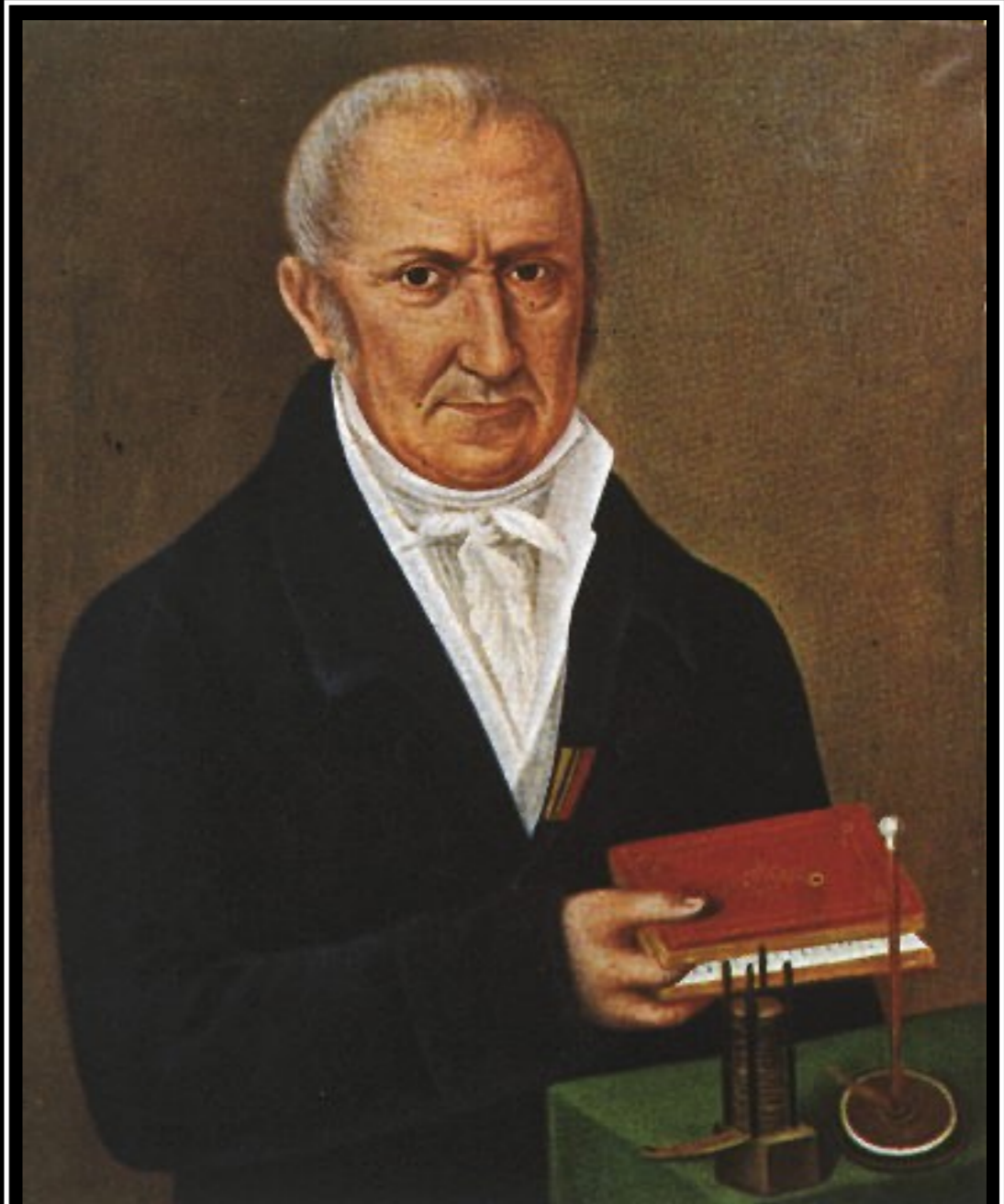
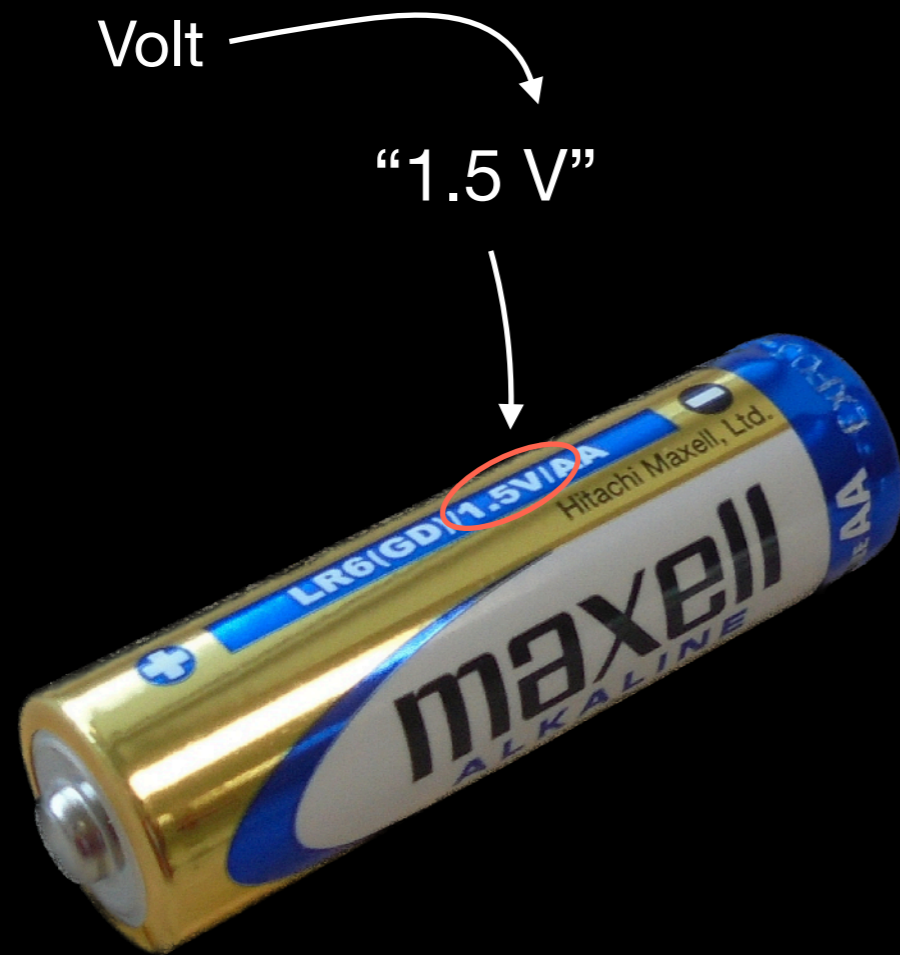
Hertz



Everything was discovered!

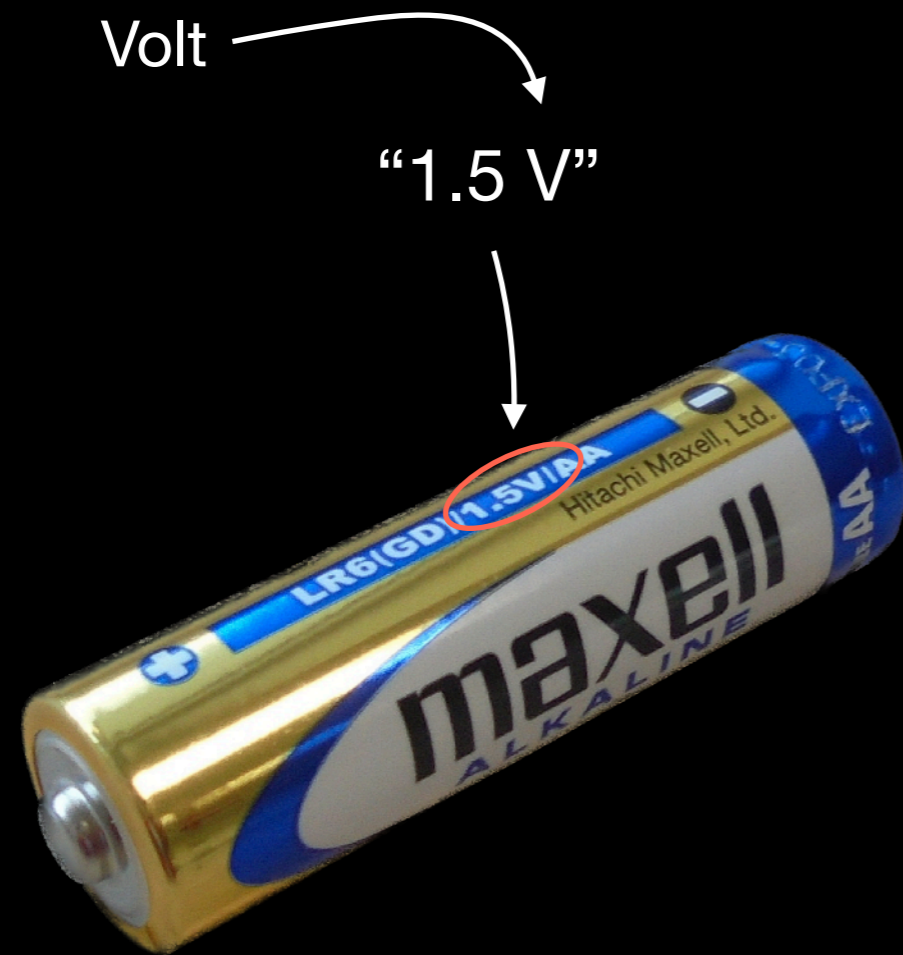


Everything was discovered!



Alessandro Volta (1800)

Everything was discovered!



Alessandro Volta (1800)

Everything was discovered!



Alessandro Volta (1800)

Everything was discovered!



Luigi Galvani (1790s)



Alessandro Volta (1800)

Discoveries didn't come out of nowhere



Discoveries didn't come out of nowhere



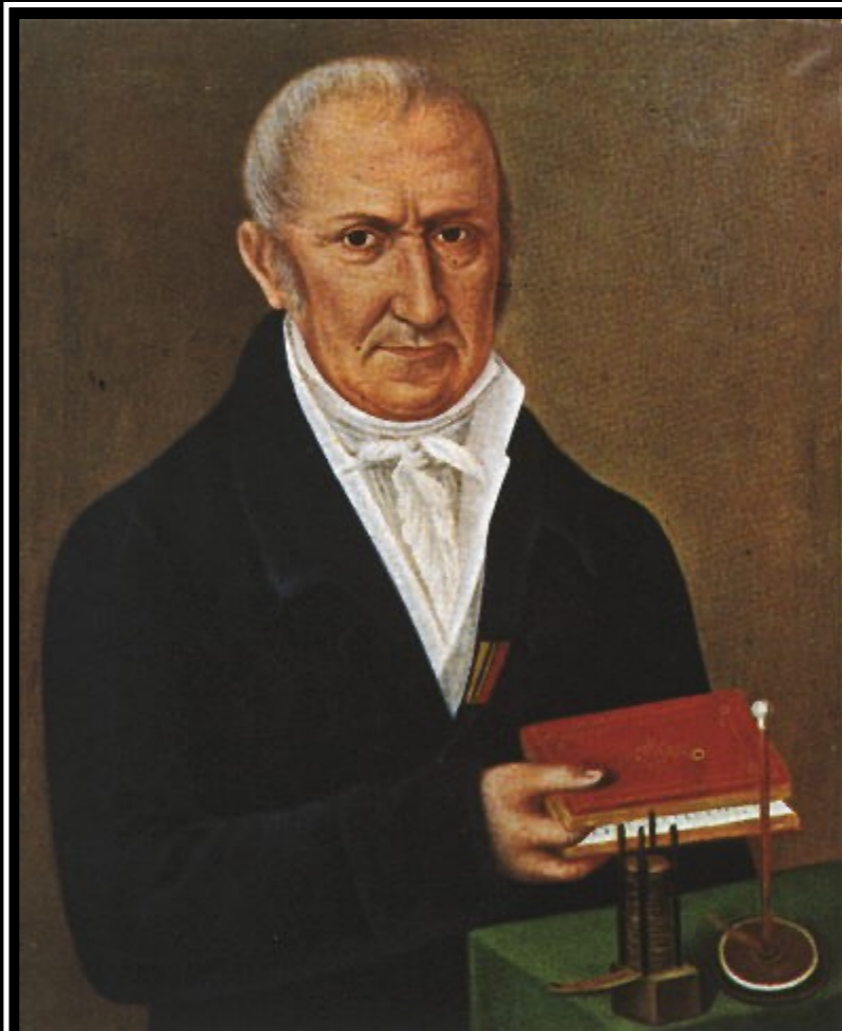
Heinrich Hertz (1880s)



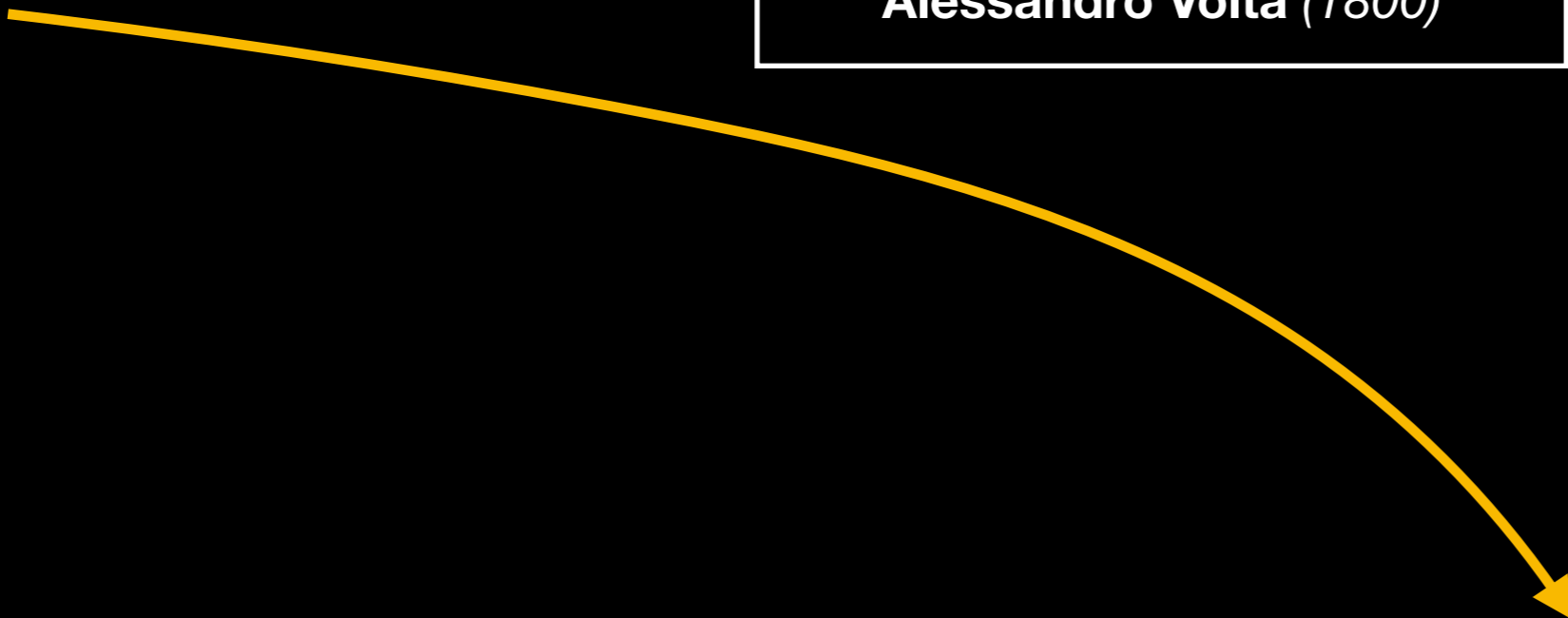
Discoveries didn't come out of nowhere



Heinrich Hertz (1880s)



Alessandro Volta (1800)



Discoveries didn't come out of nowhere



Heinrich Hertz (1880s)



Alessandro Volta (1800)



Luigi Galvani (1790s)

Today: science mixes with technology

Today: science mixes with technology



“Where does electricity come from?”

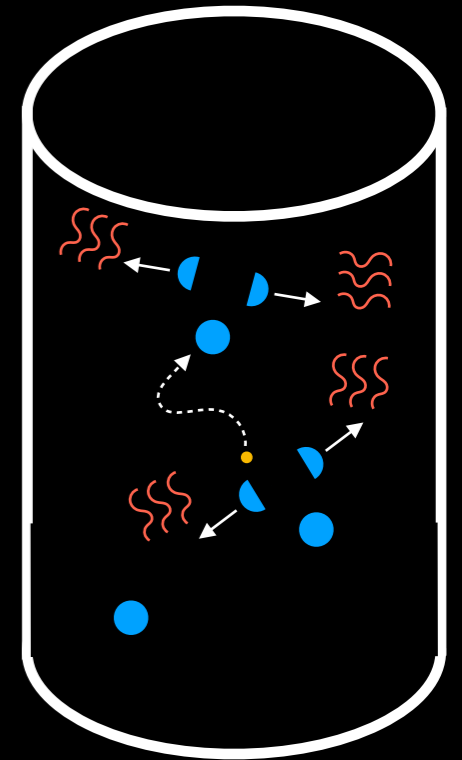
Today: science mixes with technology



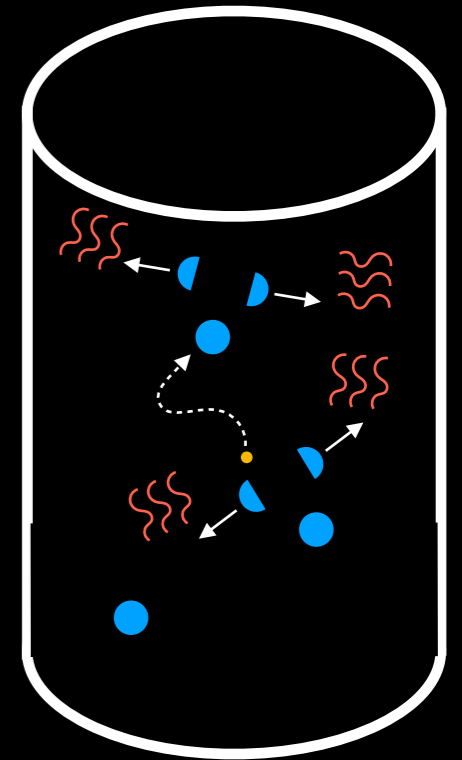
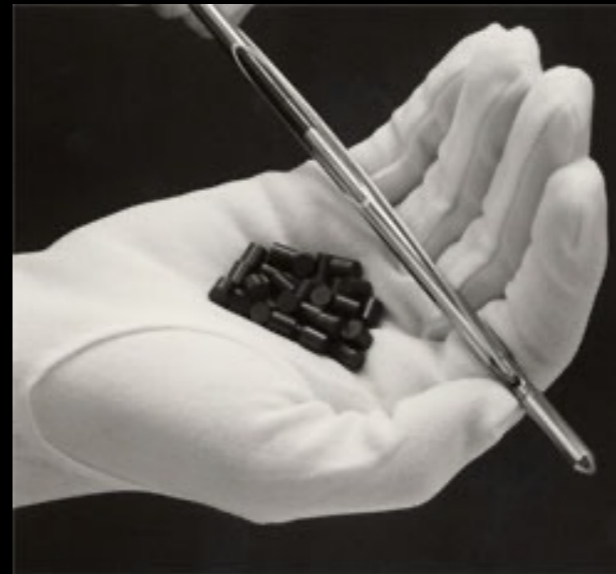
“Where does electricity come from?”



“It is generated by atoms of Uranium the size of a millionth-billionth of a foot.”



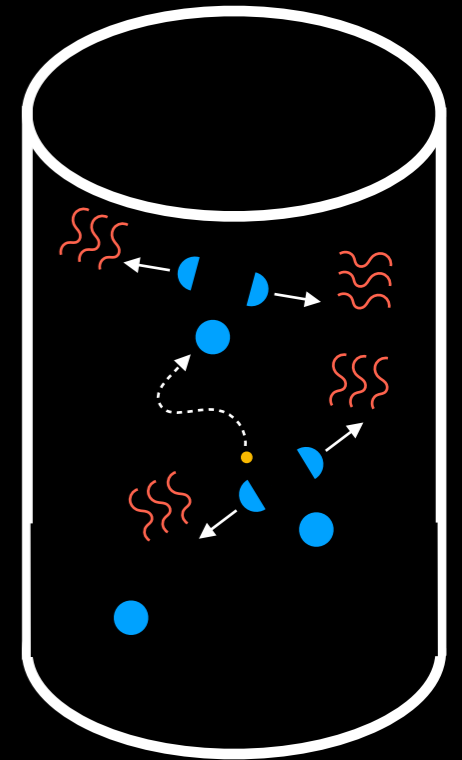
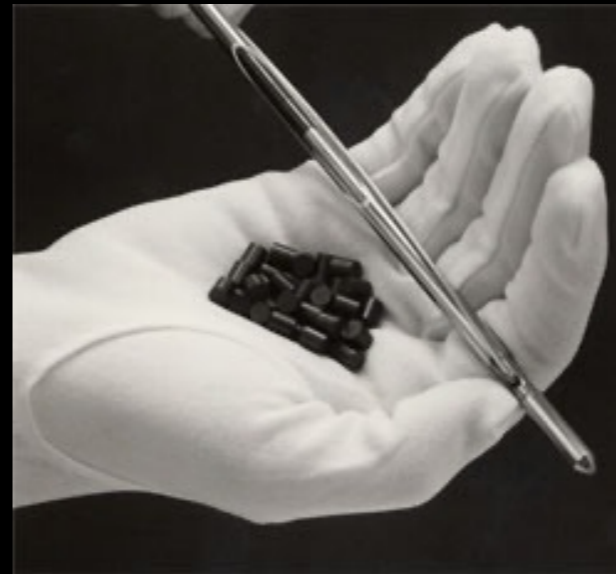
Today: science mixes with technology



“Where does electricity come from?”

“It is generated by atoms of Uranium the size of a millionth-billionth of a foot.”

Today: science mixes with technology

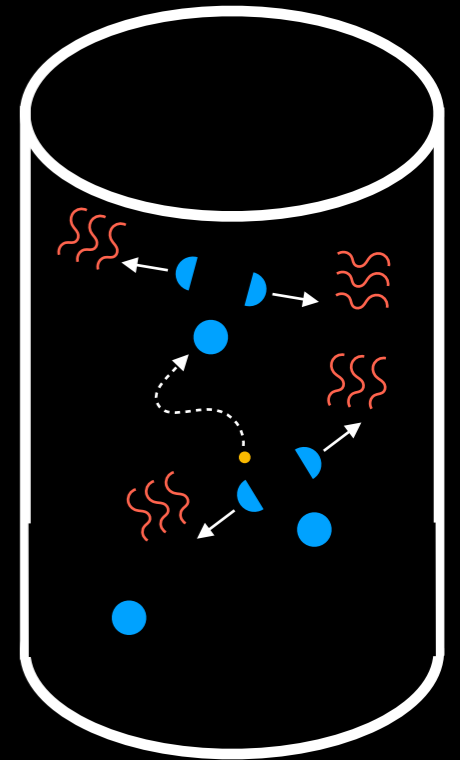
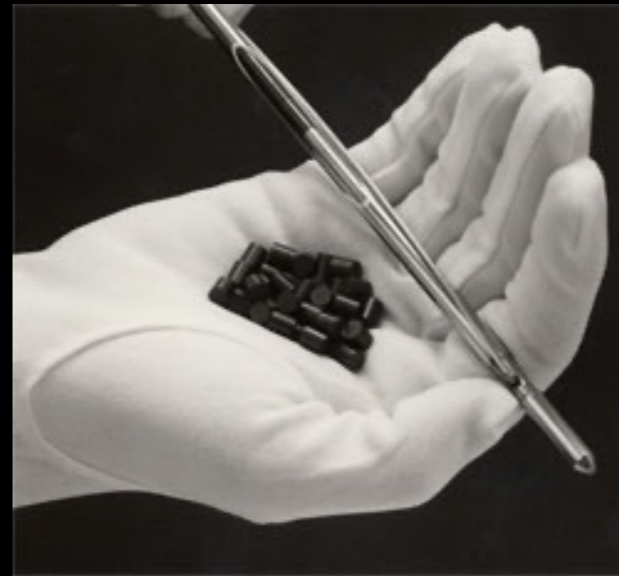


“Where does electricity come from?”

??

“It is generated by atoms of Uranium the size of a millionth-billionth of a foot.”

Today: science mixes with technology



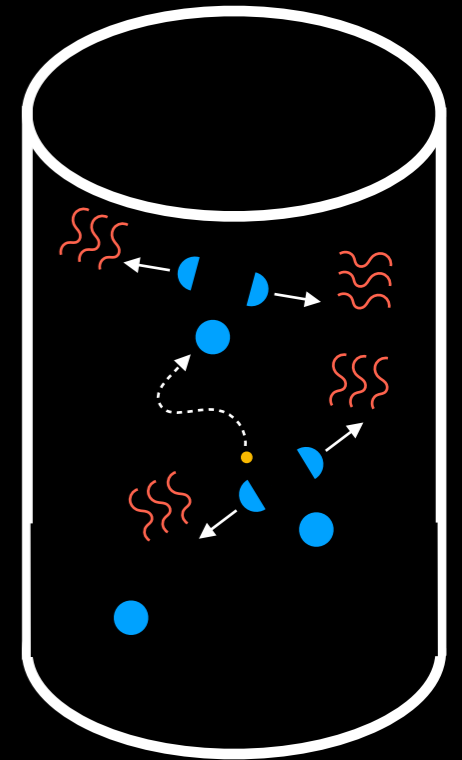
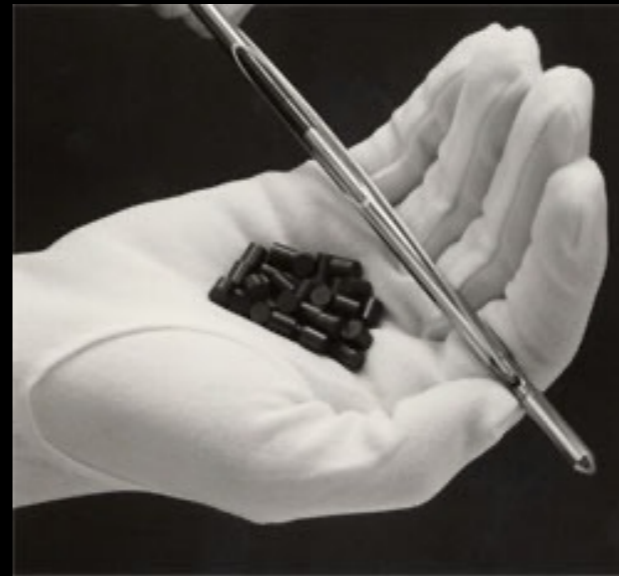
“Where does electricity come from?”

??

“It is generated by atoms of Uranium the size of a millionth-billionth of a foot.”

??

Today: science mixes with technology



“Where does electricity come from?”

??

“It is generated by atoms of Uranium the size of a millionth-billionth of a foot.”

??

All of this once was cutting-edge science

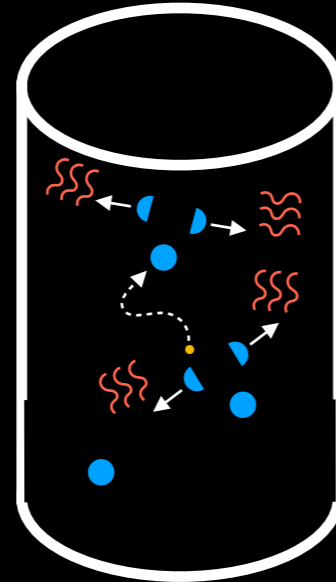
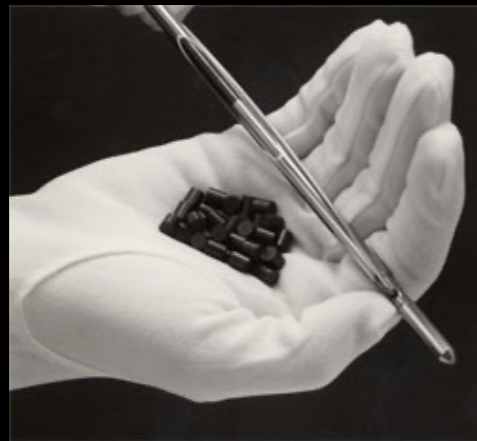
All of this once was cutting-edge science

“How many kinds of electricity are there?”



All of this once was cutting-edge science

“How many kinds of electricity are there?”

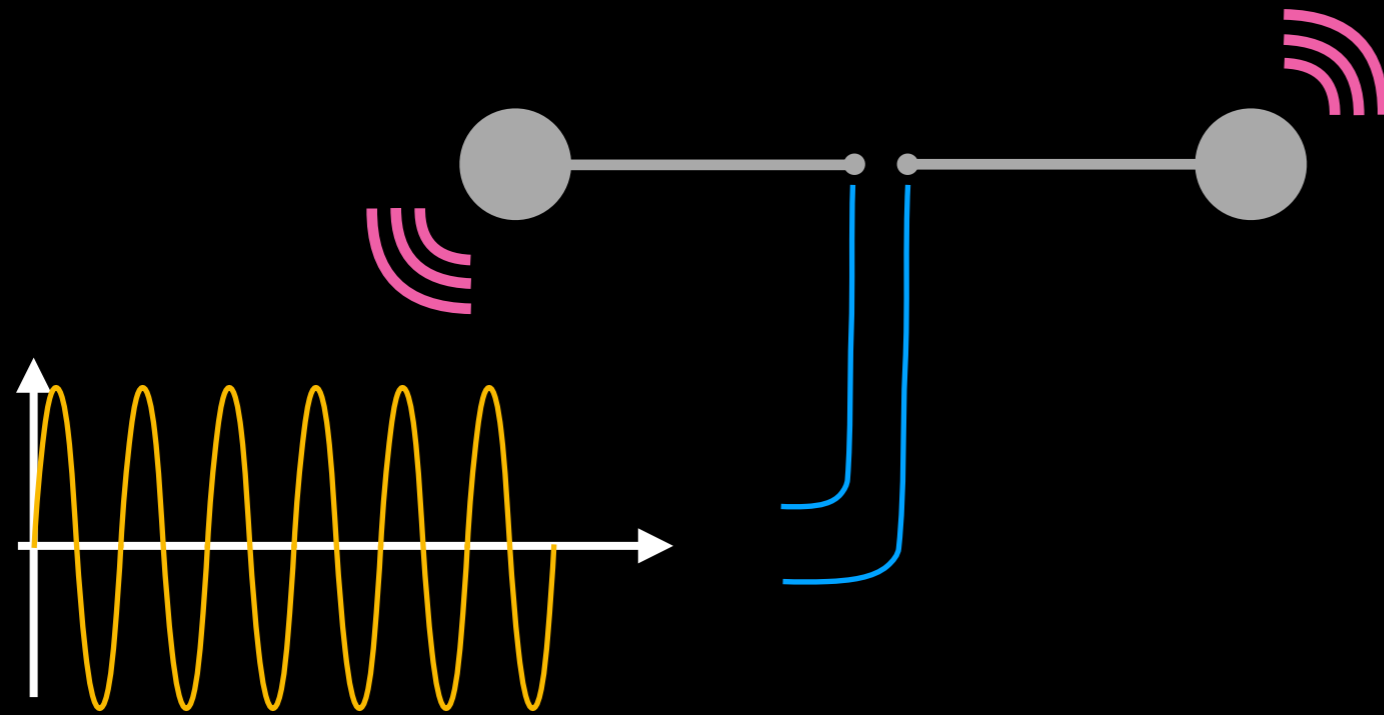


“If uranium is made of atoms, what are the atoms of electricity that flow through the wire?”



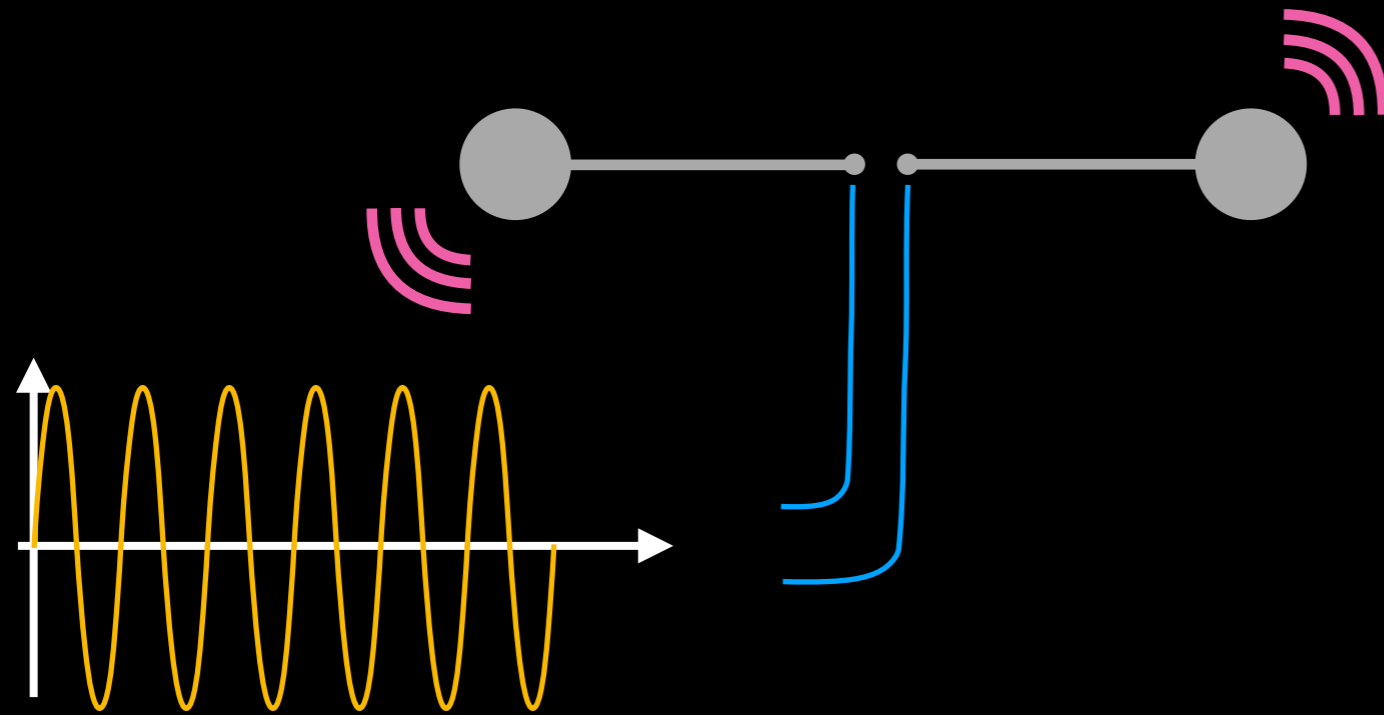
All of this once was cutting-edge science

All of this once was cutting-edge science

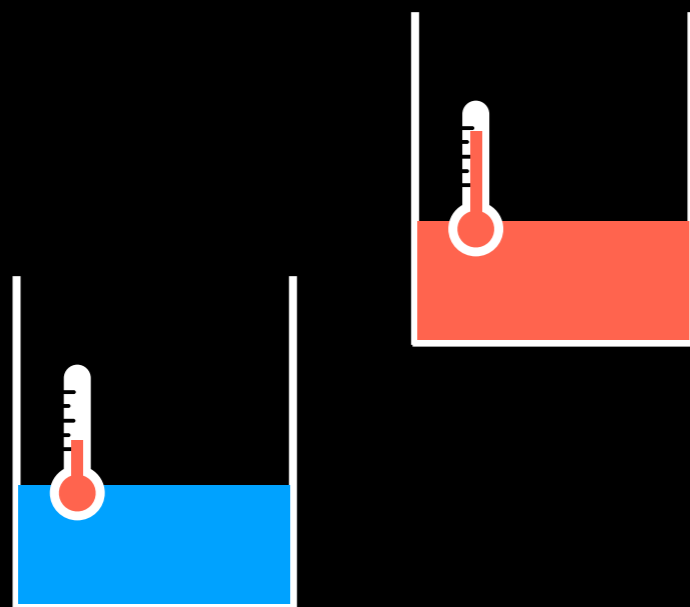


“What are radio waves
made of?”

All of this once was cutting-edge science



“What are radio waves made of?”



“What changes when cold water is made hot?”

This is how we *roughly* got here

This is how we *roughly* got here



Heinrich Hertz (1880s)

This is how we *roughly* got here



Heinrich Hertz (1880s)

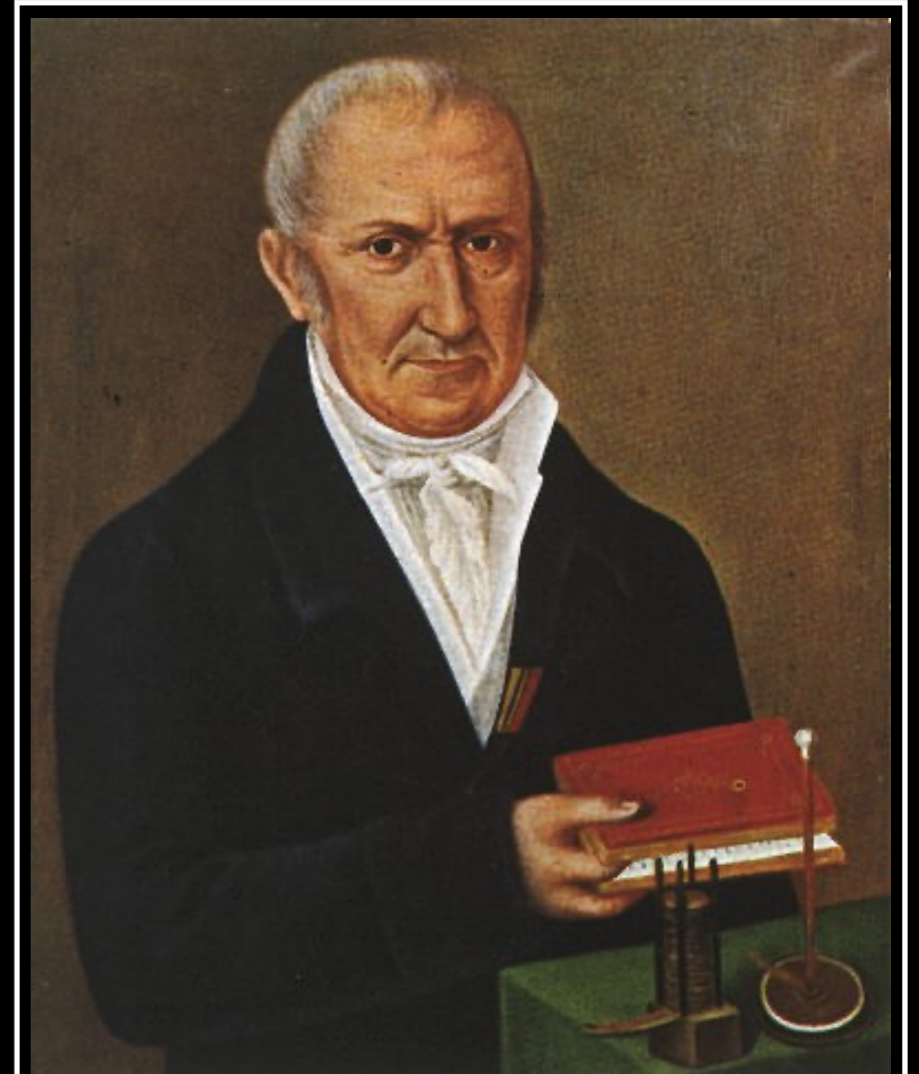
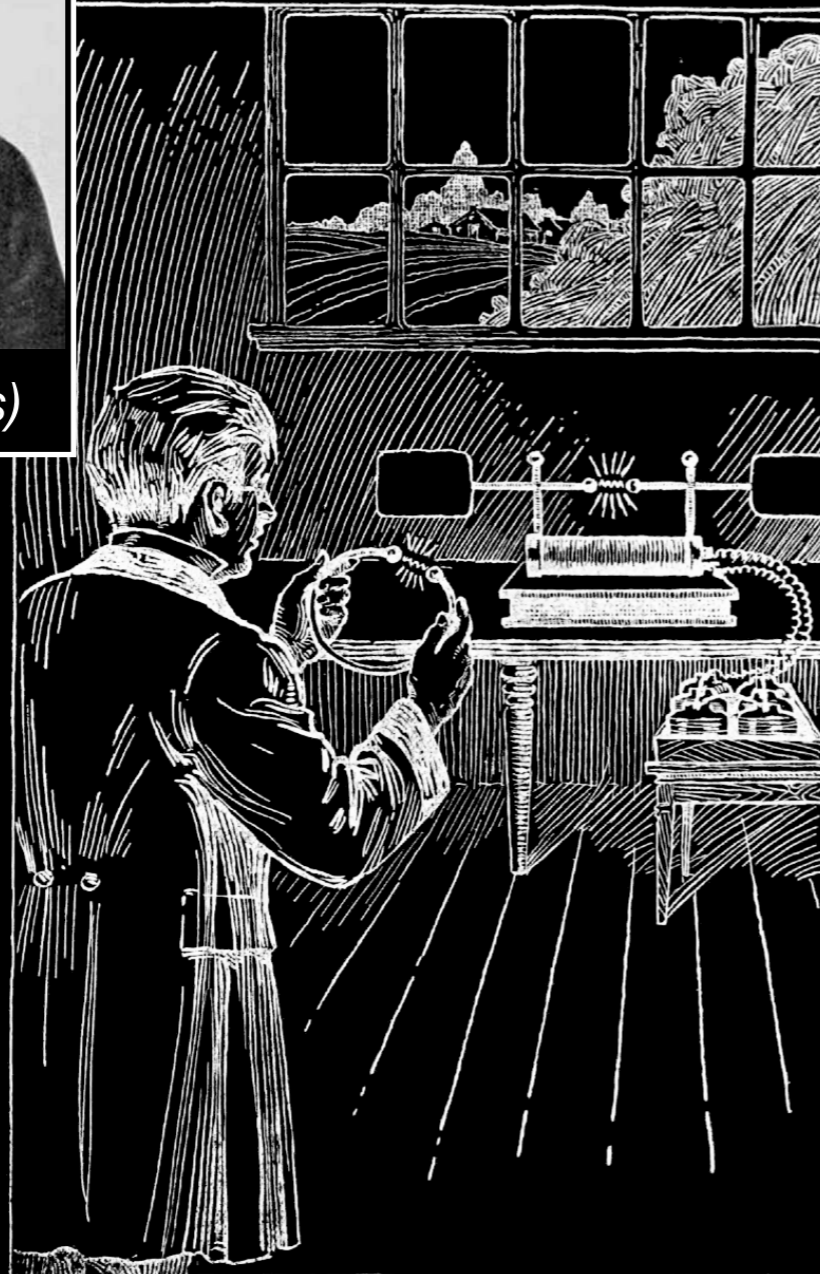


Alessandro Volta (1800)

This is how we *roughly* got here

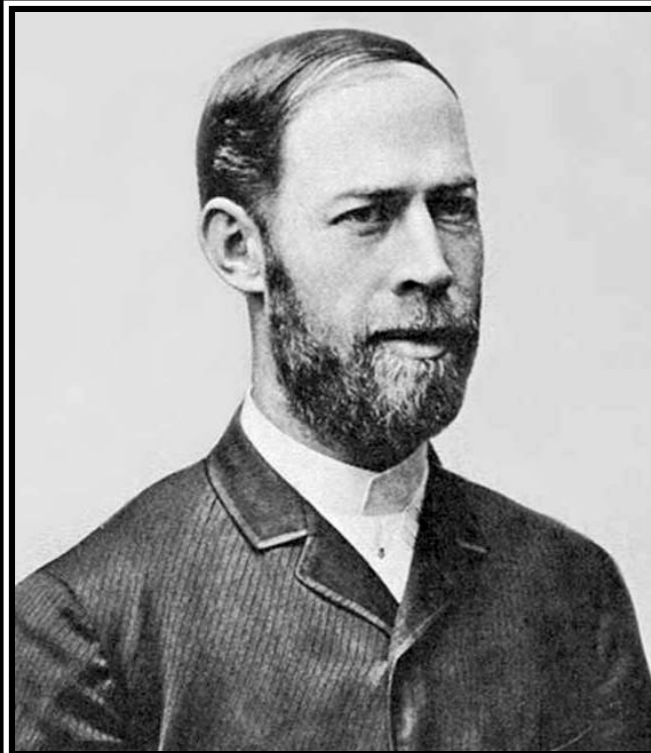


Heinrich Hertz (1880s)

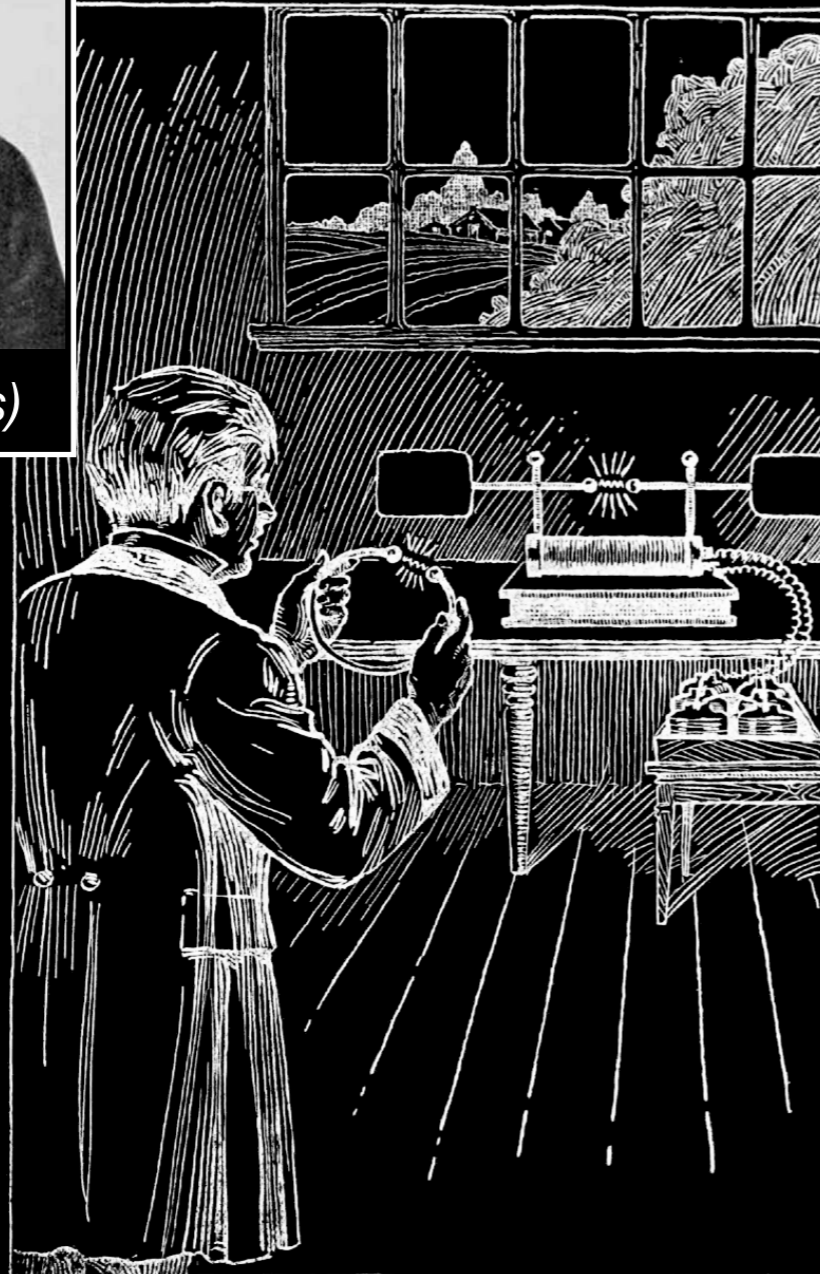


Alessandro Volta (1800)

This is how we *roughly* got here



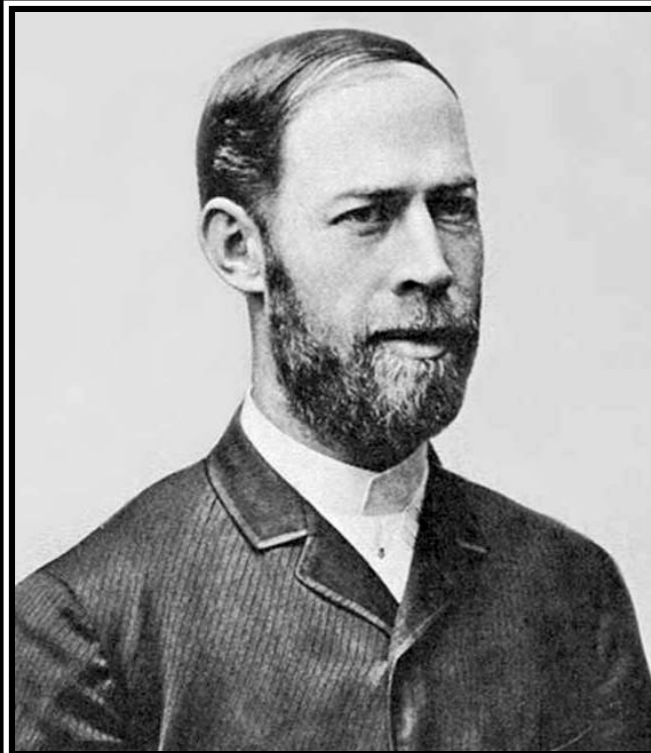
Heinrich Hertz (1880s)



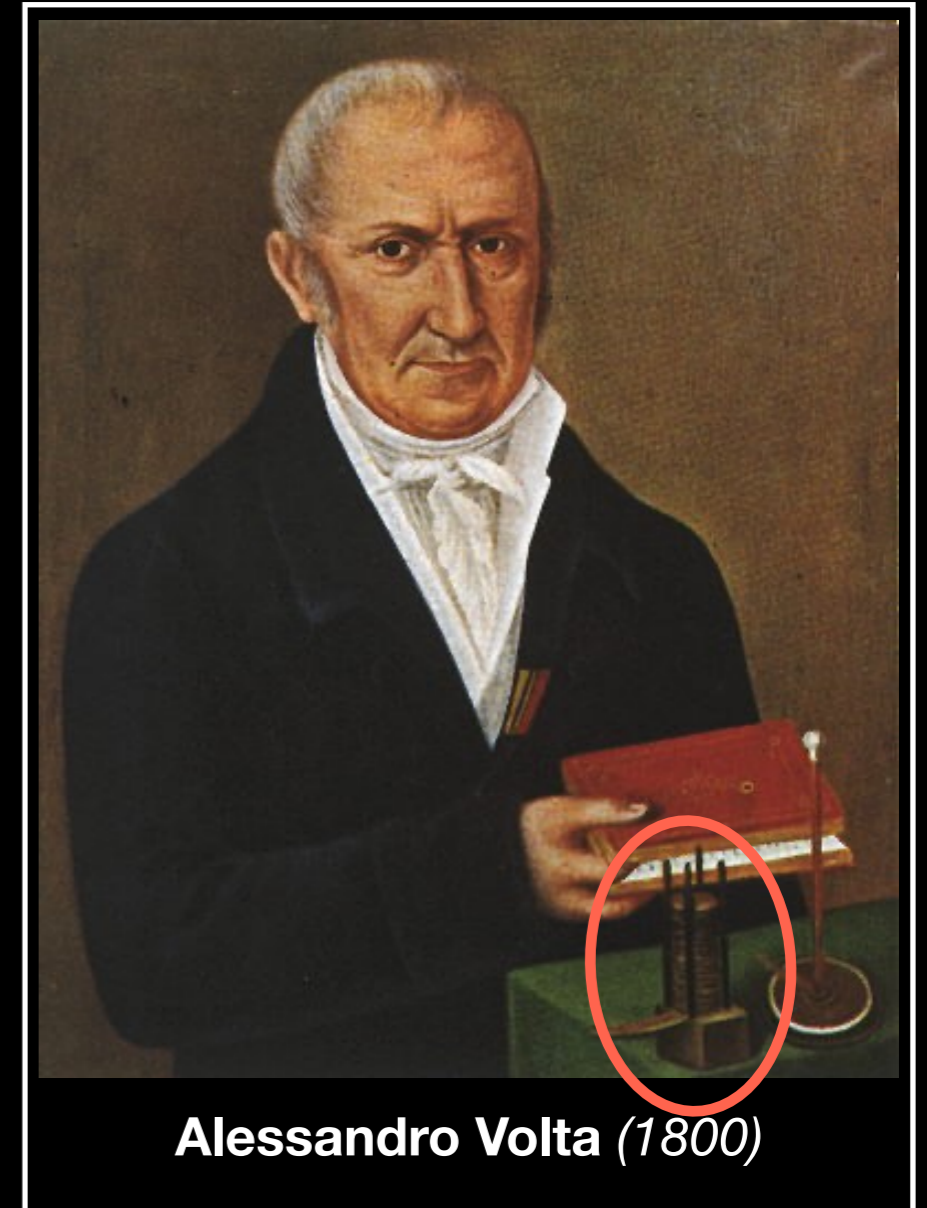
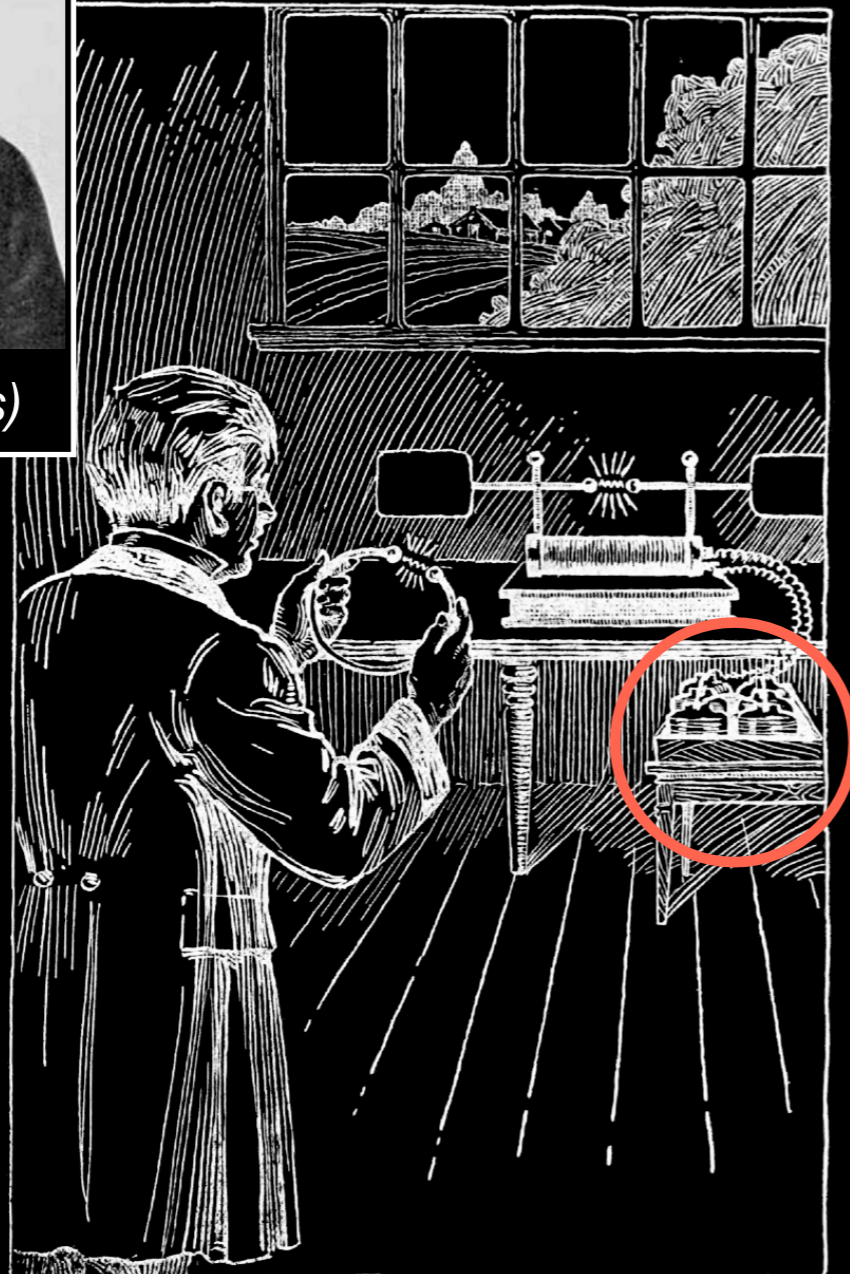
Alessandro Volta (1800)

Without a stable source of electricity,
Hertz's discovery would not have
been possible!

This is how we *roughly* got here



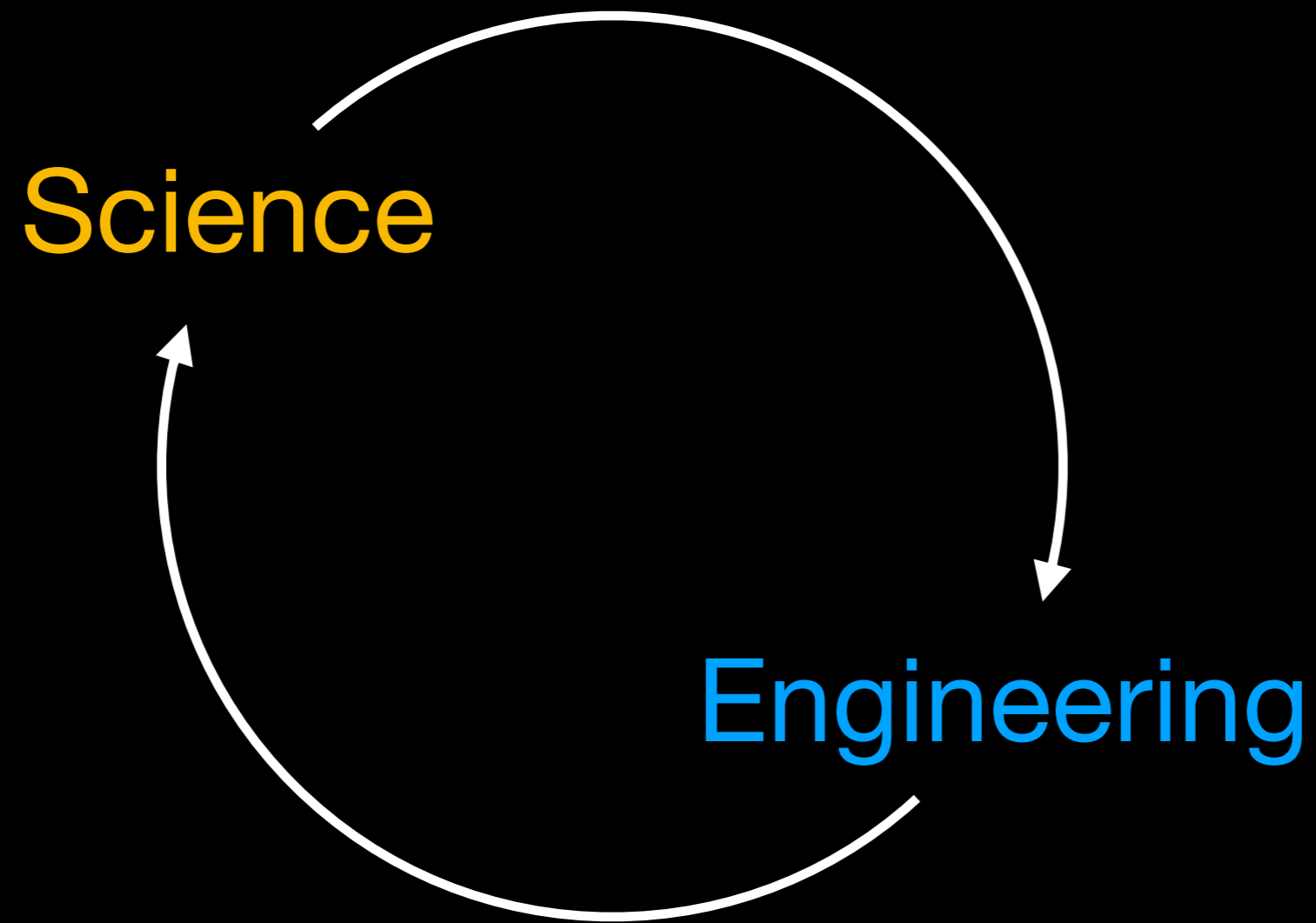
Heinrich Hertz (1880s)



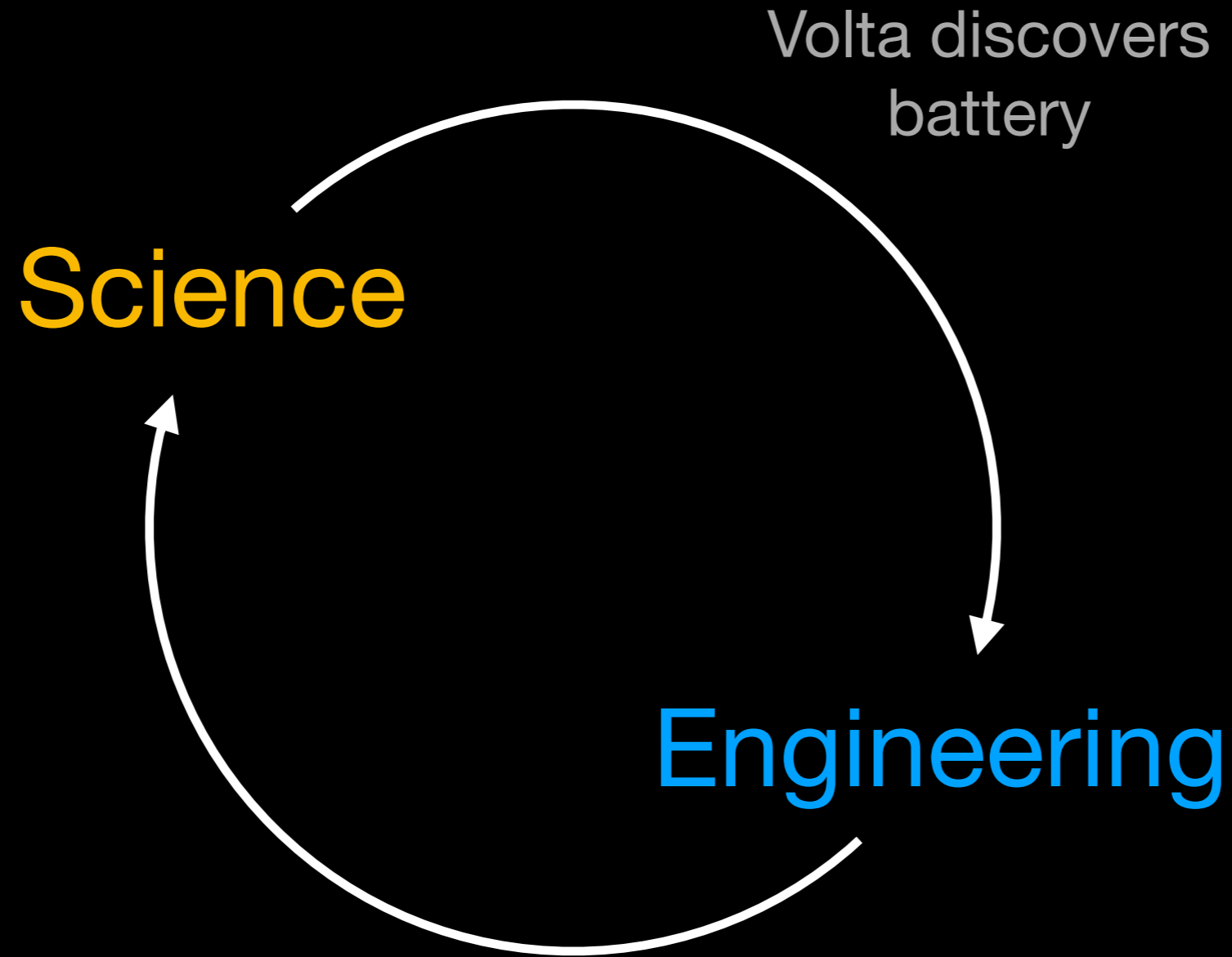
Alessandro Volta (1800)

Without a stable source of electricity,
Hertz's discovery would not have
been possible!

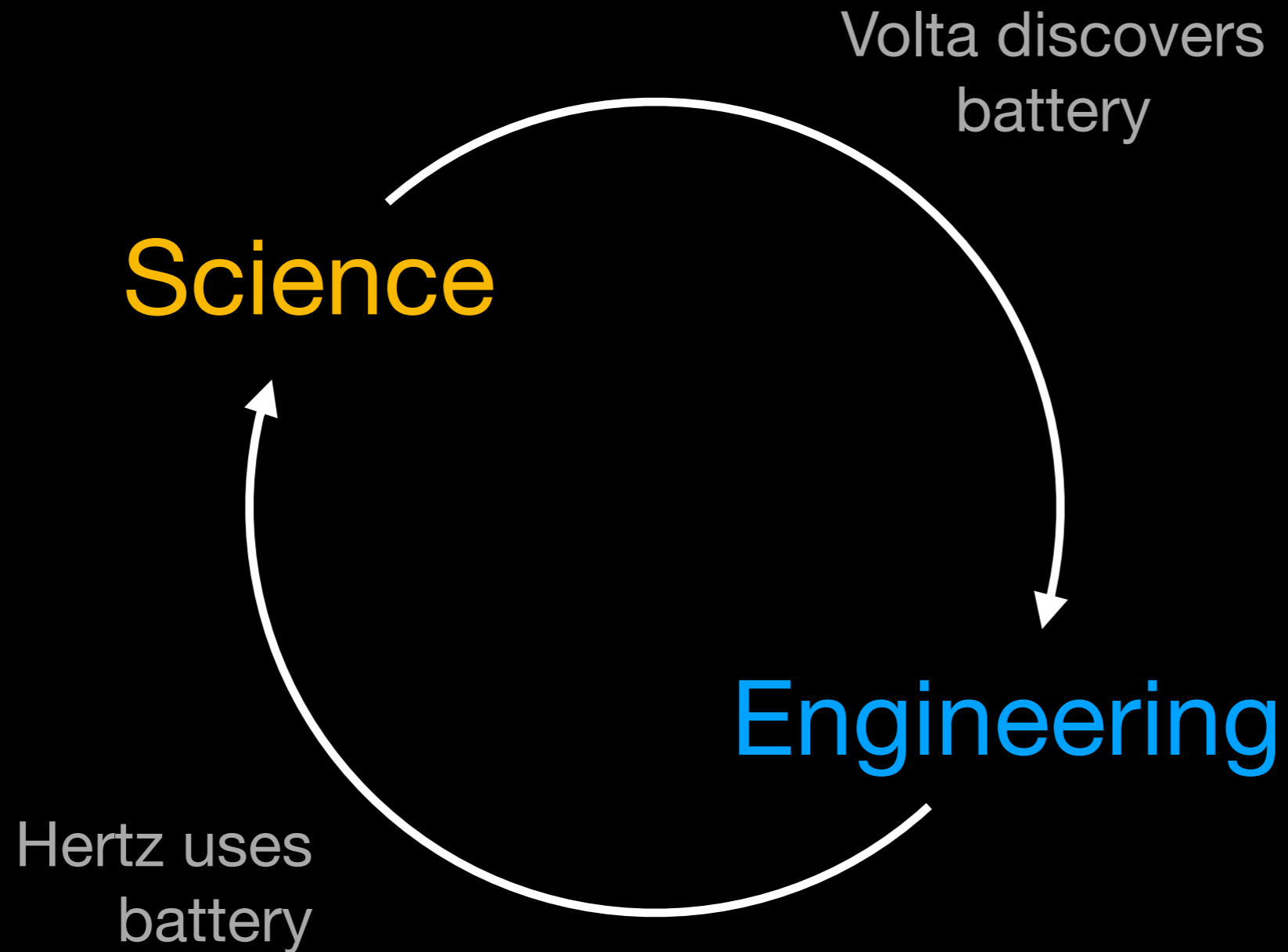
This is how we *roughly* got here



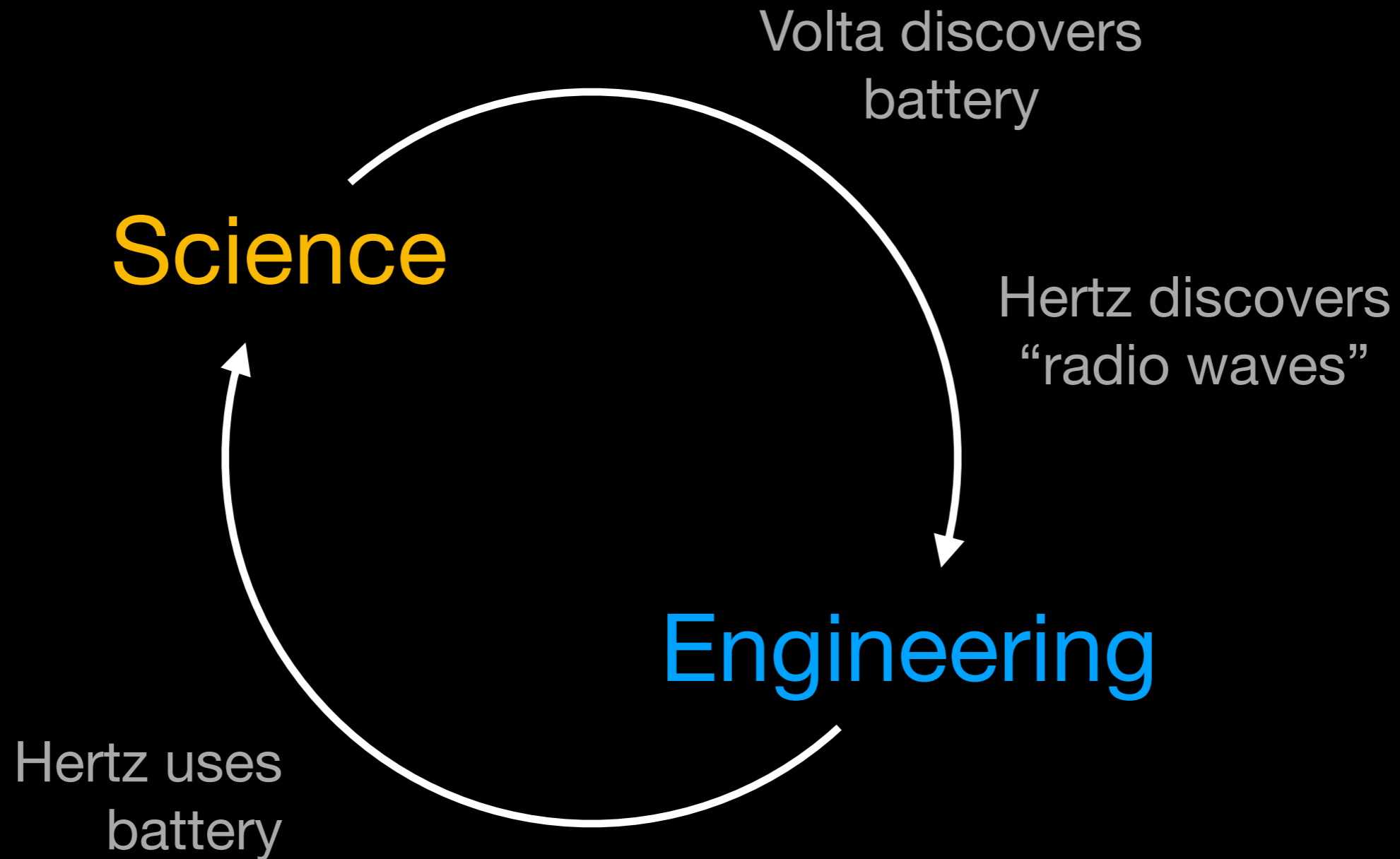
This is how we *roughly* got here



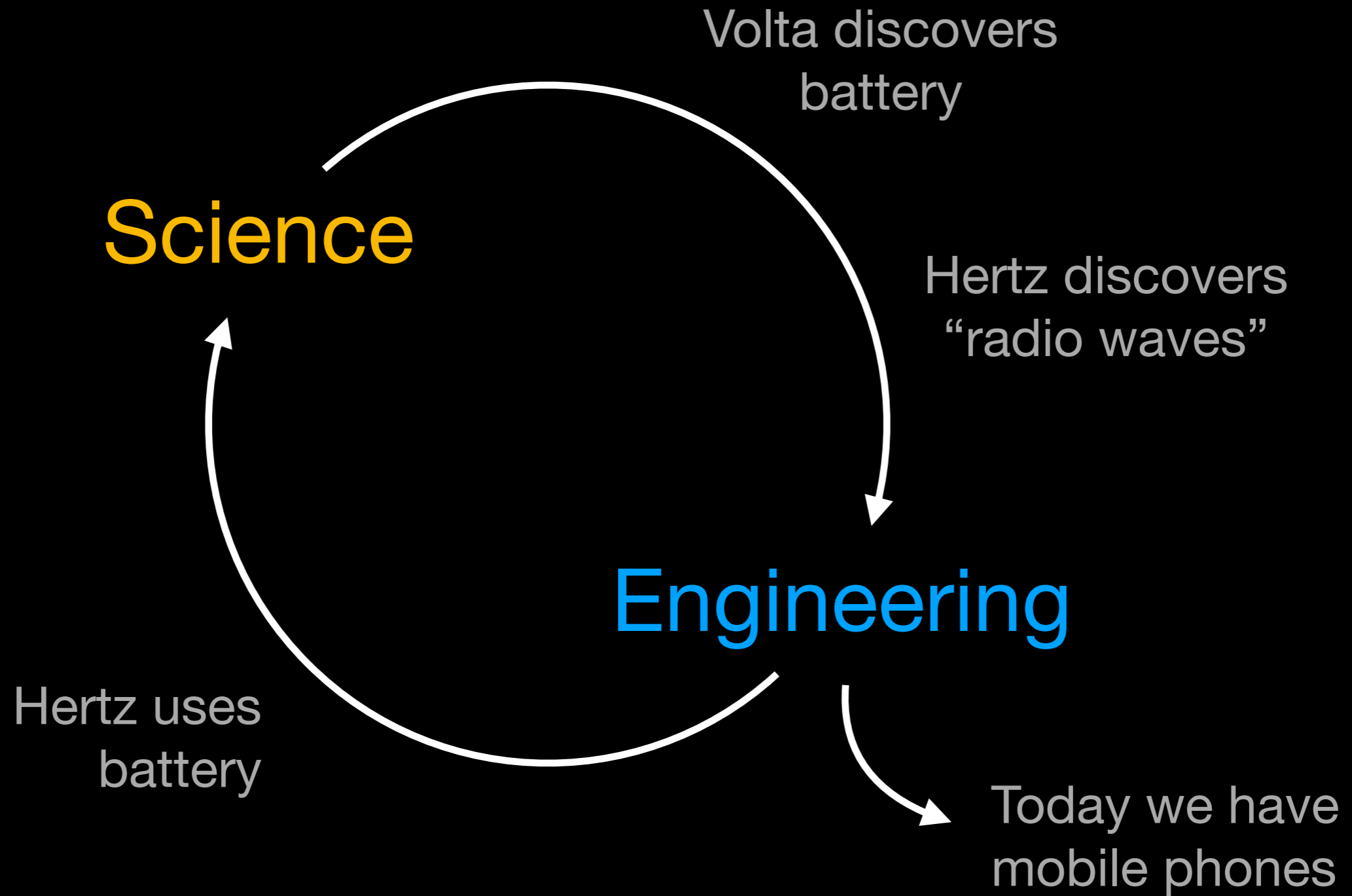
This is how we *roughly* got here



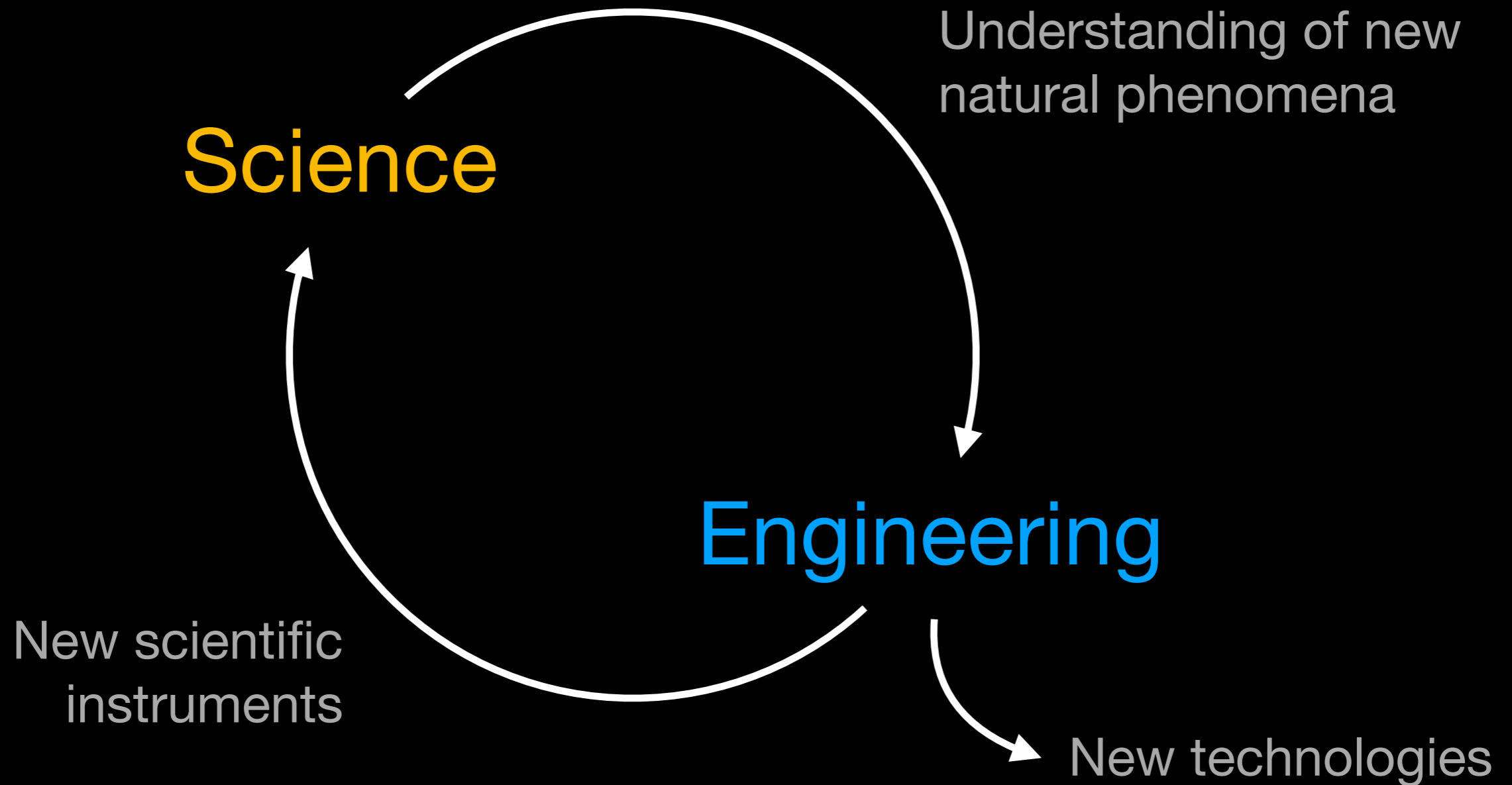
This is how we *roughly* got here



This is how we *roughly* got here

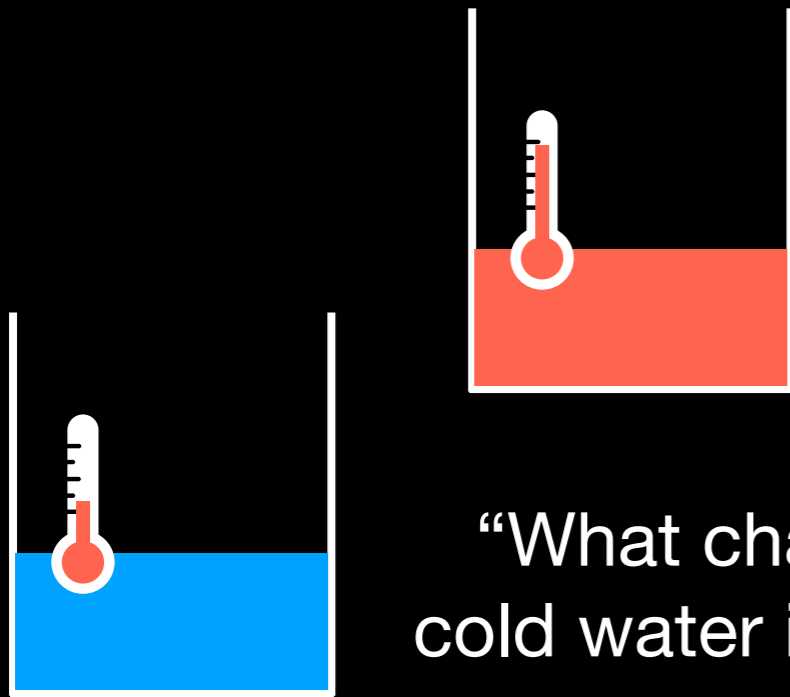


This is how we *roughly* got here



This is how we *roughly* got here

We can understand *something* without having to understand *everything*

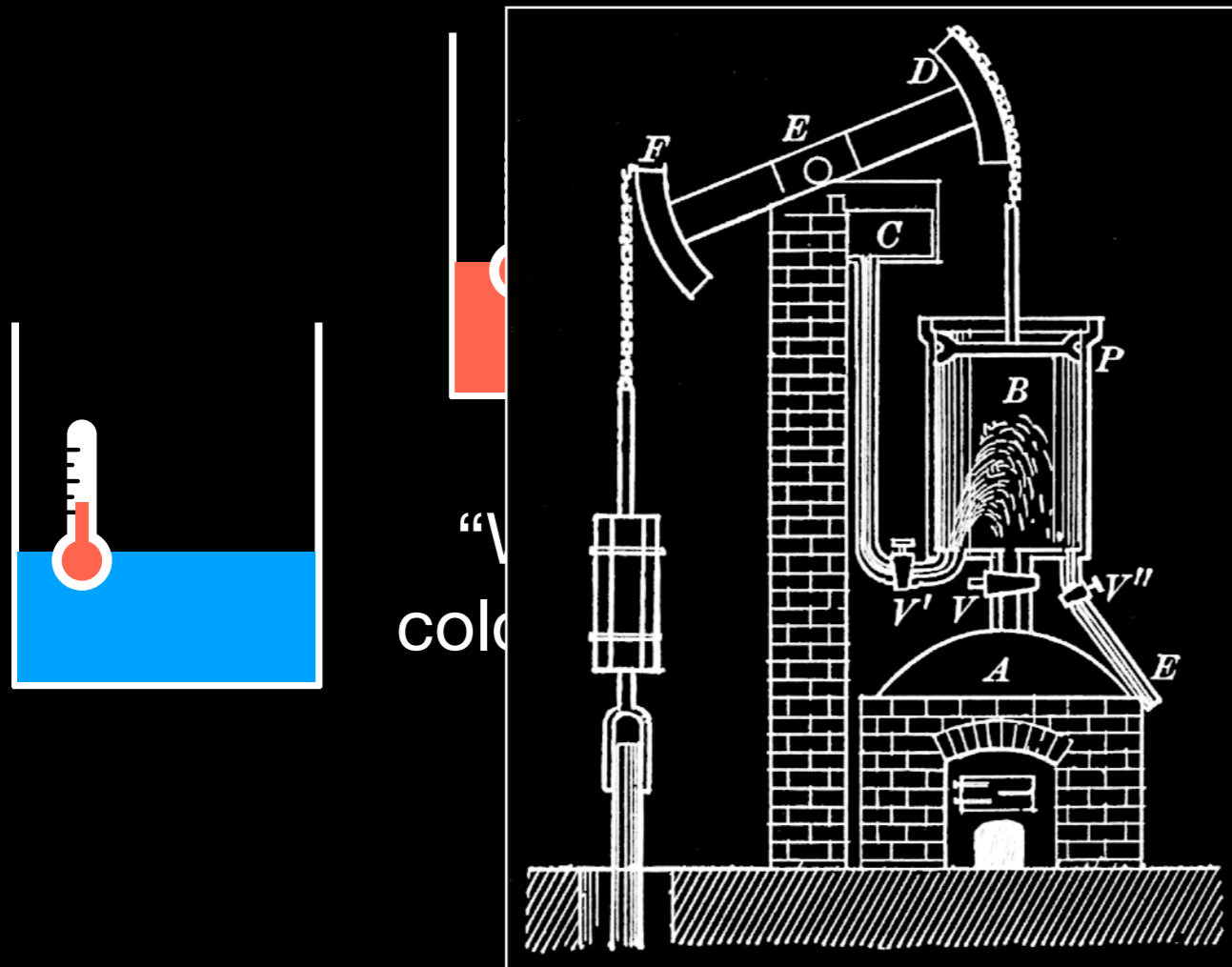


“What changes when cold water is made hot?”

“If a large complicated thing seems mysterious, open it up and see if its parts are less mysterious”

This is how we *roughly* got here

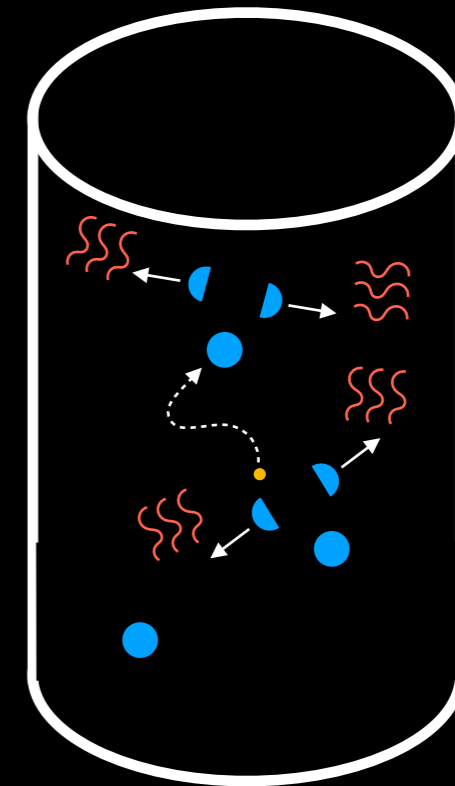
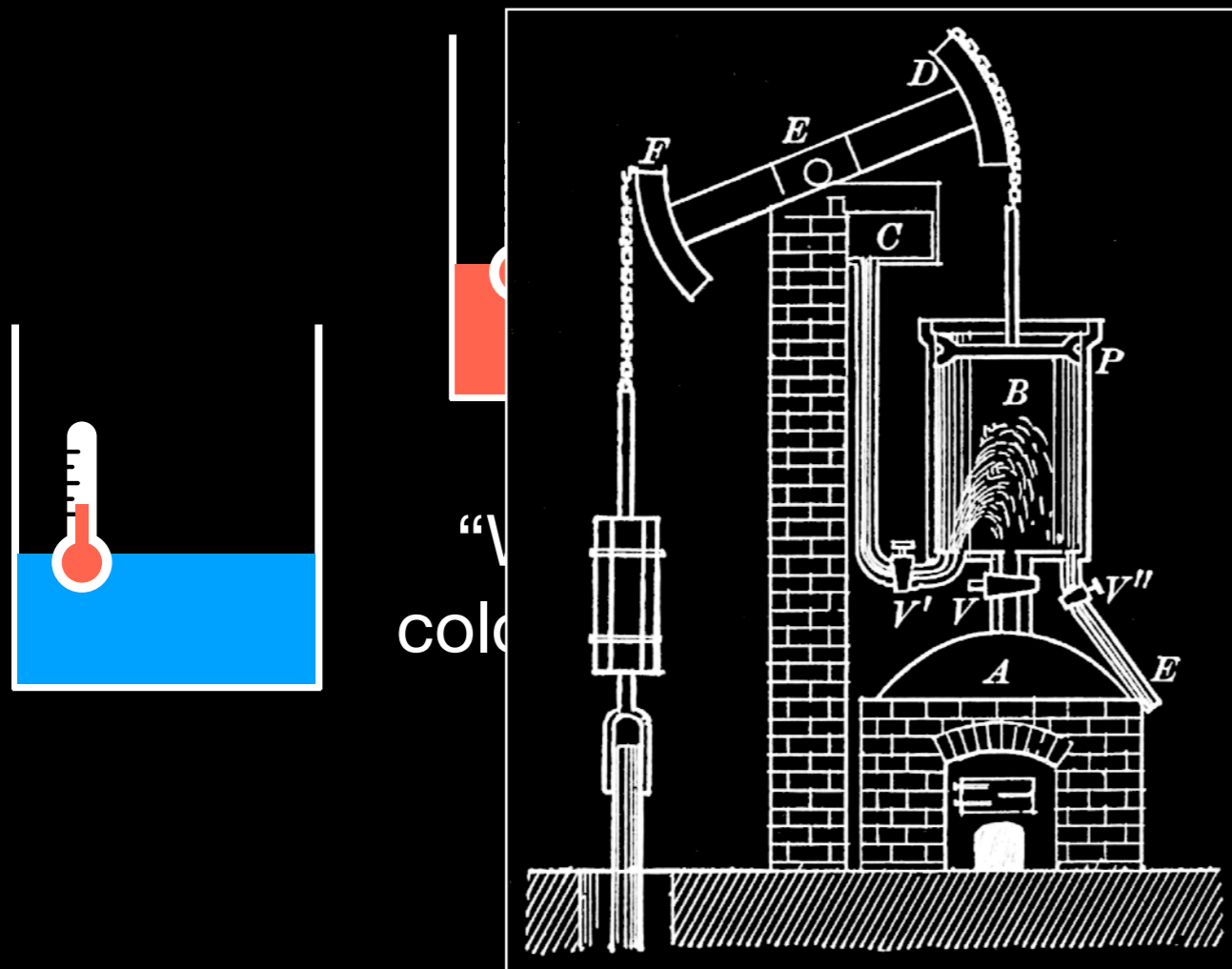
We can understand *something* without having to understand *everything*



“If a large complicated thing seems mysterious, open it up and see if its parts are less mysterious”

This is how we *roughly* got here

We can understand *something* without having to understand *everything*



“What is matter made of?”

“If a large complicated thing seems mysterious, open it up and see if its parts are less mysterious”



**HOW FUNDAMENTAL SCIENCE
HAS CHANGED THE WORLD**

A STORY OF INVENTION AND DISCOVERY

For the next seven lectures ...

See the world through the eyes of the scientists and engineers of the past, searching answers to three fundamental questions.

For the next seven lectures ...

Part I:

“What is the nature of heat?”

“How to use the power of fire?”

For the next seven lectures ...

Part I:

“What is the nature of heat?”

“How to use the power of fire?”

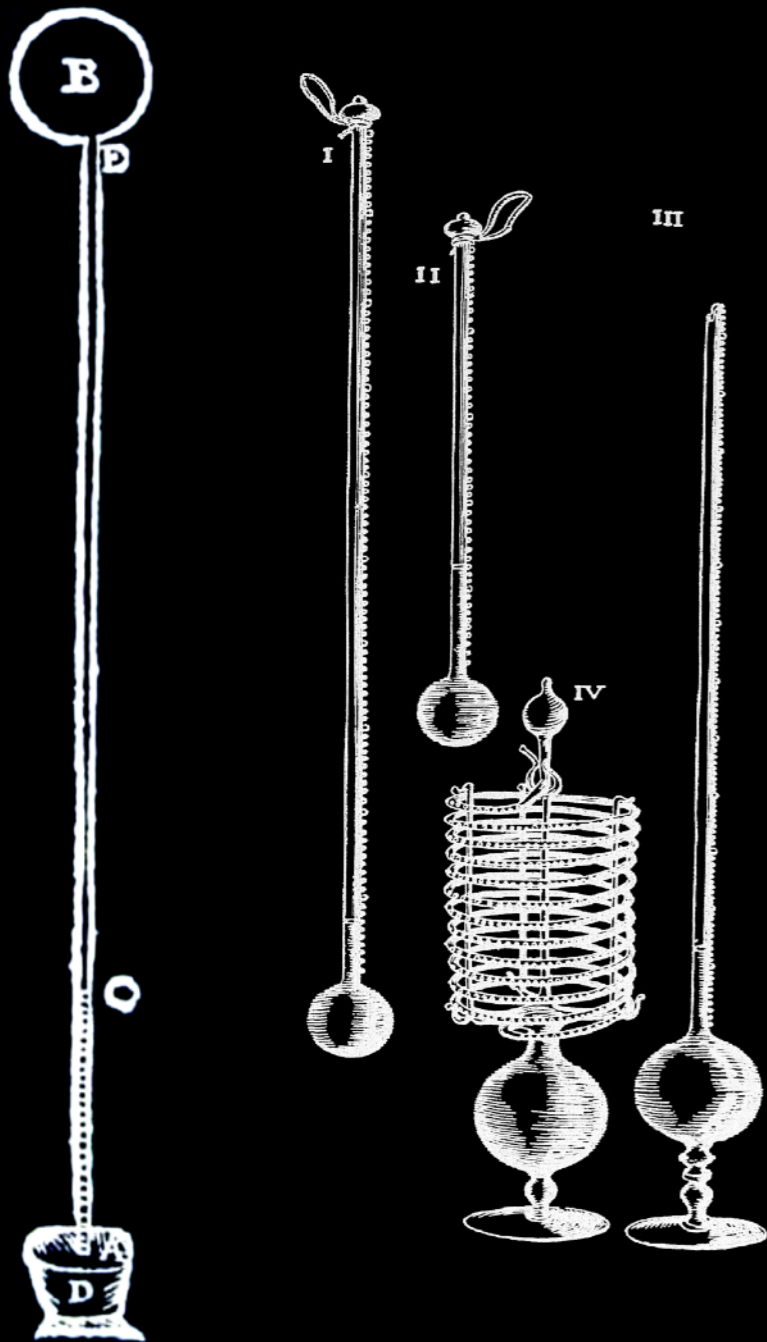


For the next seven lectures ...

Part I:

“What is the nature of heat?”

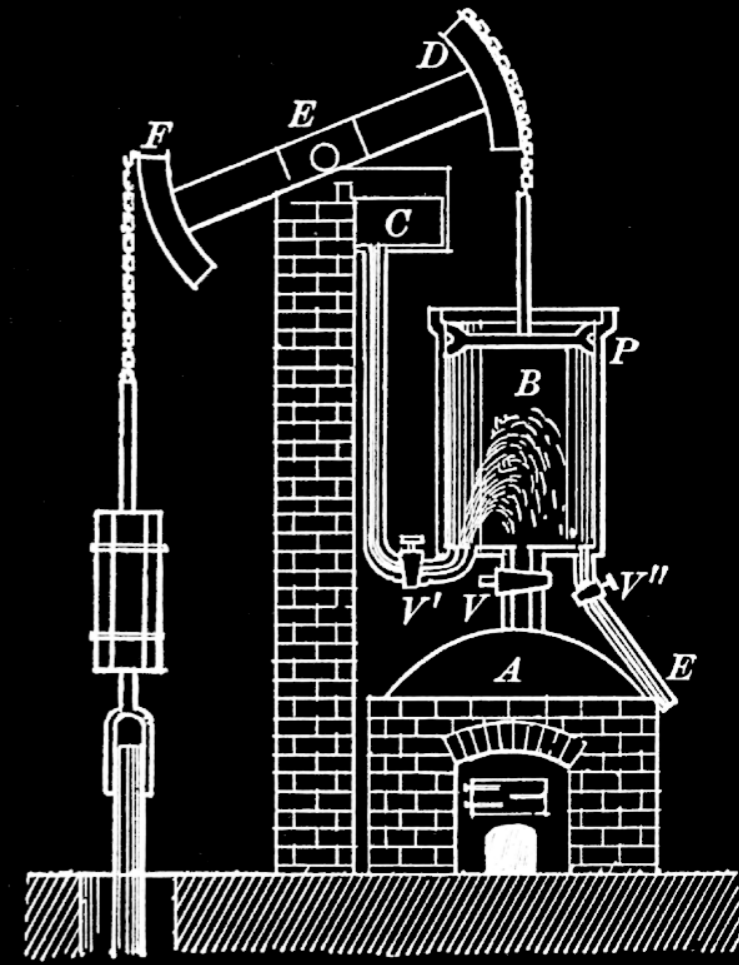
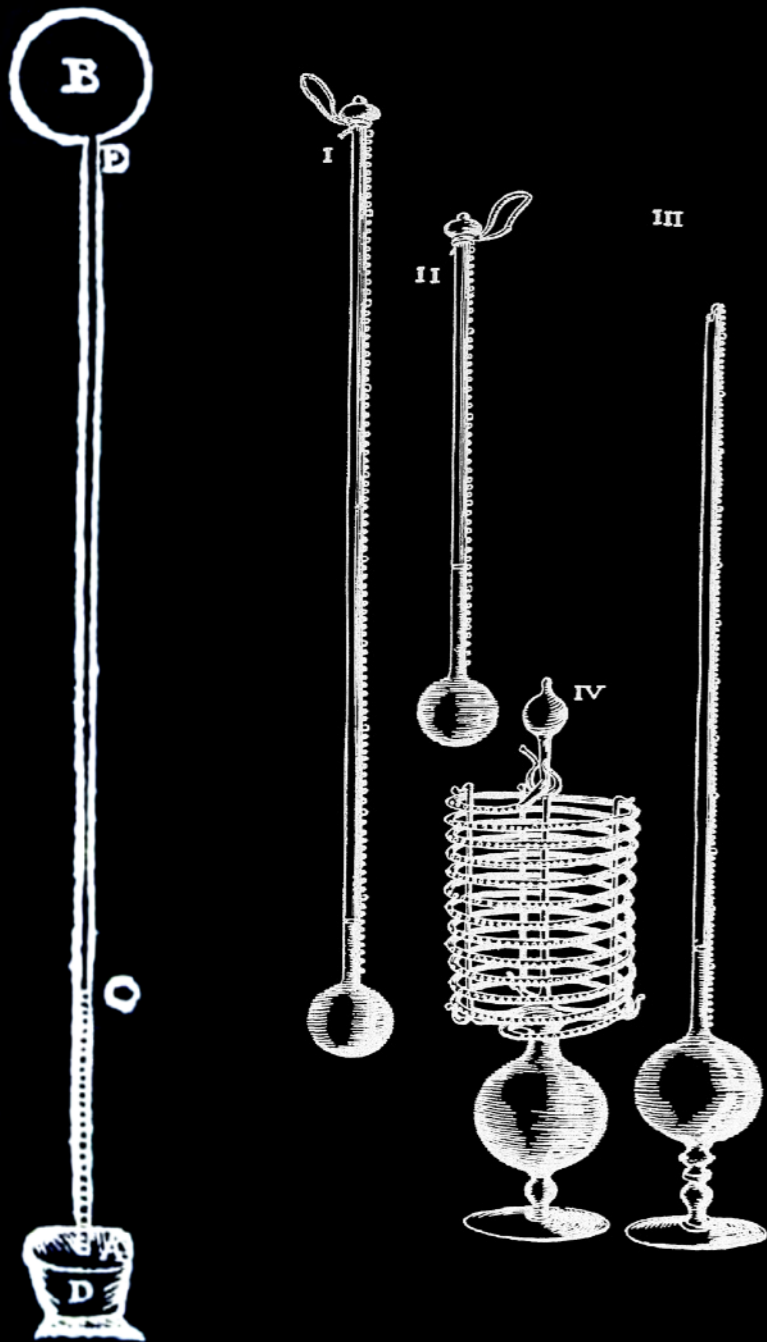
“How to use the power of fire?”



For the next seven lectures ...

Part I:

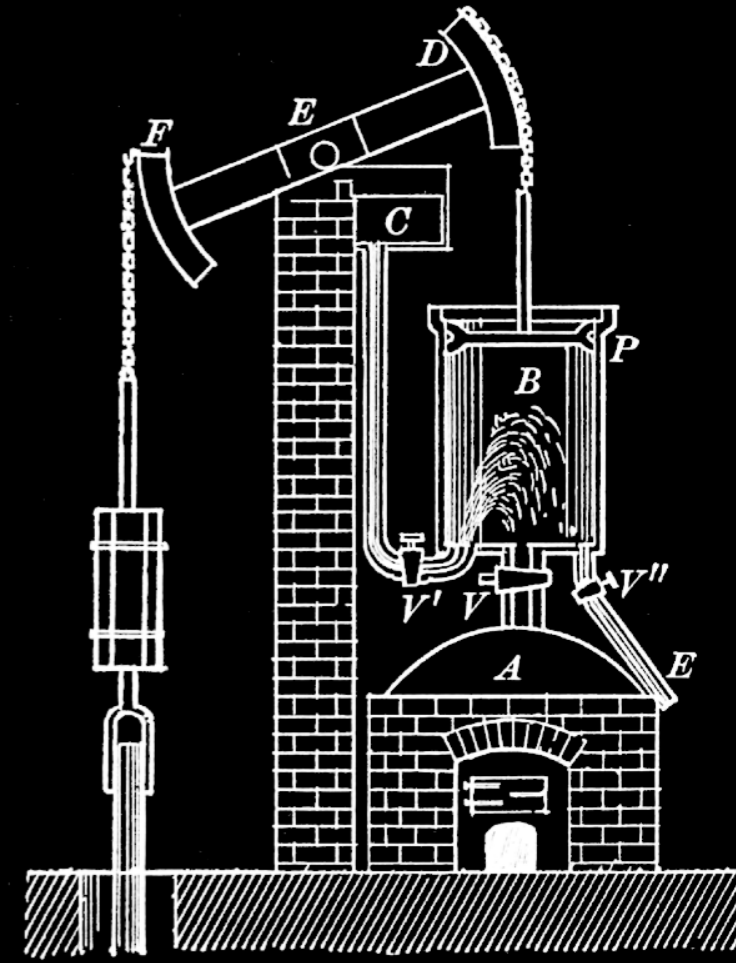
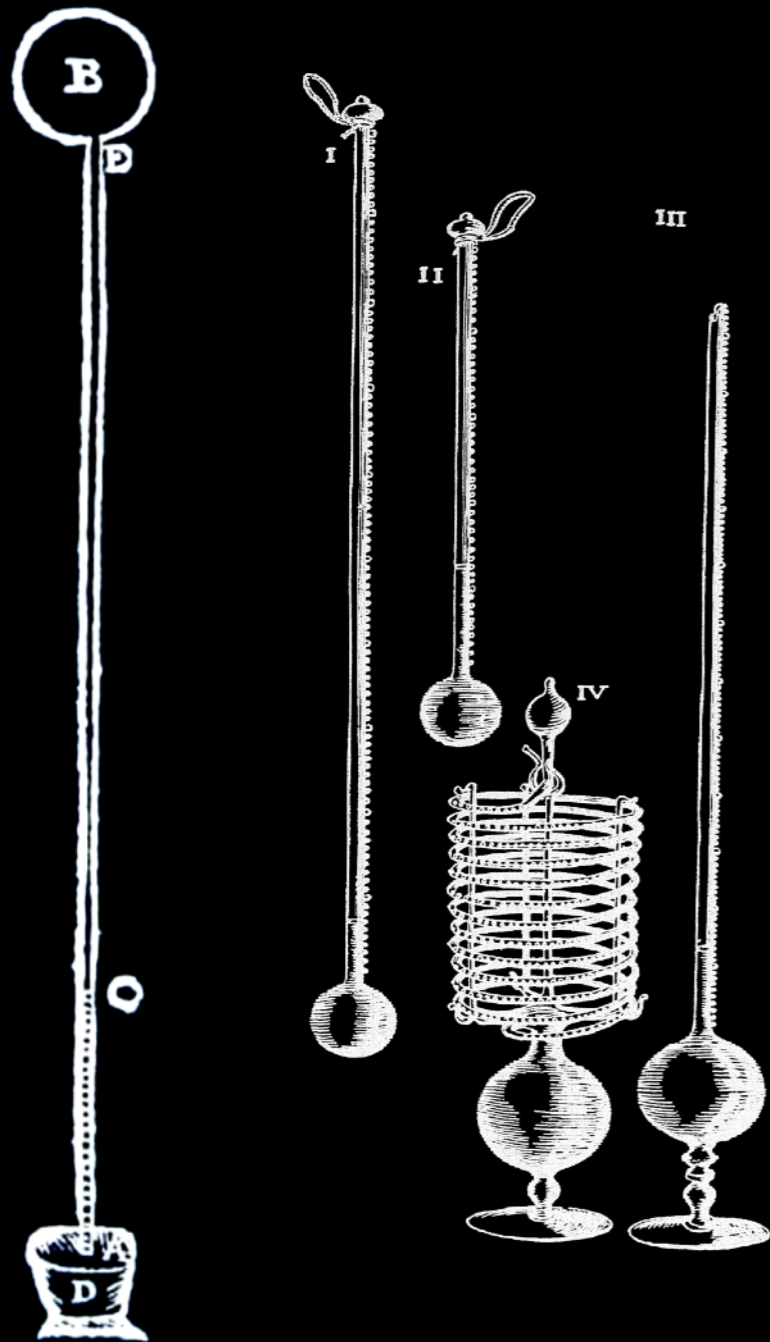
“What is the nature of heat?”
“How to use the power of fire?”



For the next seven lectures ...

Part I:

“What is the nature of heat?”
“How to use the power of fire?”



For the next seven lectures ...

Part I:

“What is the nature of heat?”
“How to use the power of fire?”

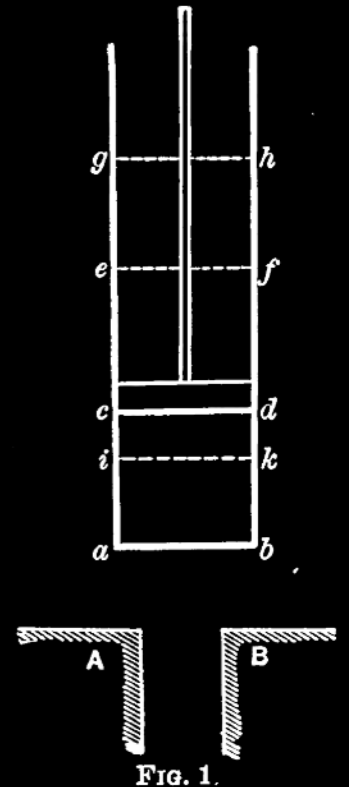
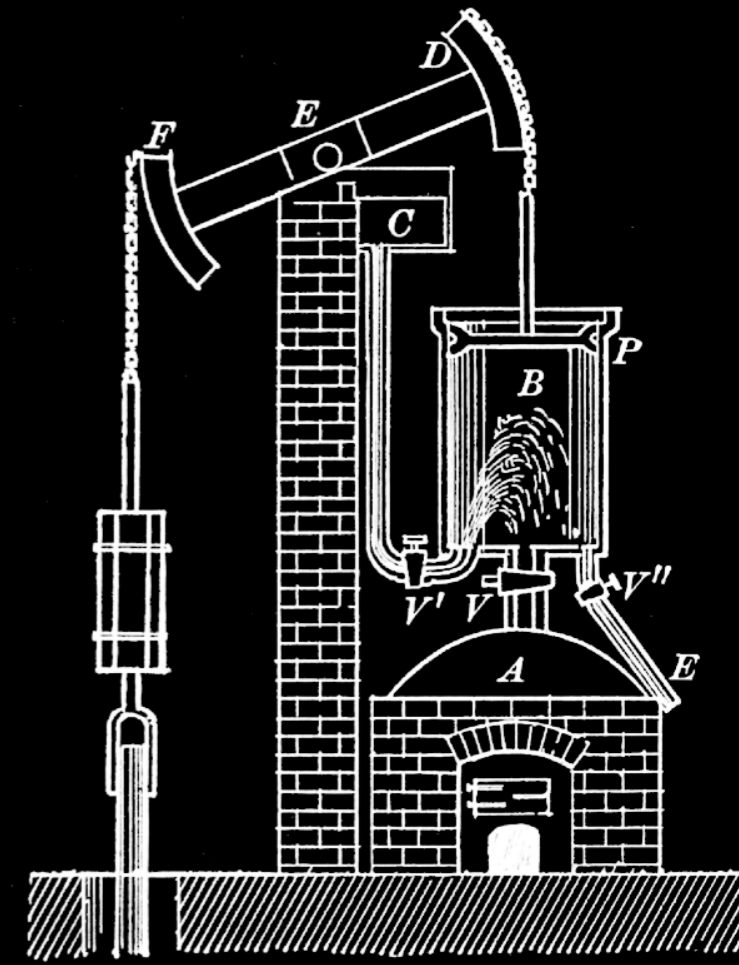
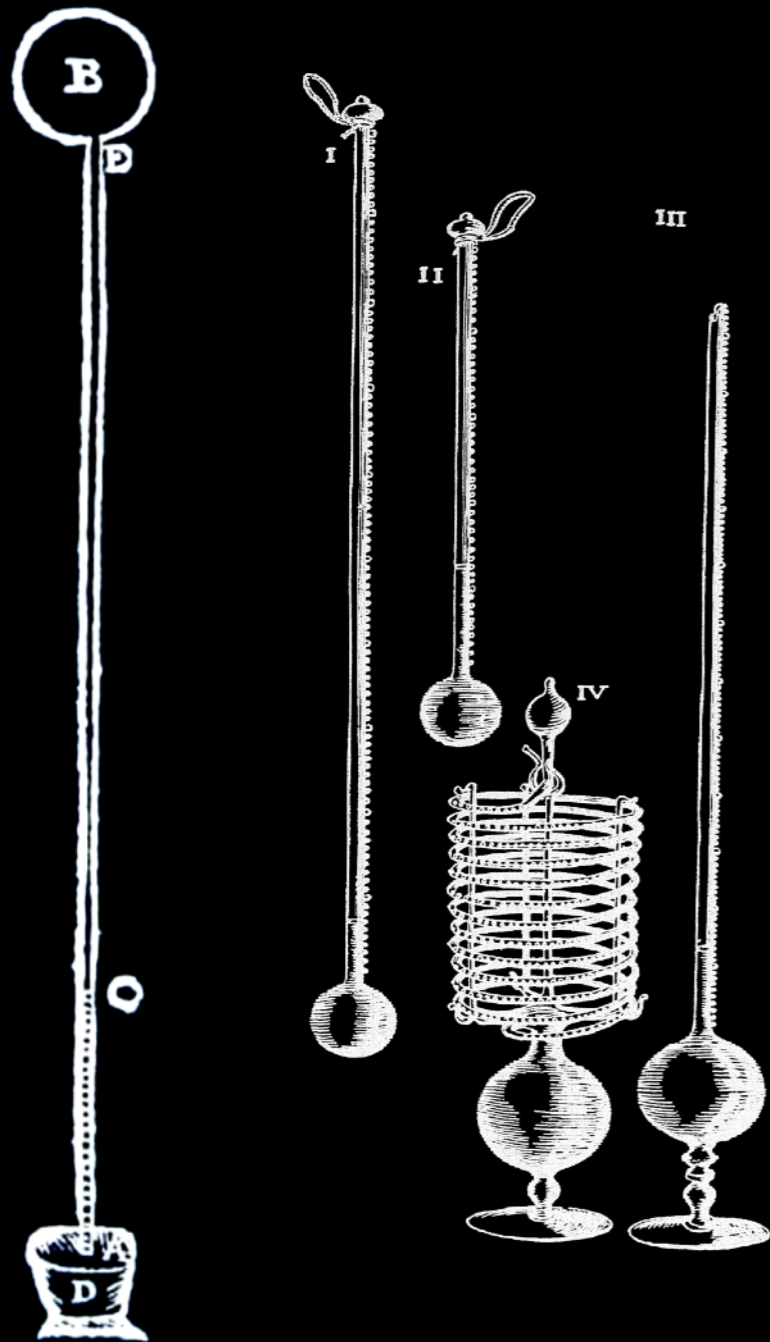


FIG. 1.

For the next seven lectures ...

Part I:

“What is the nature of heat?”
“How to use the power of fire?”

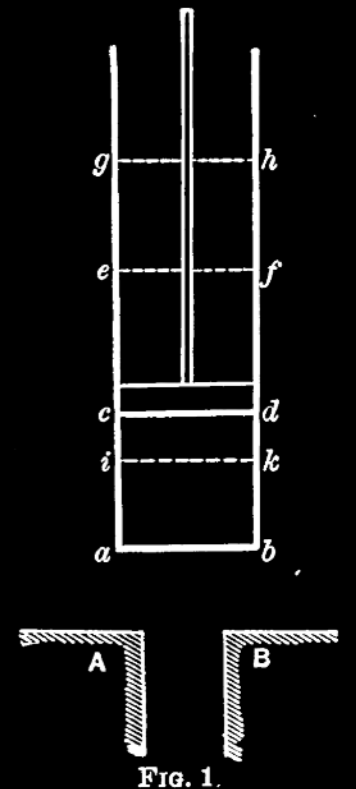
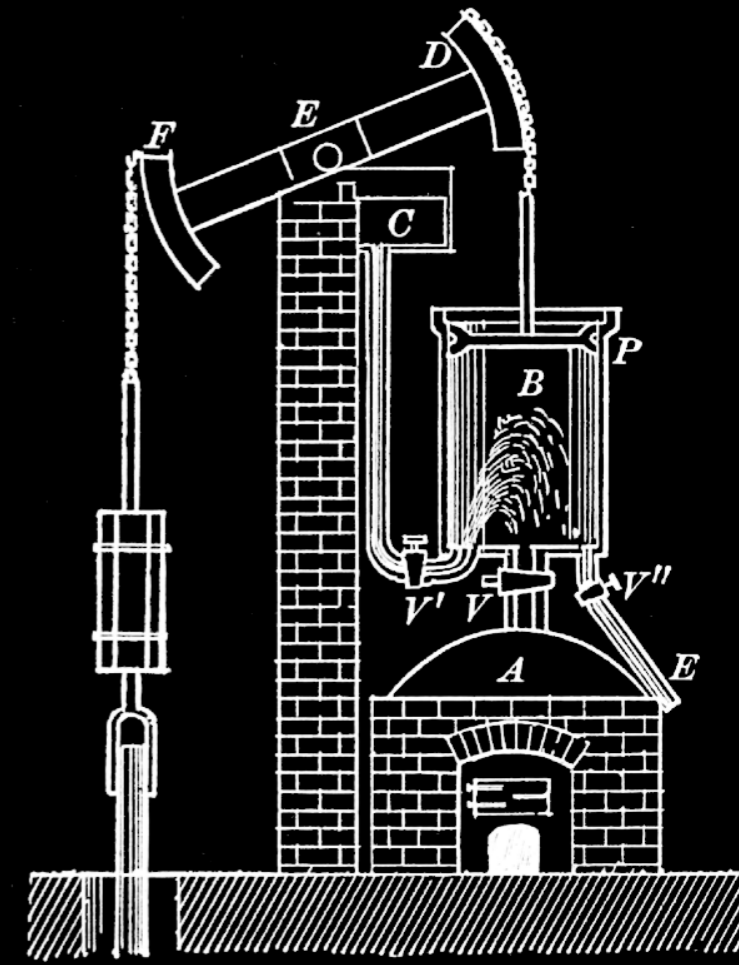
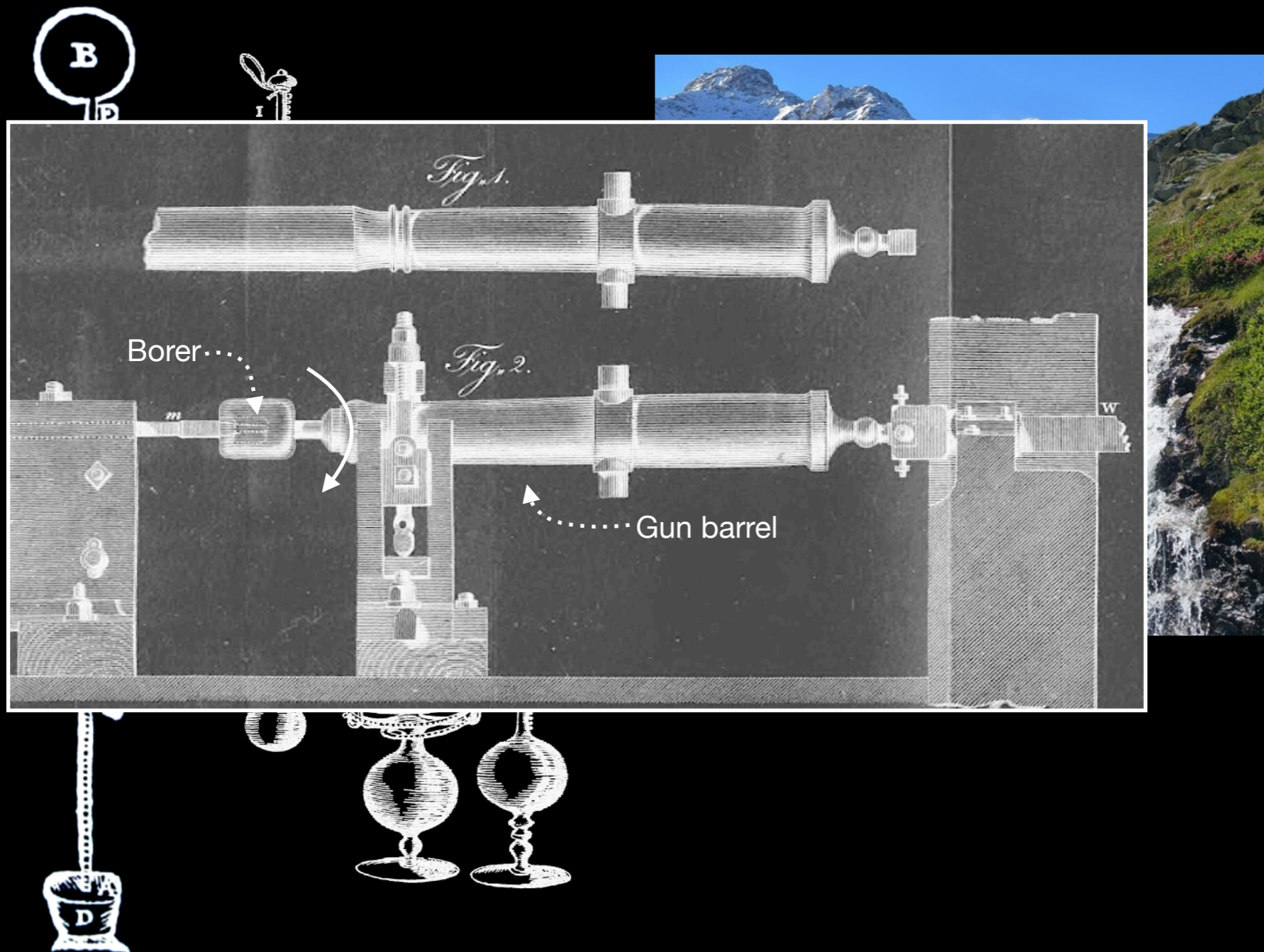


FIG. 1.

For the next seven lectures ...

Part I:

“What is the nature of heat?”
“How to use the power of fire?”

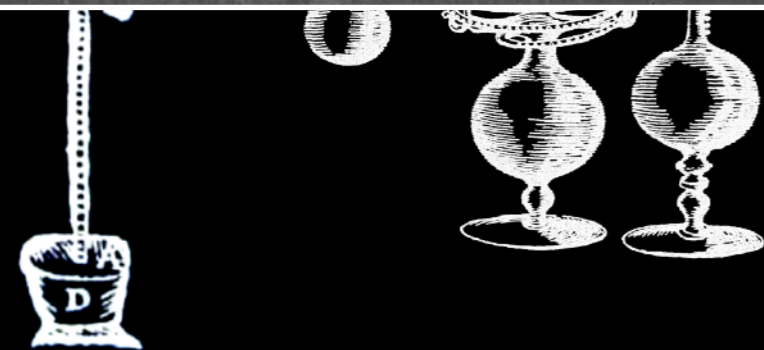
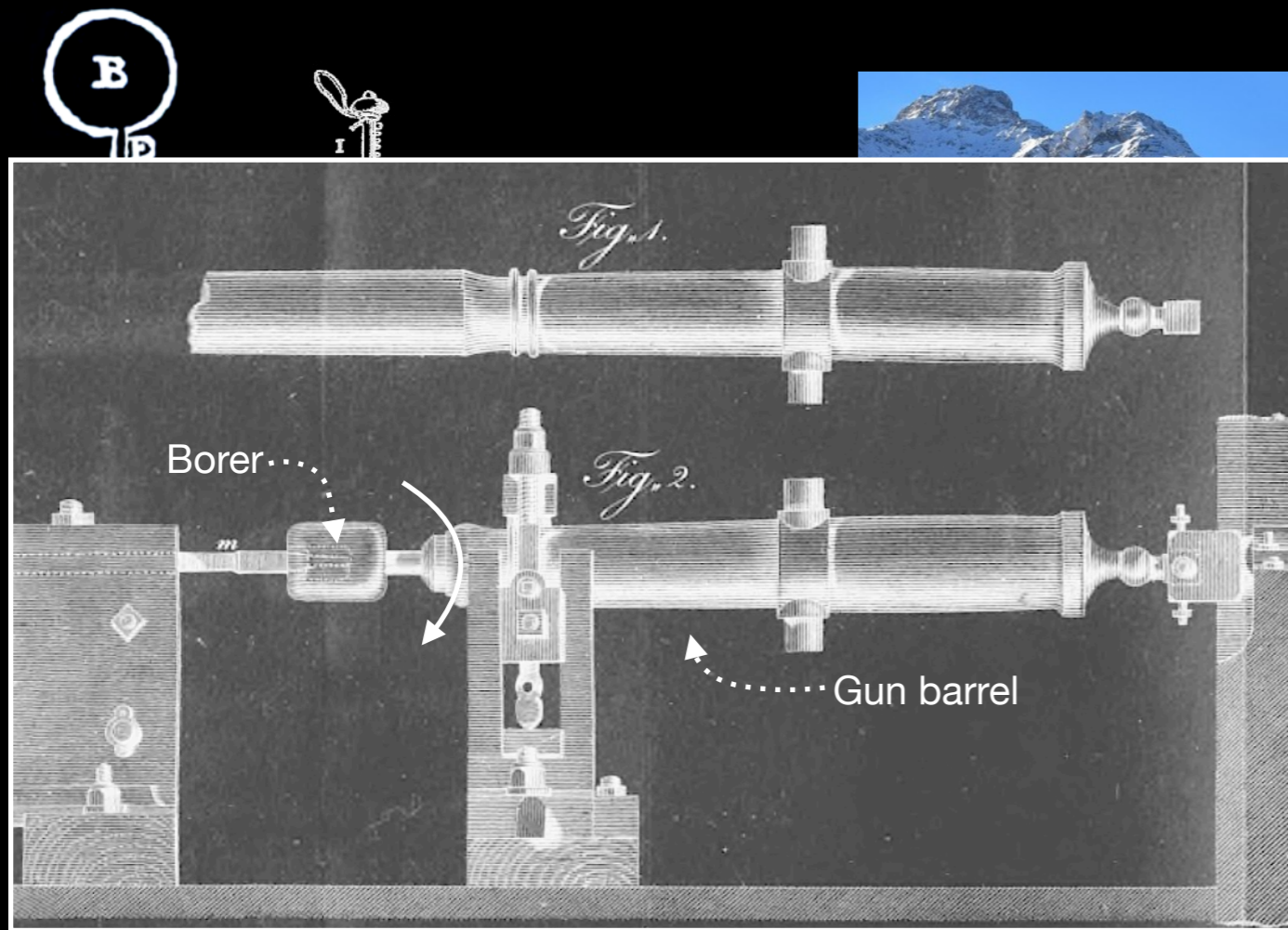
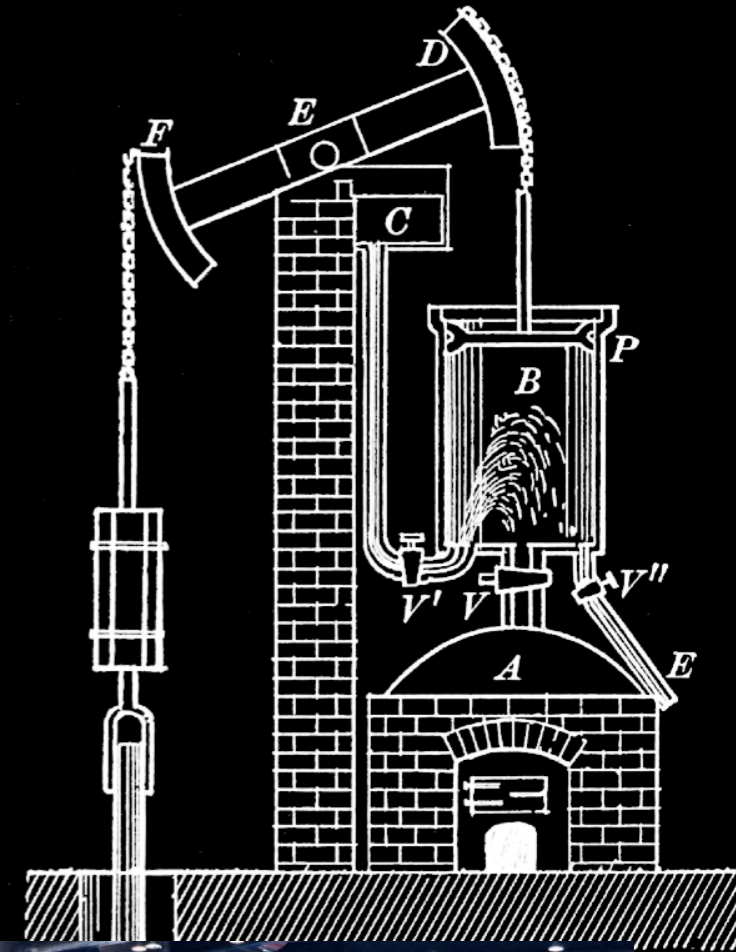


FIG. 1.

For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”



For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

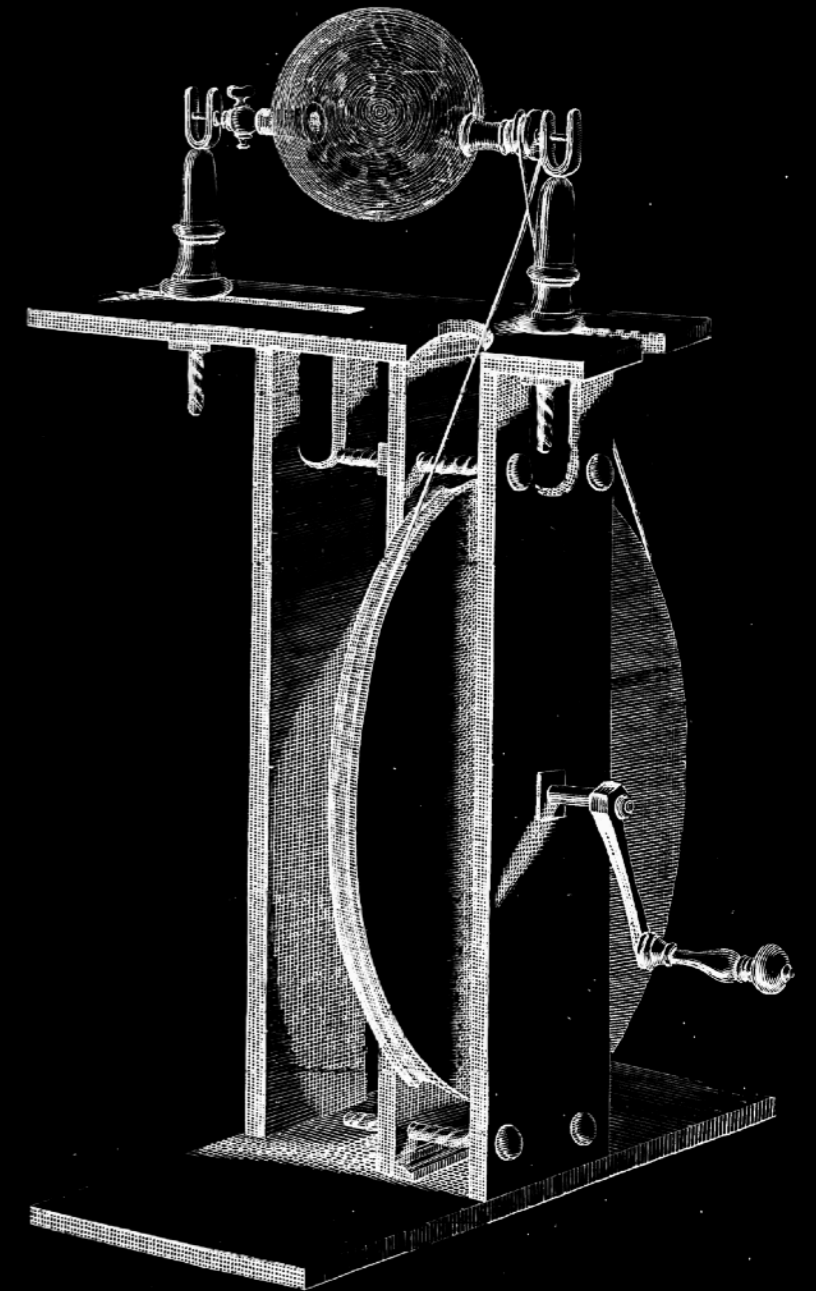


For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

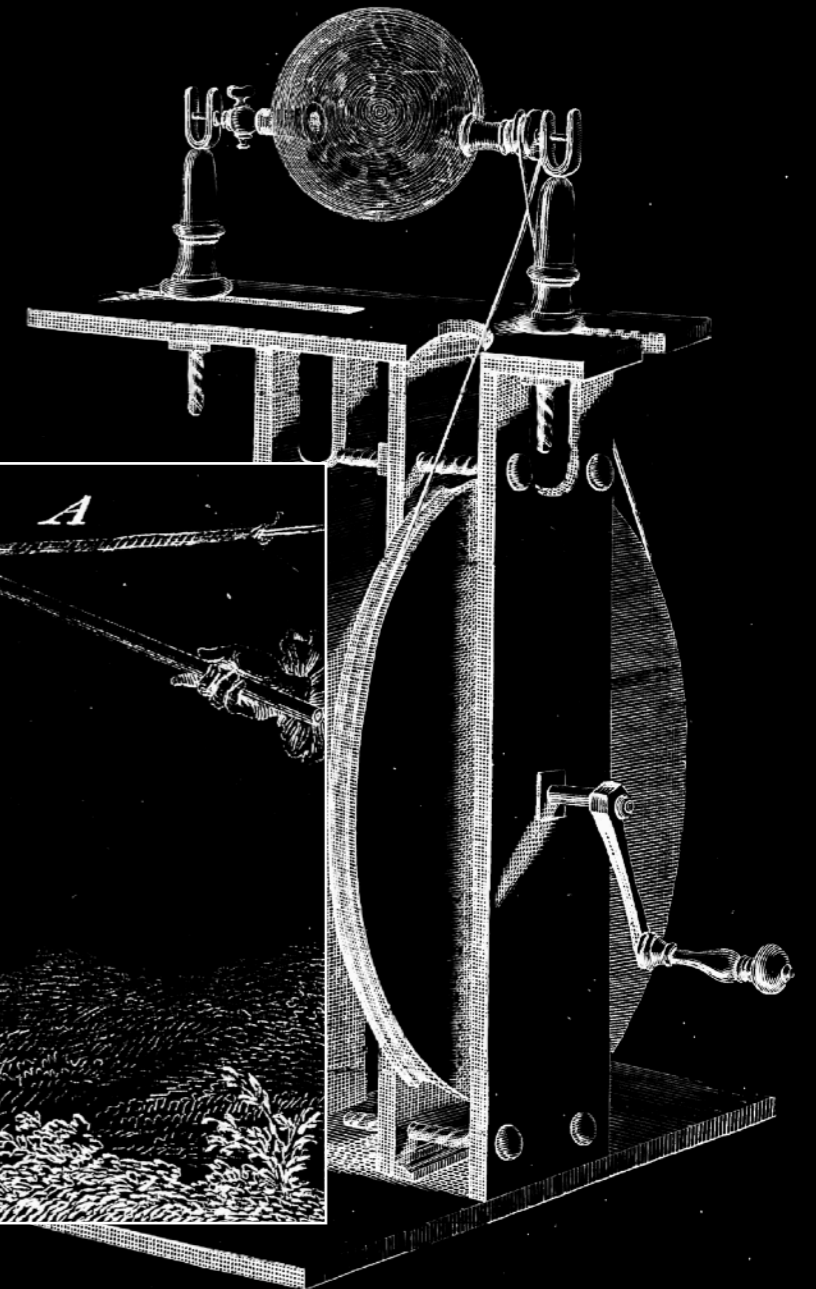
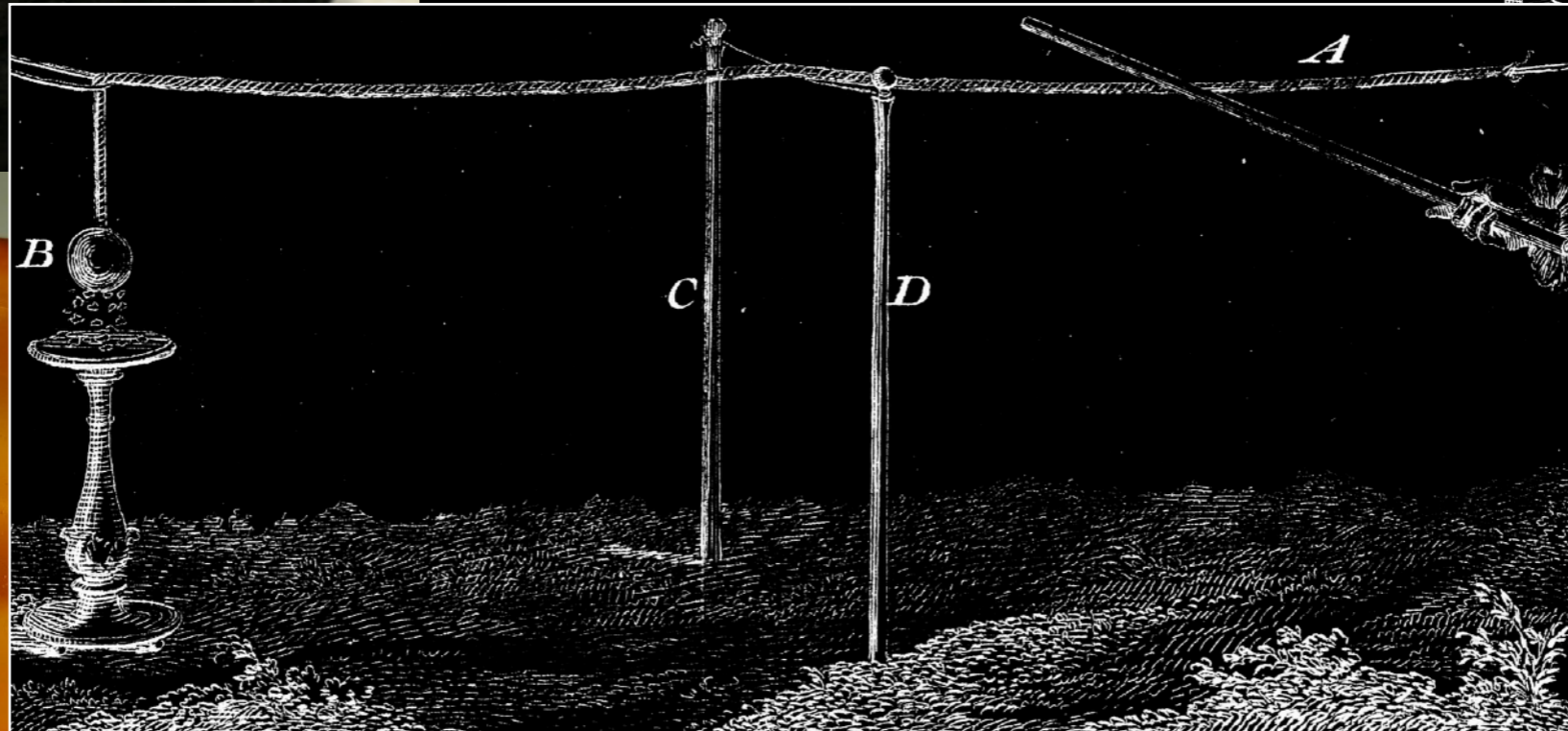
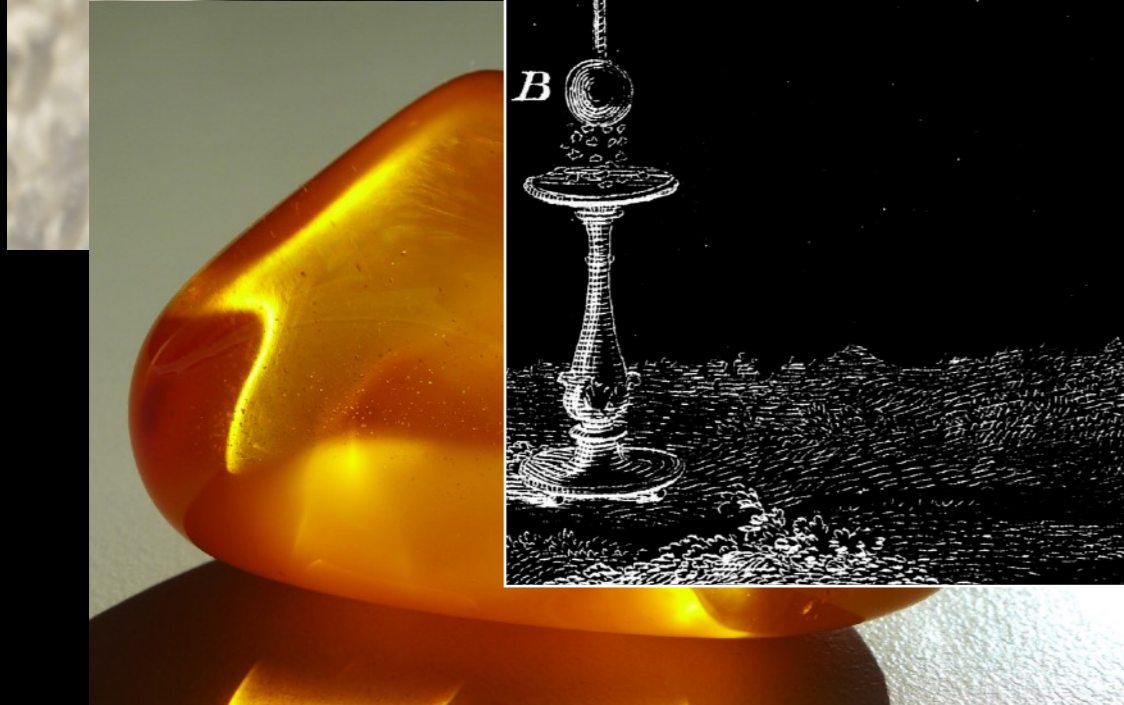
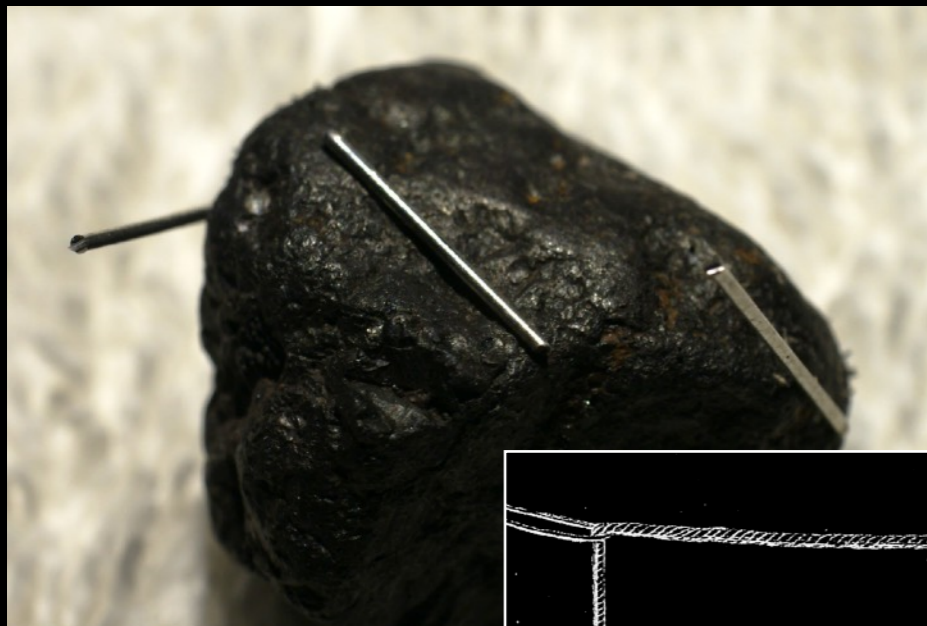


For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

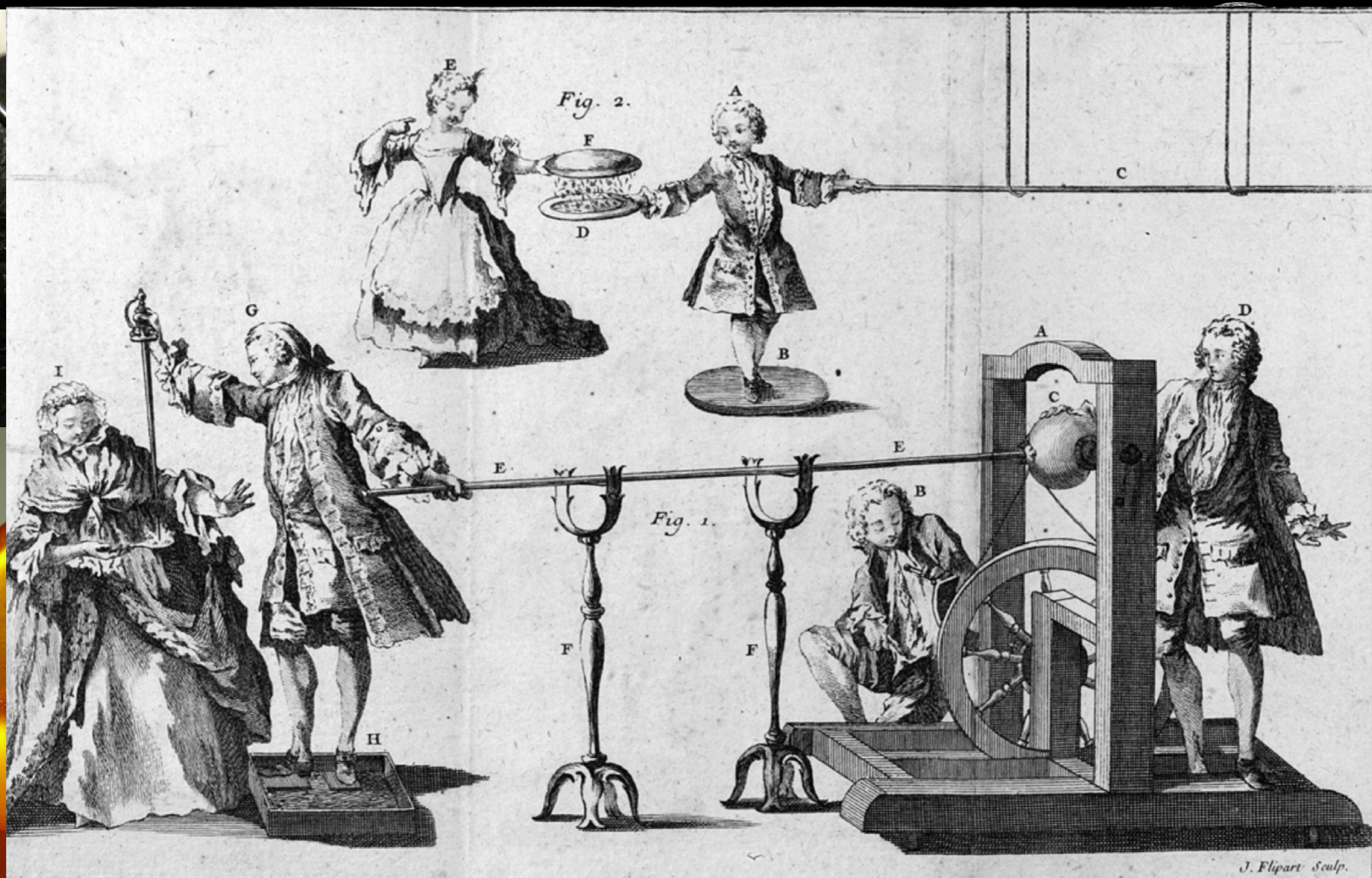


For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

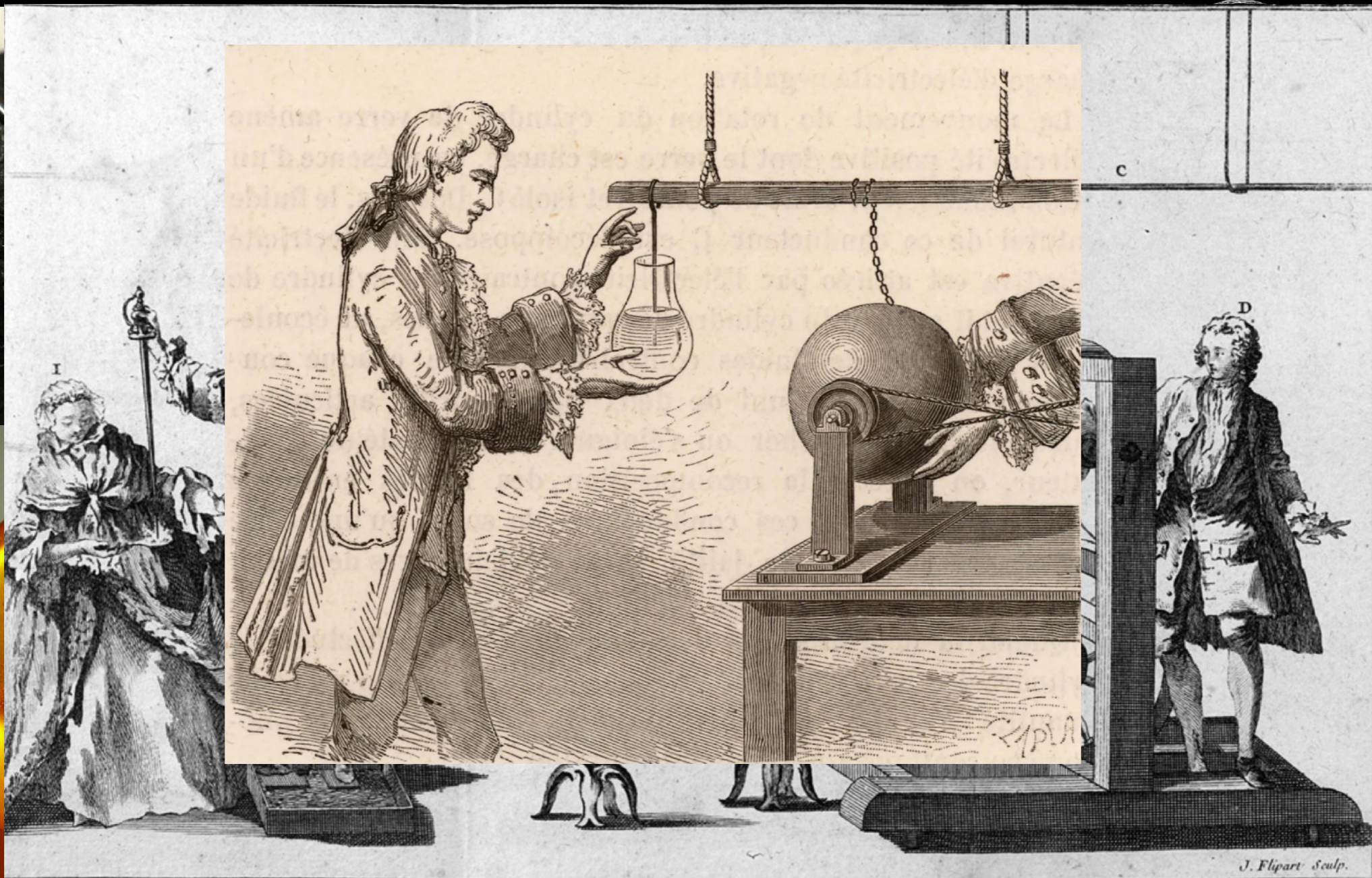


For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

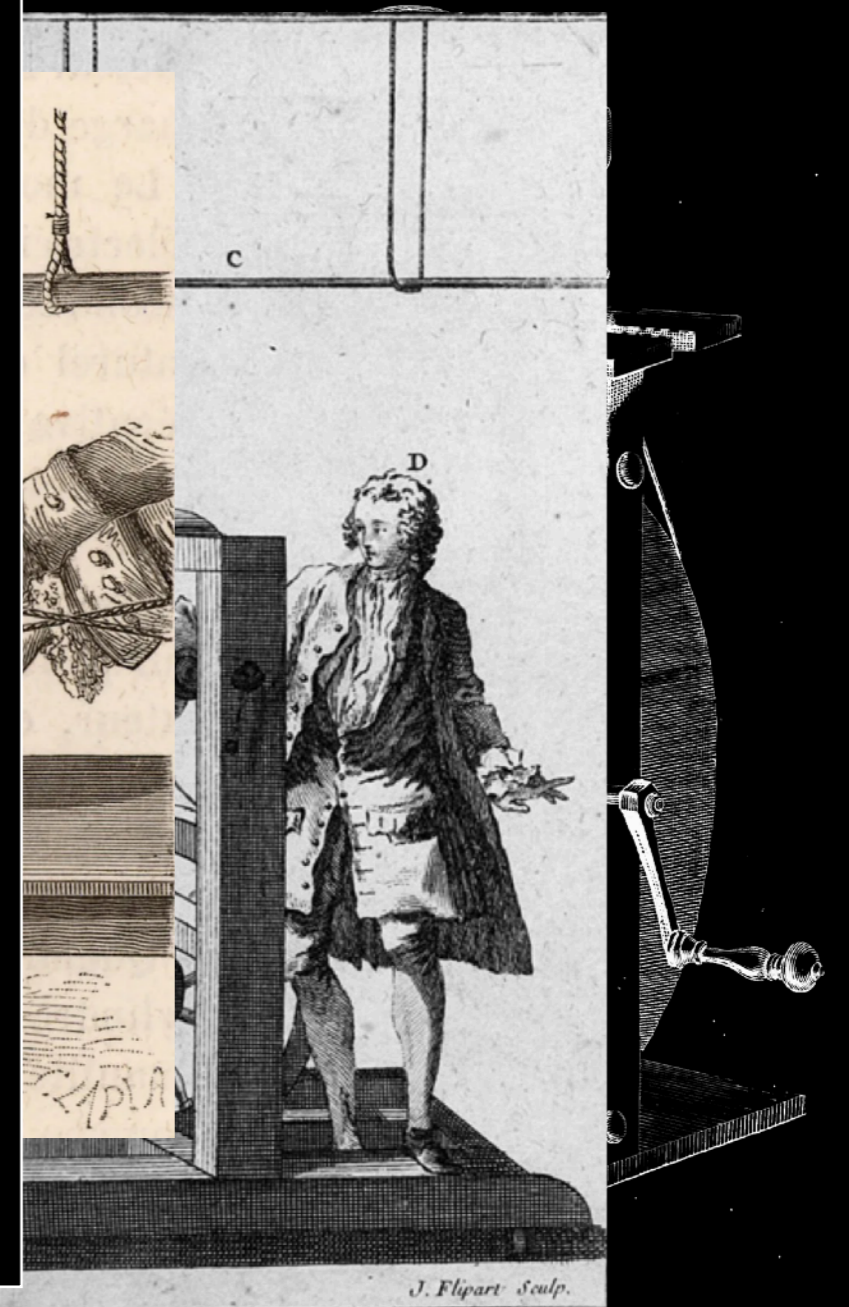
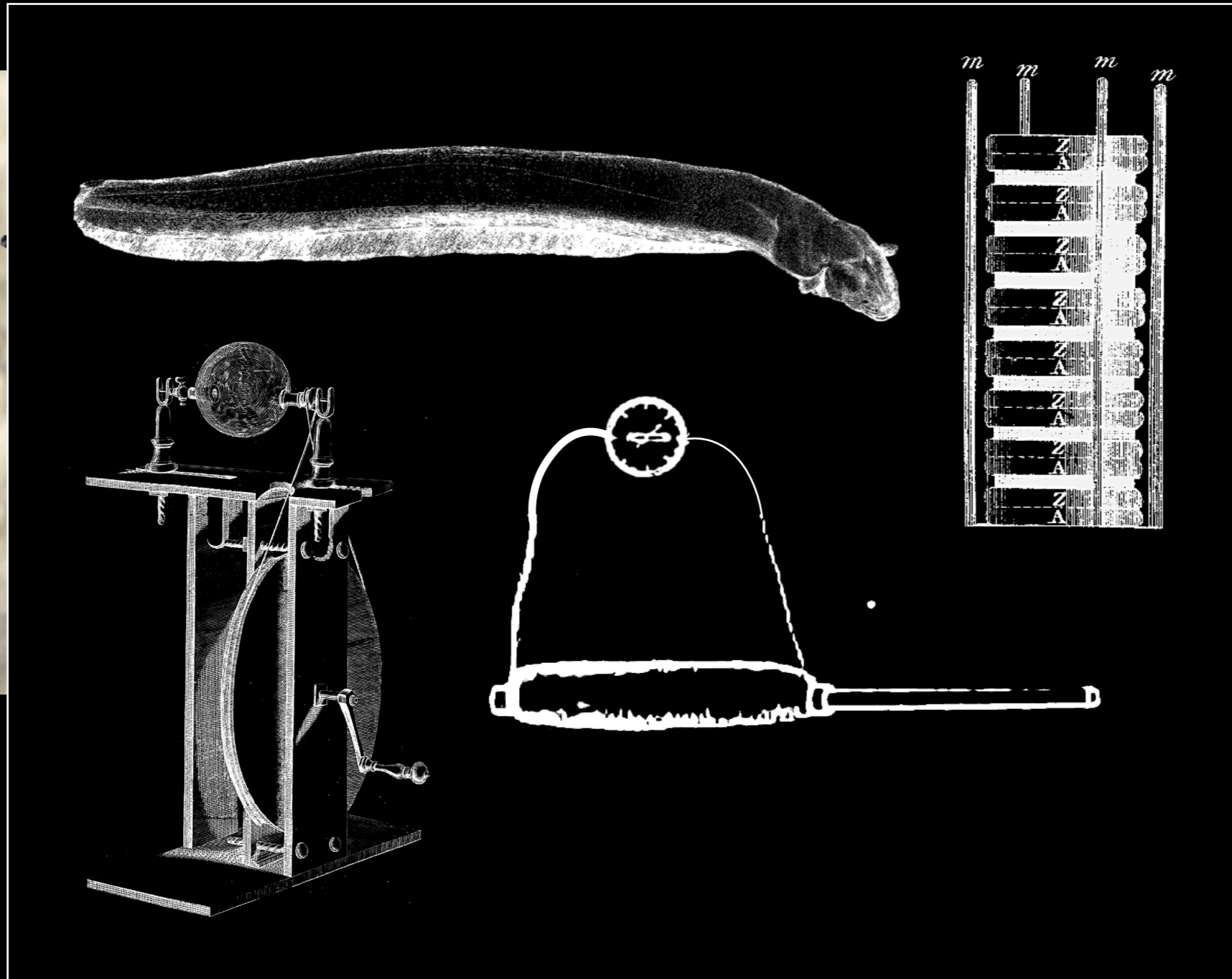


For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”

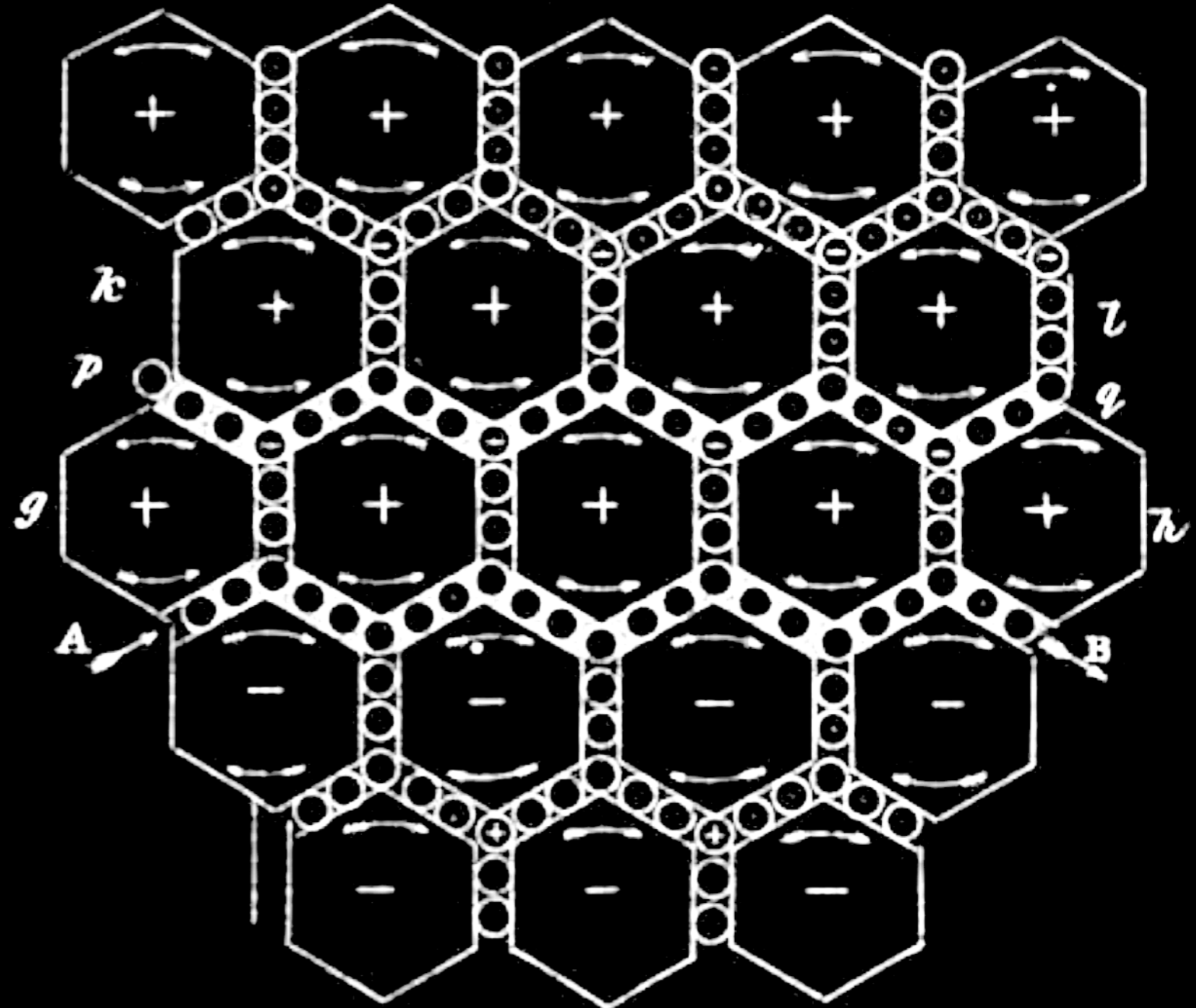
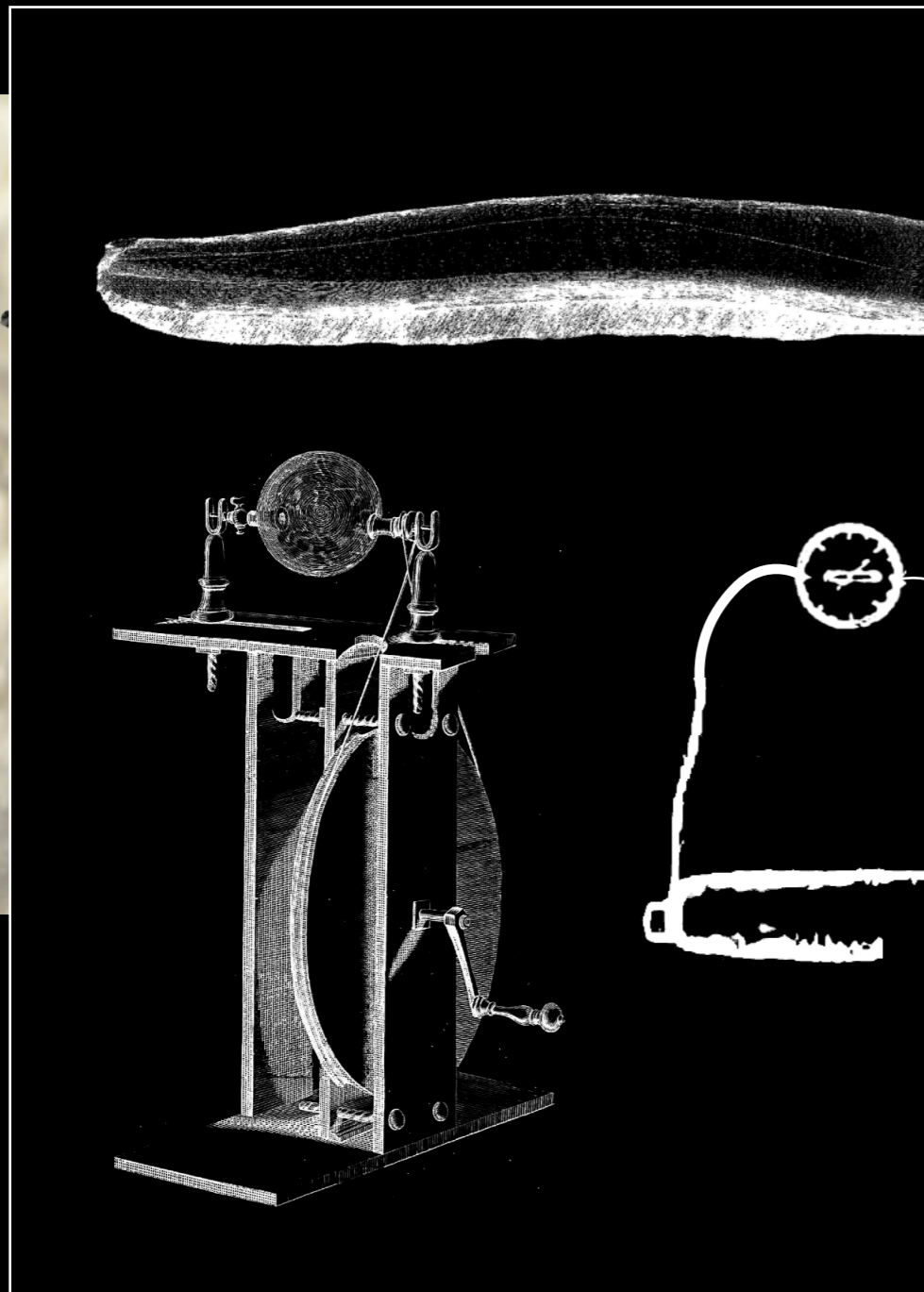


For the next seven lectures ...

Part II:

“What is the nature of electricity?”

“How to communicate without a wire?”



For the next seven lectures ...

Part III:

“What is the nature of matter?”

“How to treat cancer with subatomic particles?”

For the next seven lectures ...

Part III:

“What is the nature of matter?”

“How to treat cancer with subatomic particles?”

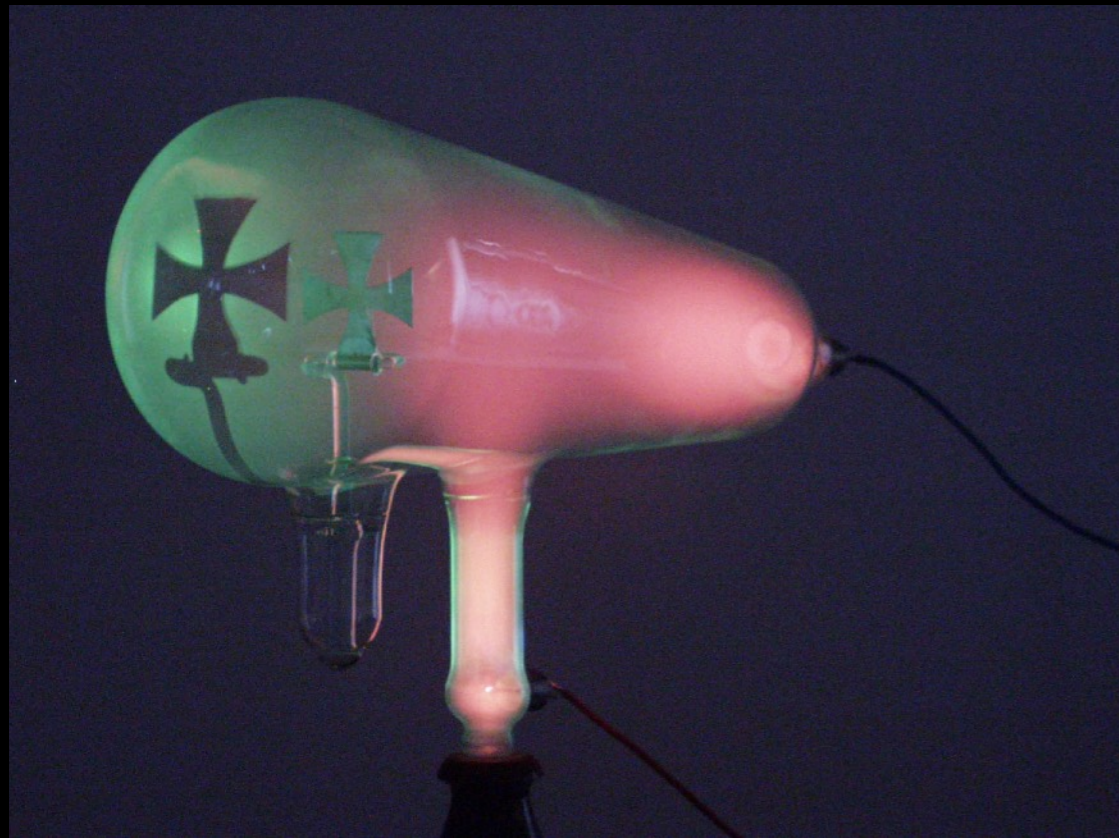


For the next seven lectures ...

Part III:

“What is the nature of matter?”

“How to treat cancer with subatomic particles?”

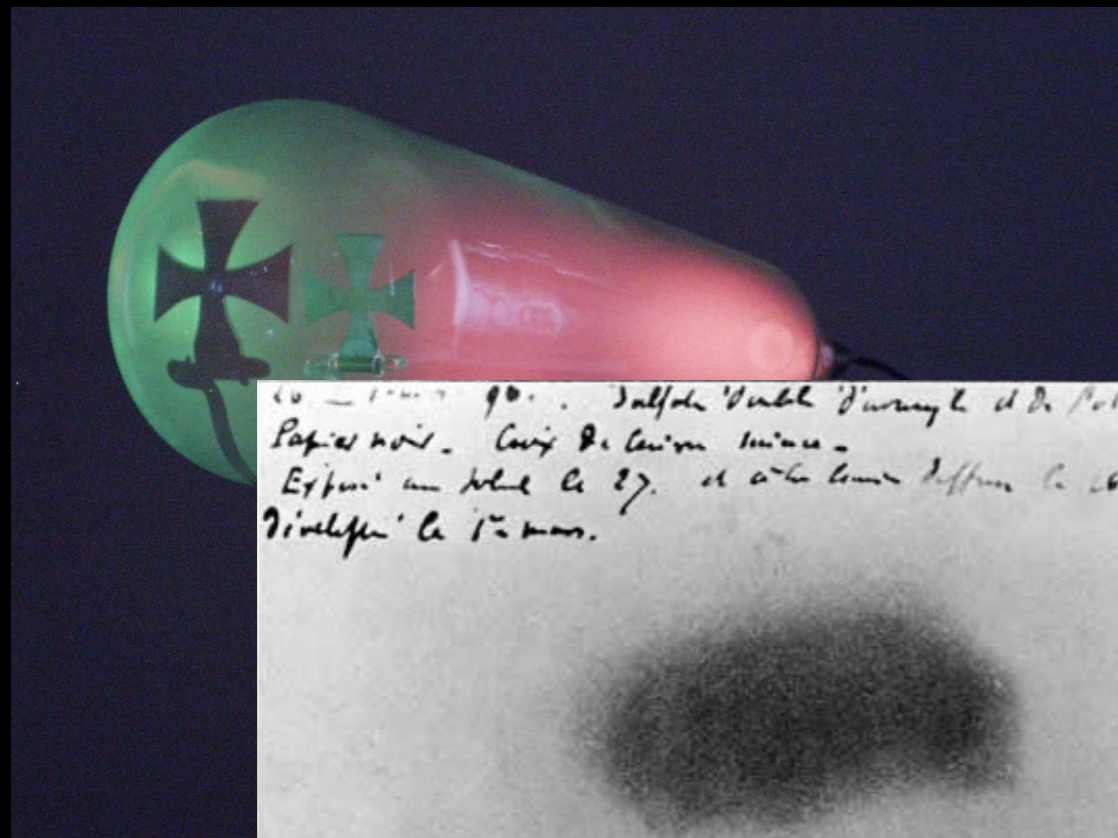


For the next seven lectures ...

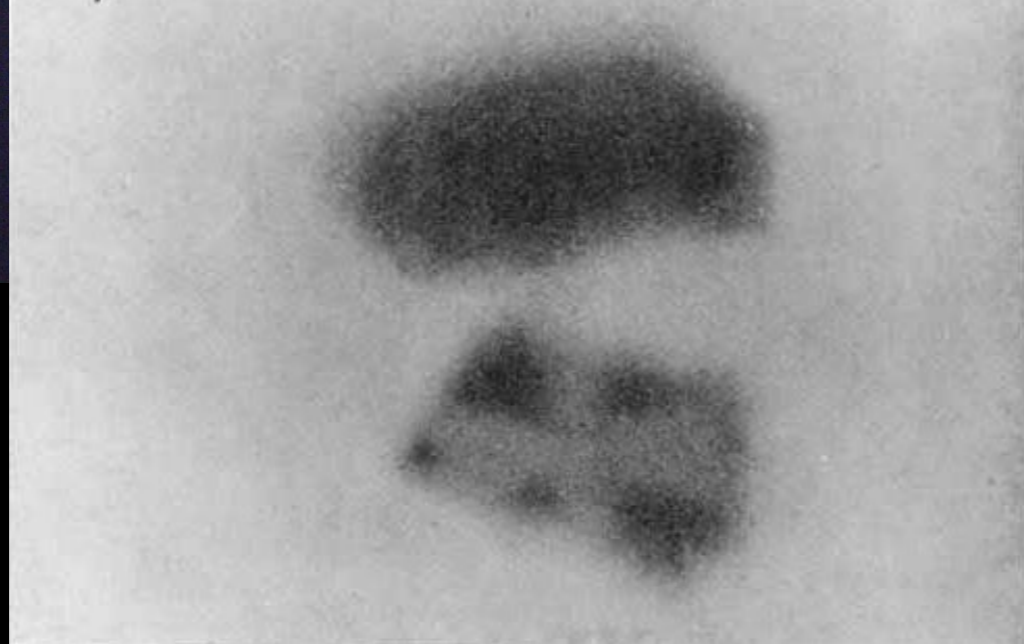
Part III:

“What is the nature of matter?”

“How to treat cancer with subatomic particles?”



60 - 1-11-90. Dalfide 'D'ouble 'D'ursey L. et De Polaris...
Papier noir. Cuvé De Cuvé...
Exposé au total de 27. et à la même distance de 16. -
D'ailleurs à 1-11-90.

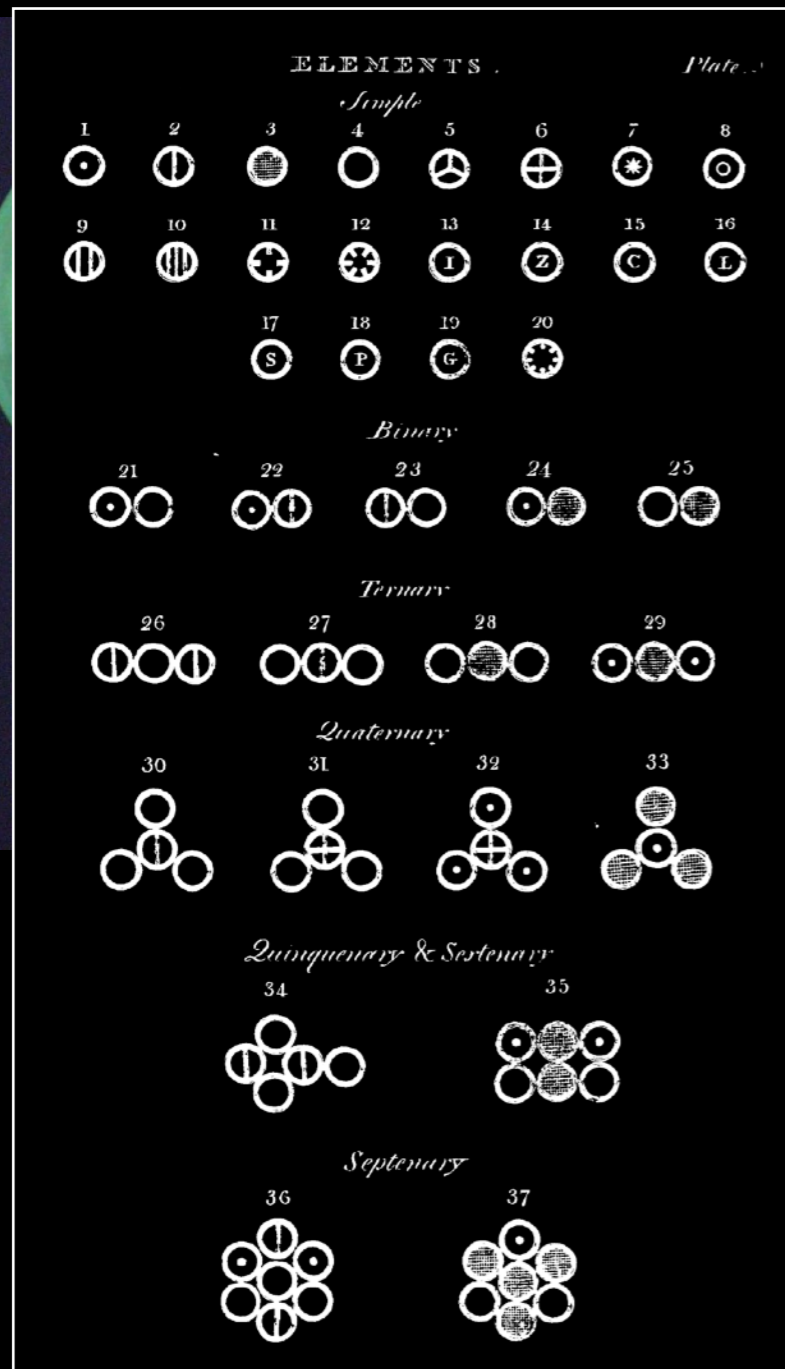


For the next seven lectures ...

Part III:

“What is the nature of matter?”

“How to treat cancer with subatomic particles?”

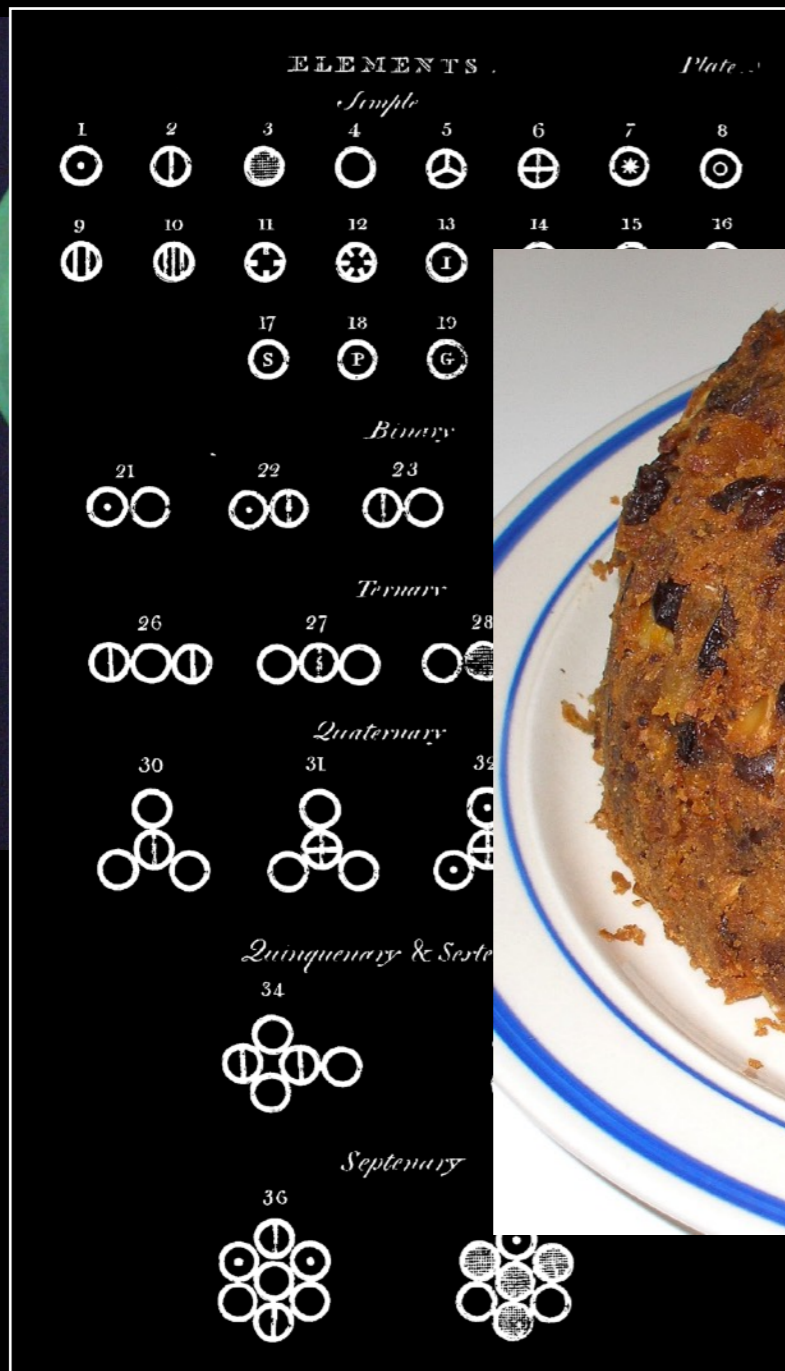


For the next seven lectures ...

Part III:

“What is the nature of matter?”

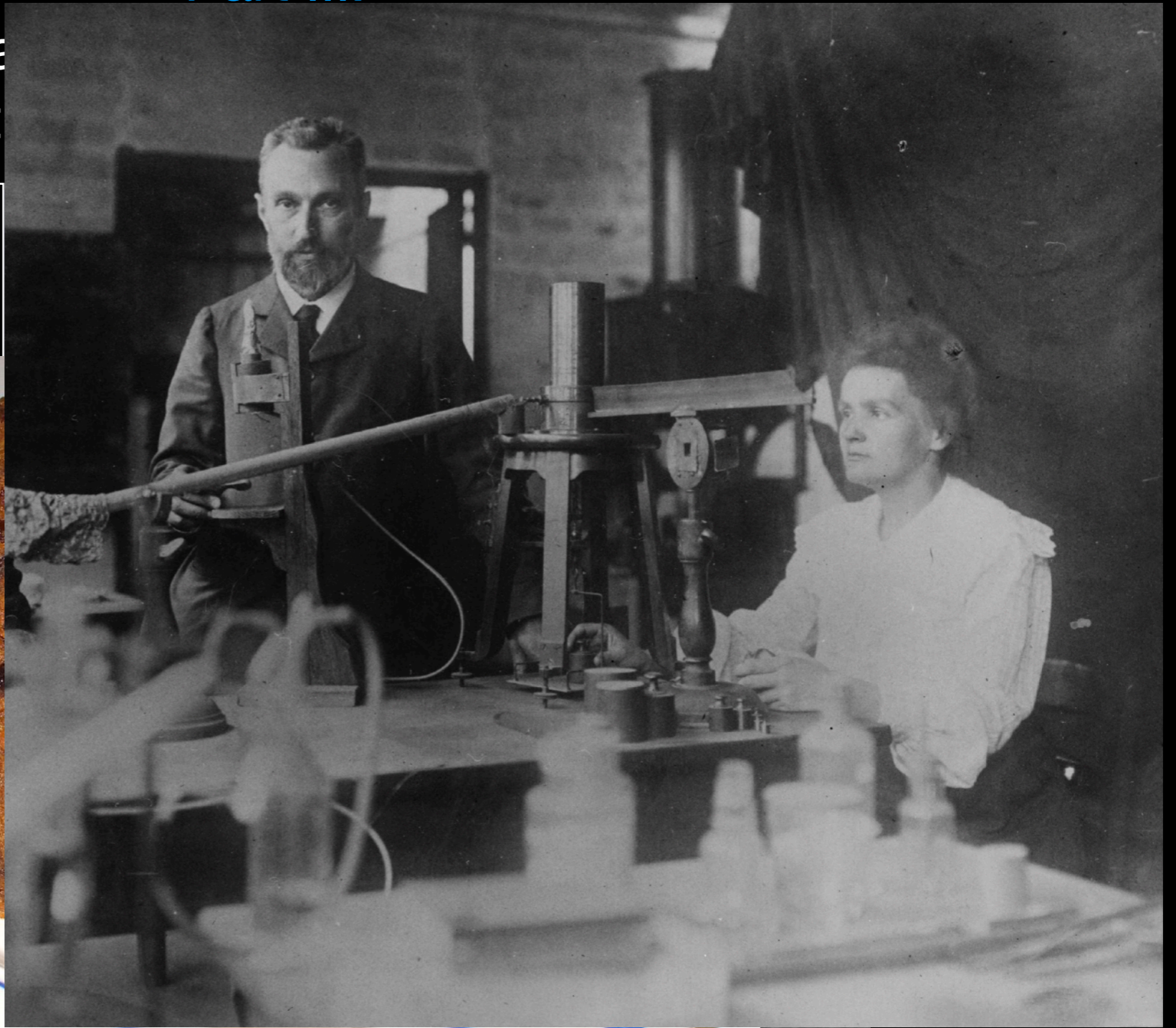
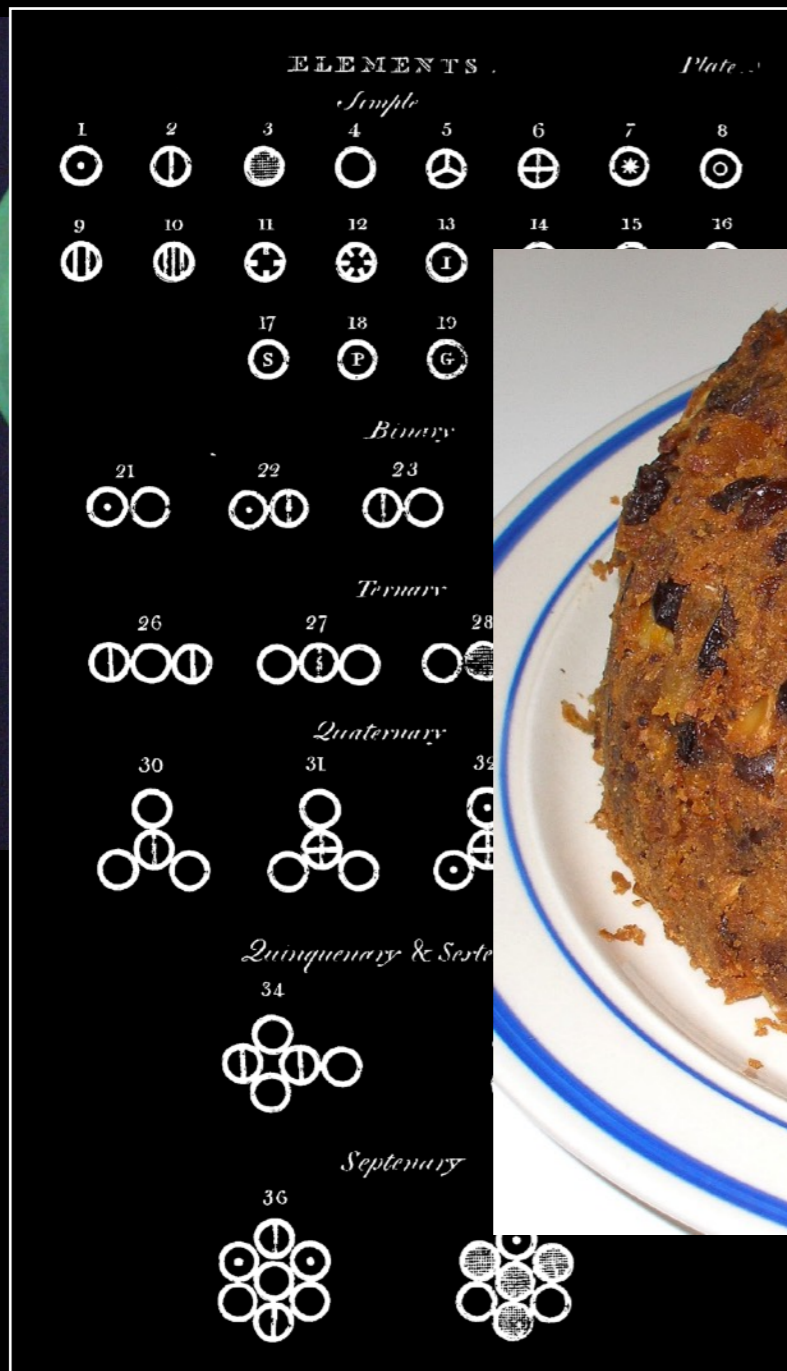
“How to treat cancer with subatomic particles?”



For the next seven lectures ...

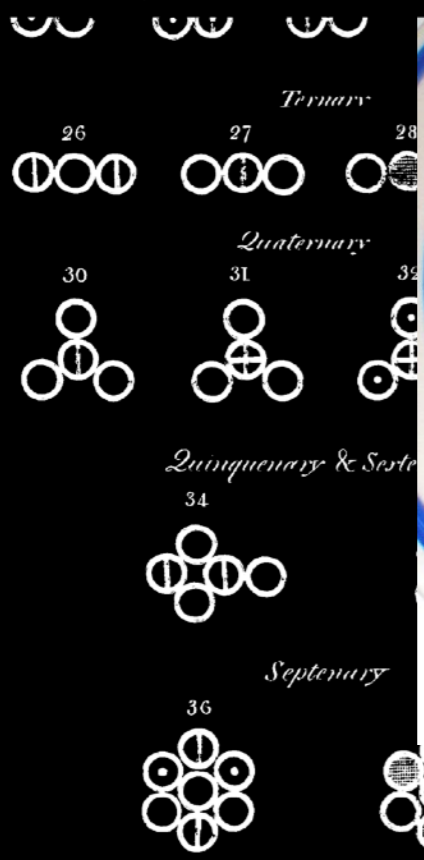
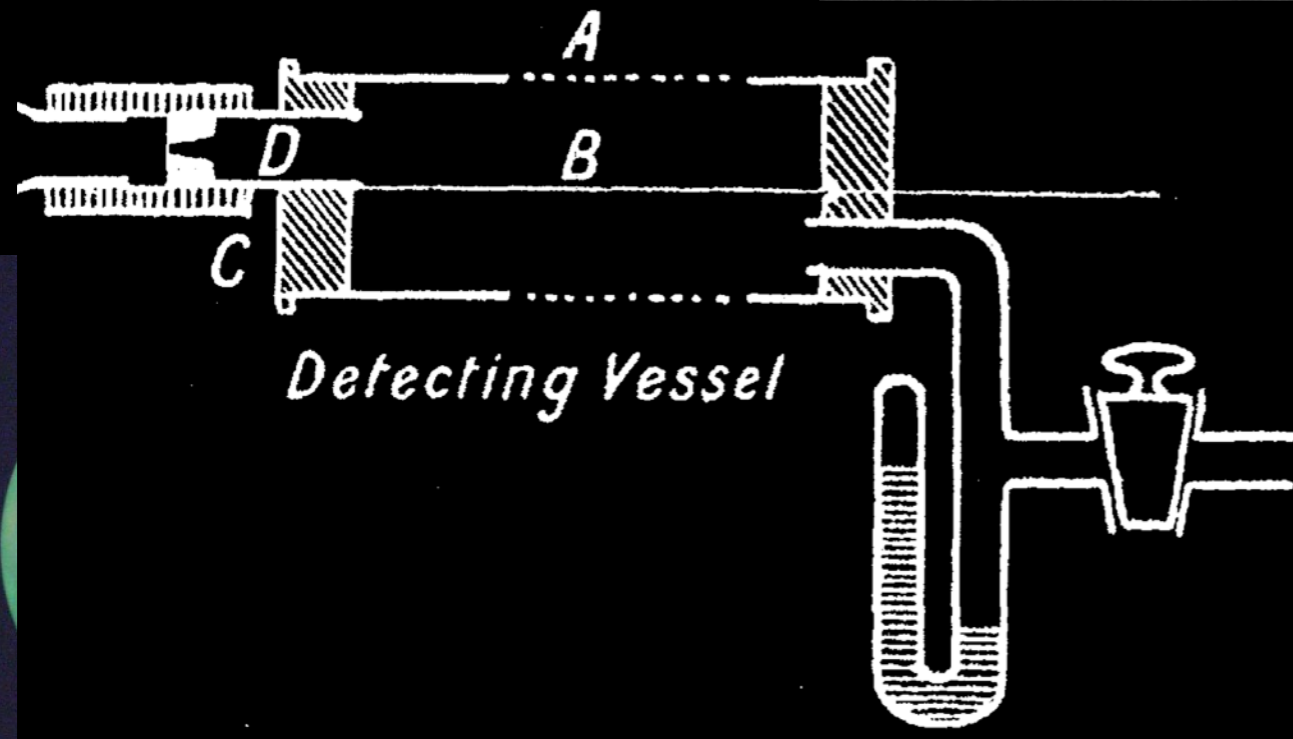
Part III:

“What
“How to treat



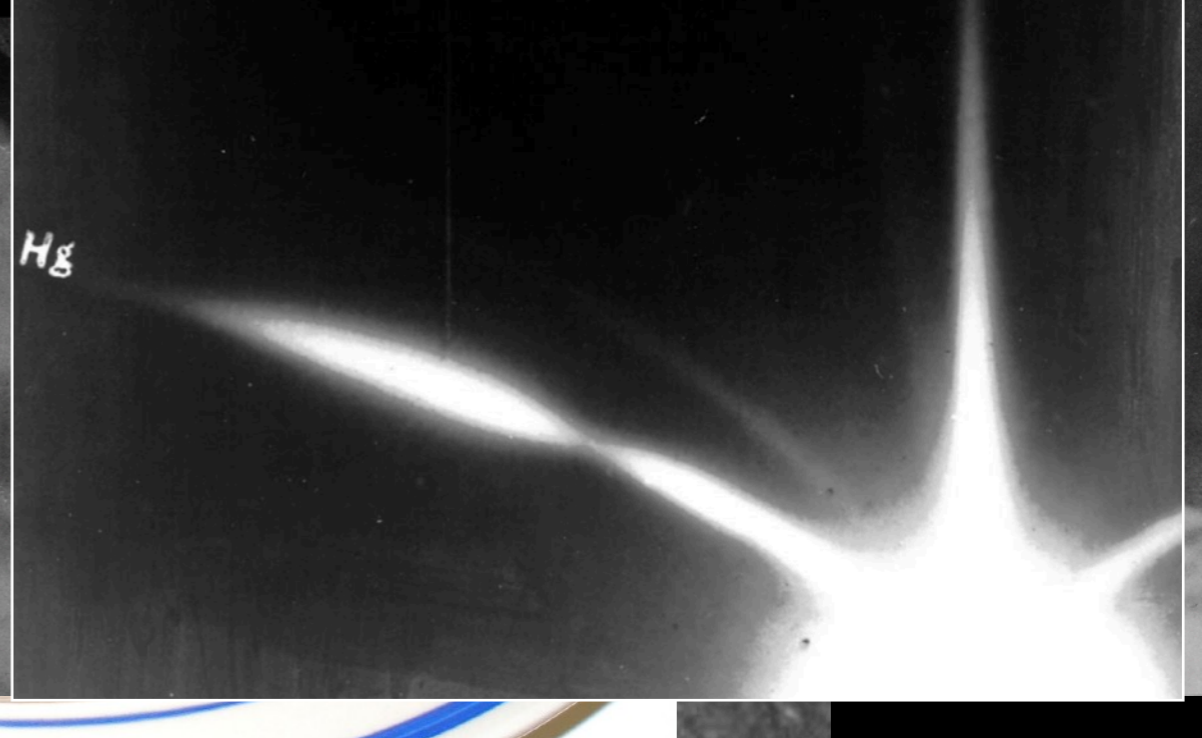
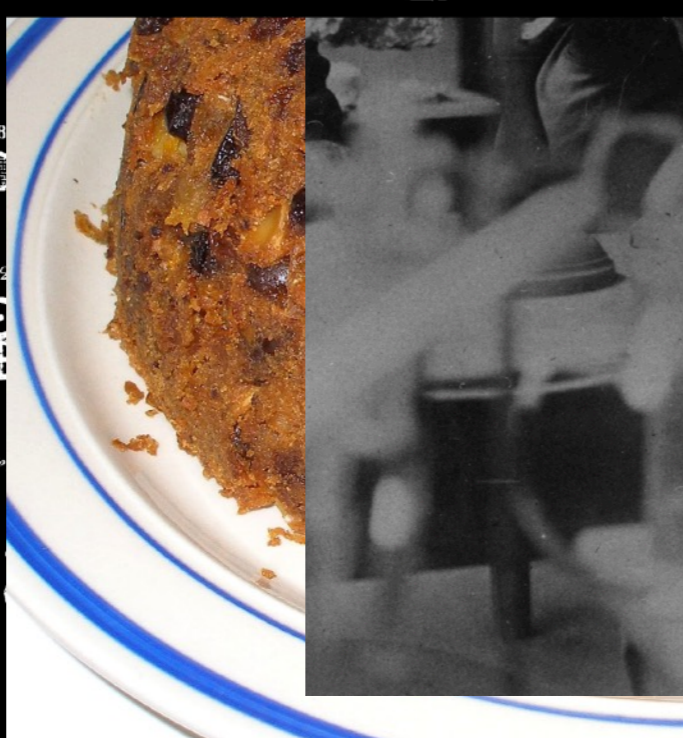
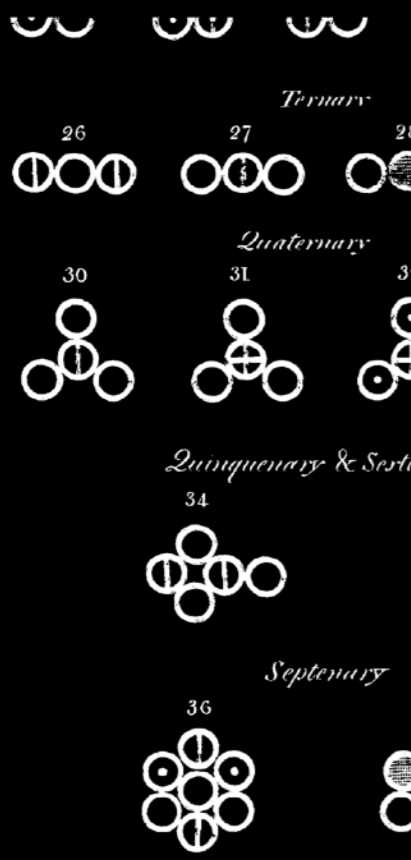
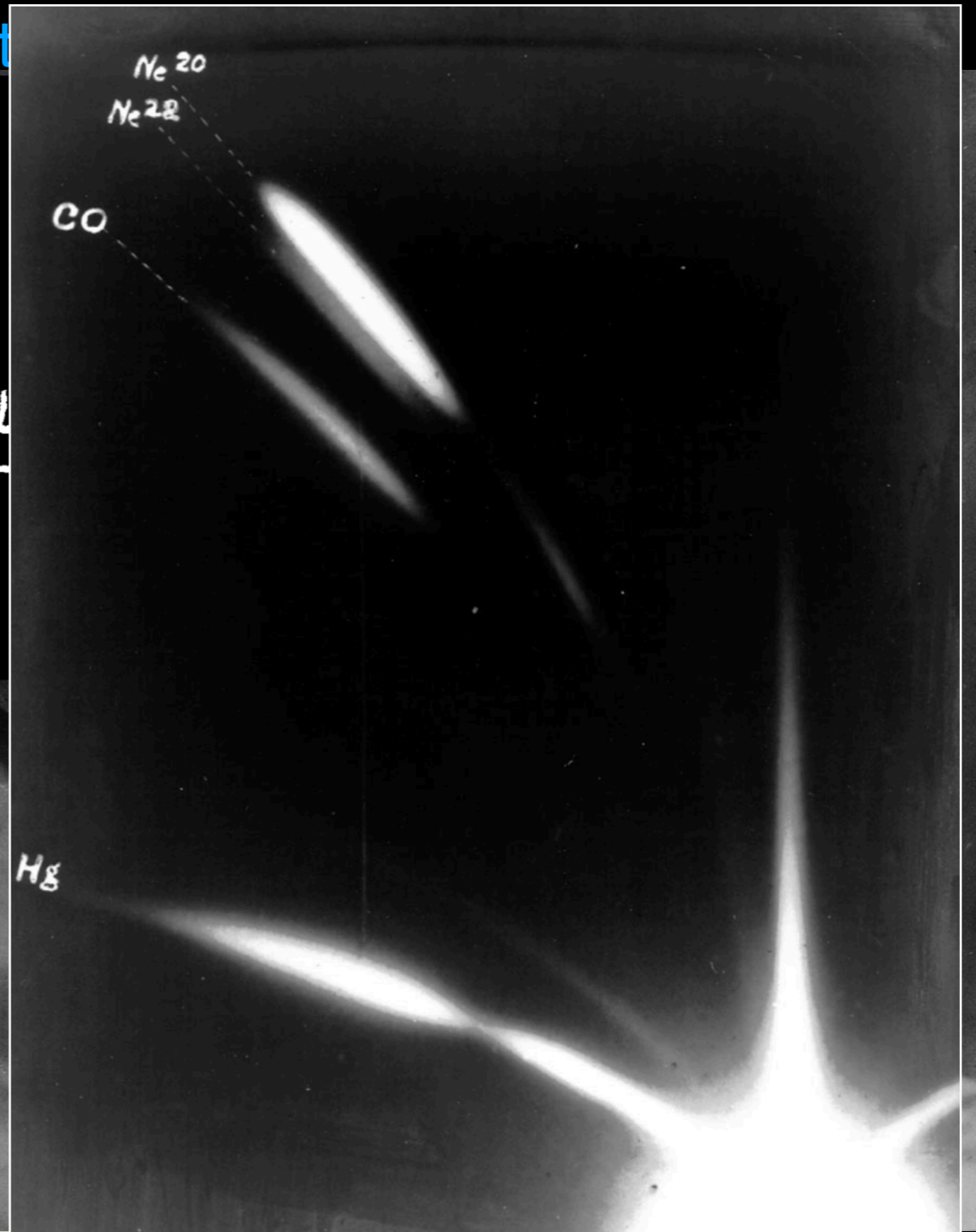
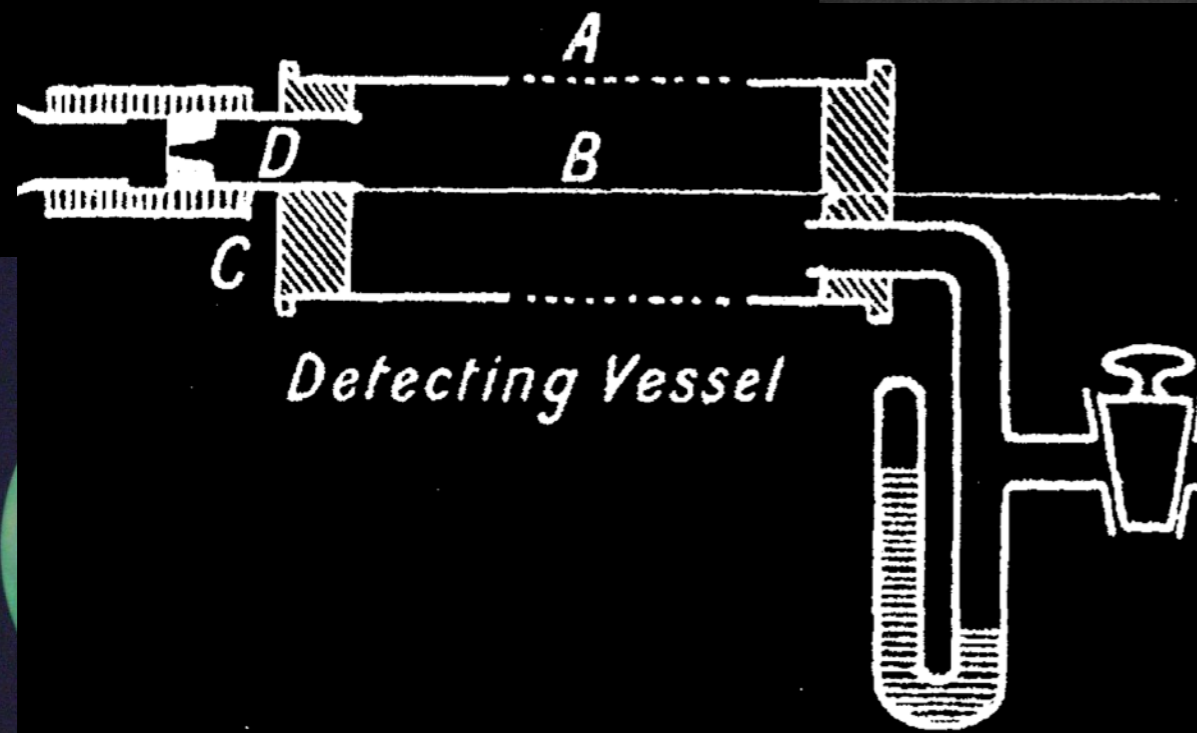
For the next seven lectures ...

Part III:



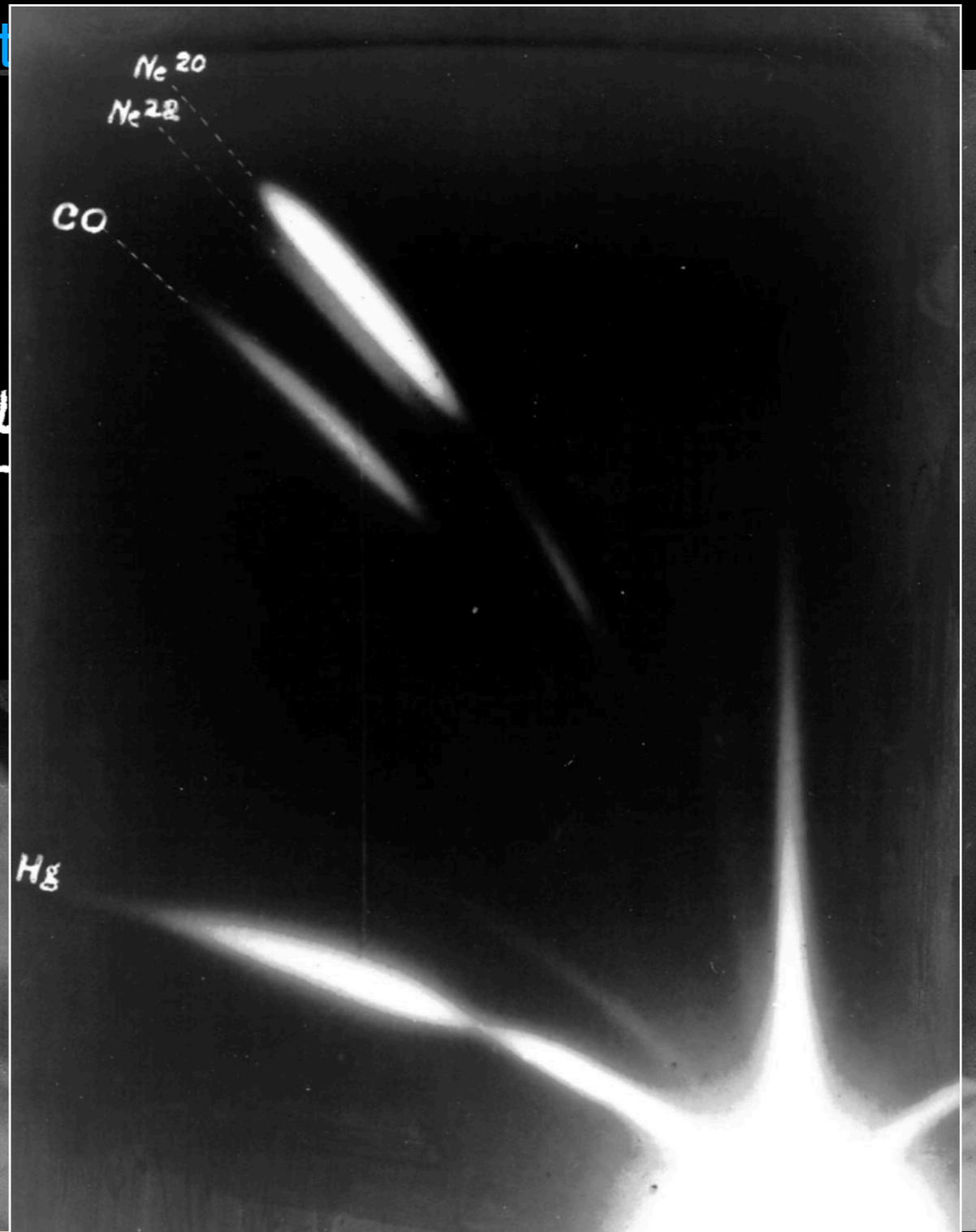
For the next seven lectures ...

Part



For the next seven lectures ...

Part

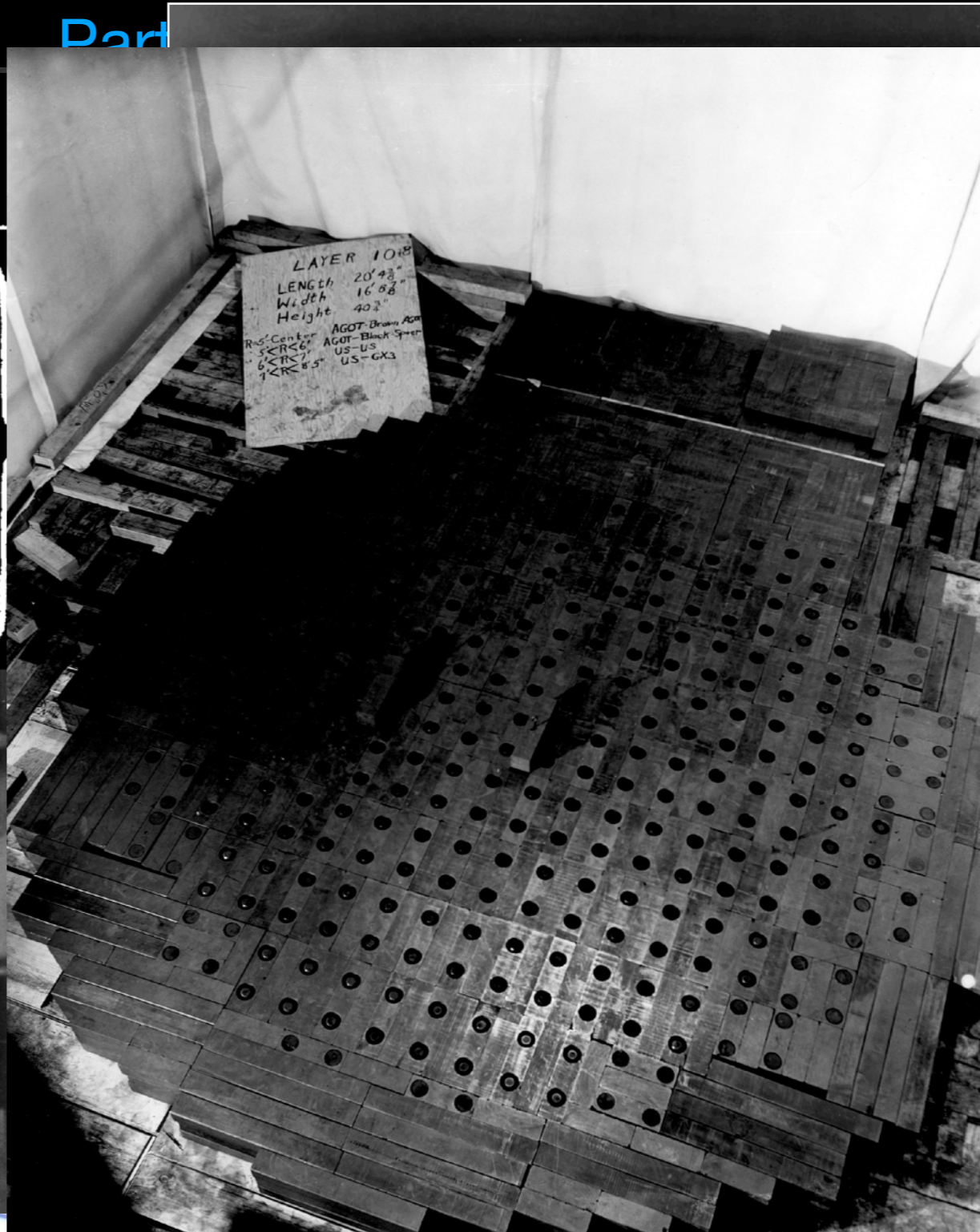


Septemary

36

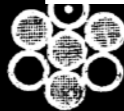


For the next seven lectures ...



Septemary

36





**HOW FUNDAMENTAL SCIENCE
HAS CHANGED THE WORLD**

A STORY OF INVENTION AND DISCOVERY

This is also my story!



Grein, Austria

This is also my story!

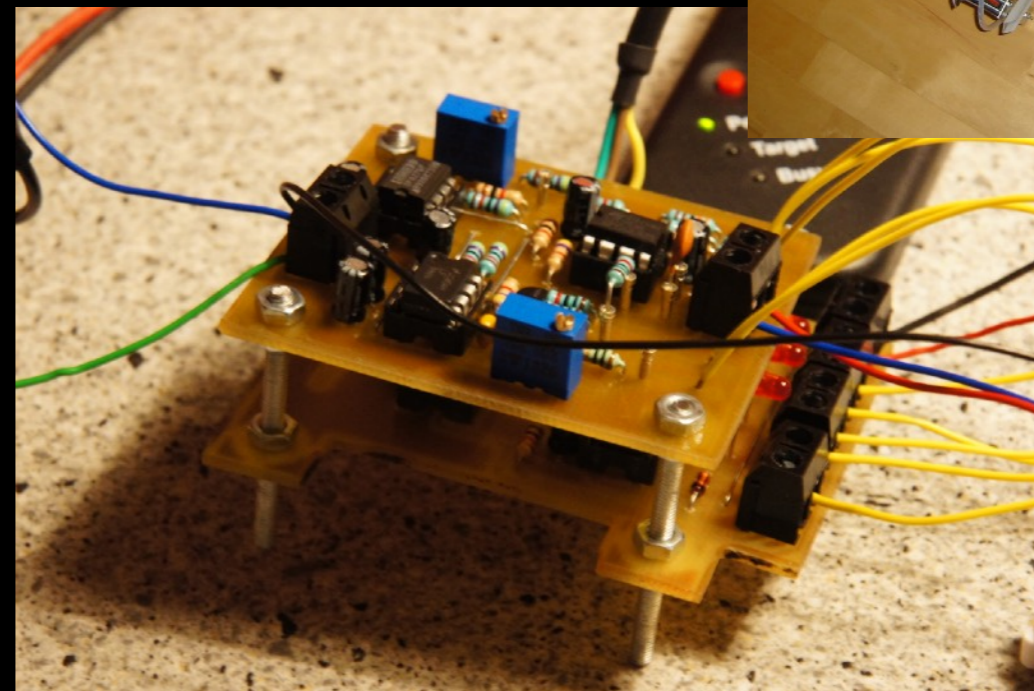
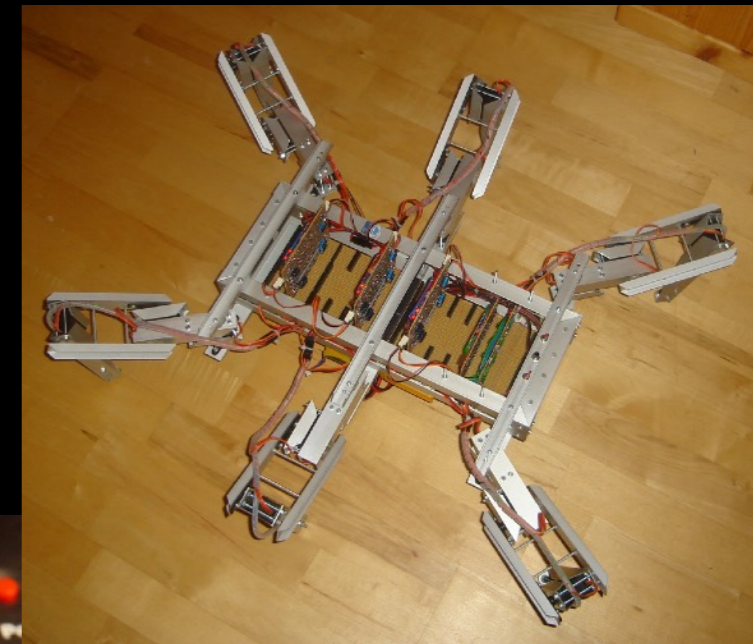


This is also my story!

2007–2011: Fell in love with electronics during high school



Home-made electronics
(from scratch) in my
parents' basement



This is also my story!



This is also my story!

2013–2016: Studying physics in Vienna

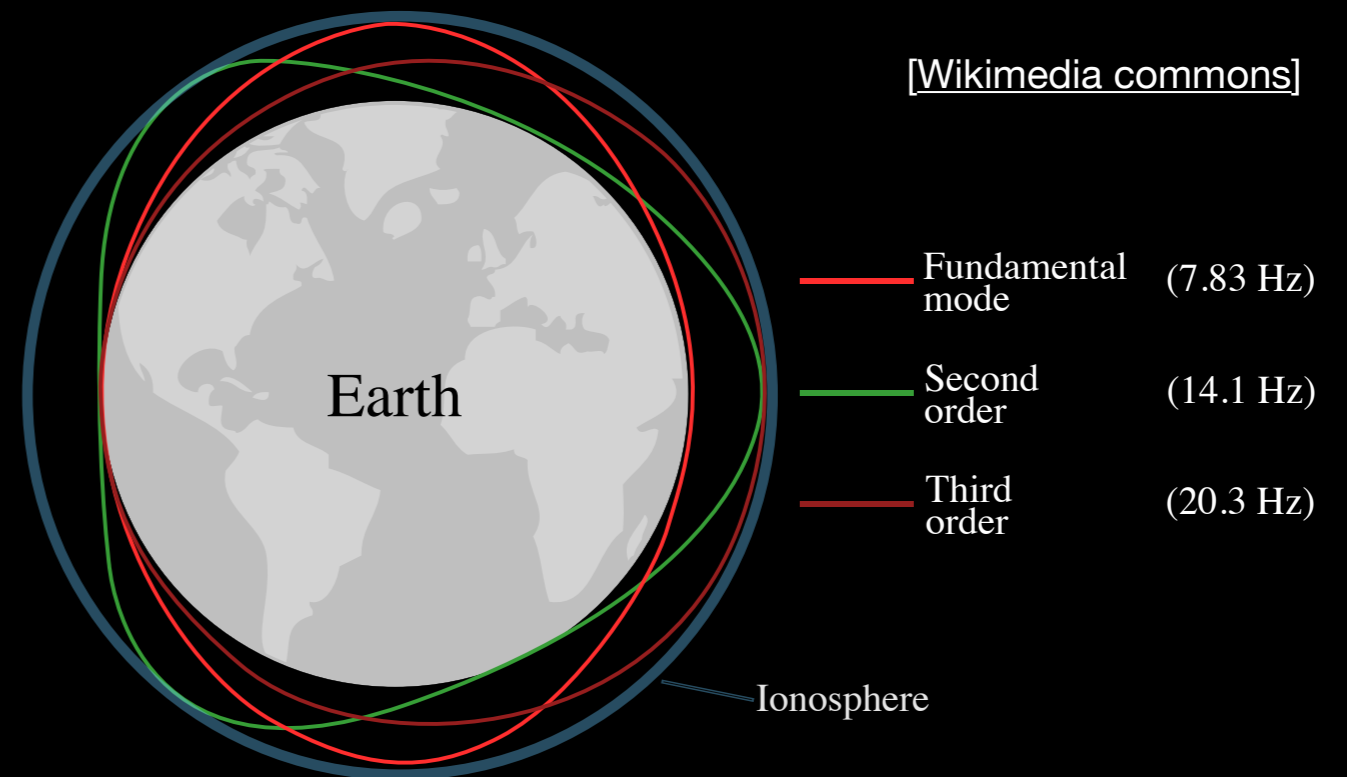


This is also my story!

2013–2016: Studying physics in Vienna

Learned about radio waves

→ measured Schumann resonances of the Earth



This is also my story!

2013–2016: Studying physics in Vienna

Learned about radio waves

→ measured Schumann resonances of the Earth



This is also my story!

2013–2016: Studying physics in Vienna

Learned about radio waves

→ measured Schumann resonances of the Earth

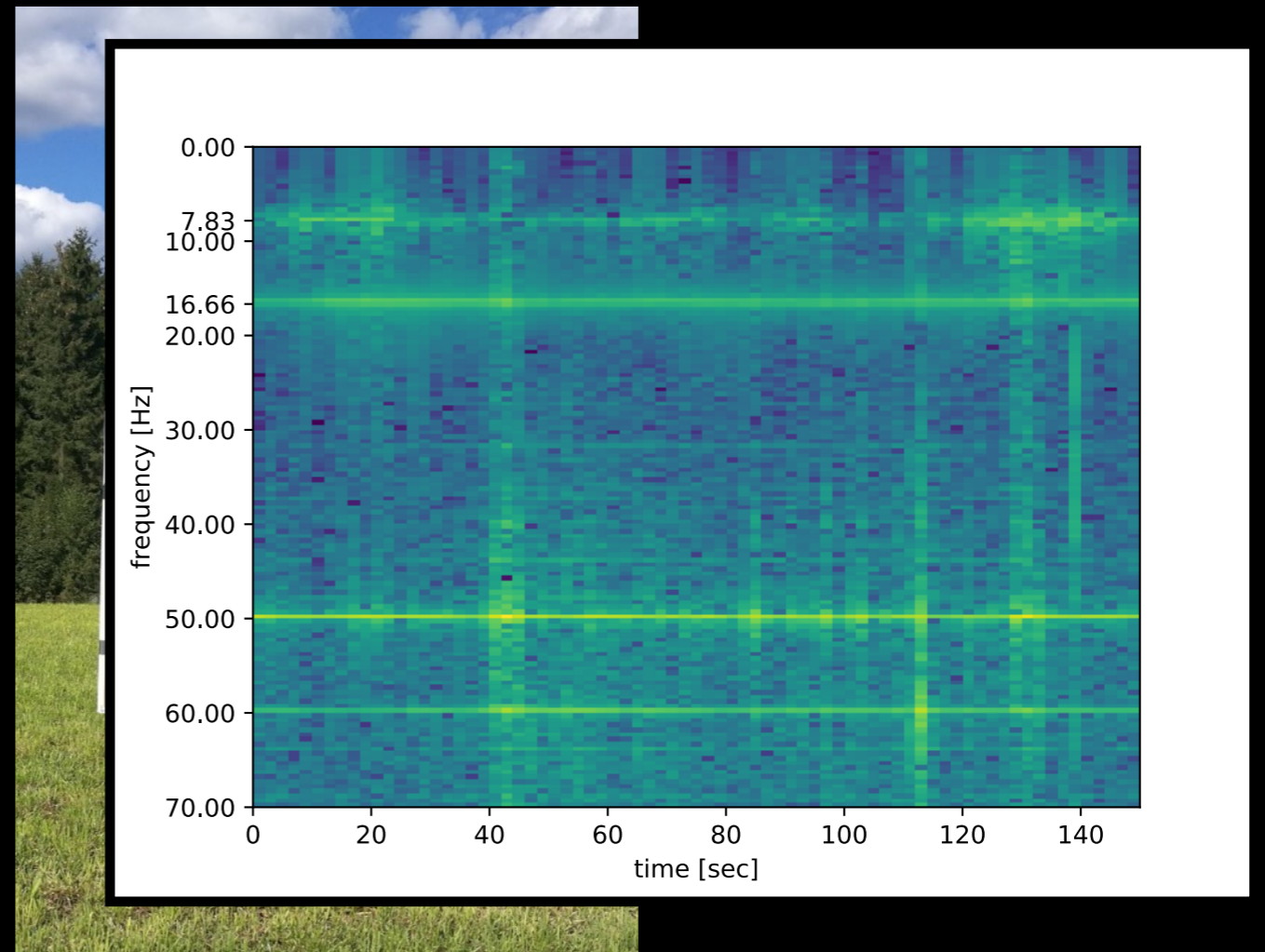


This is also my story!

2013–2016: Studying physics in Vienna

Learned about radio waves

→ measured Schumann resonances of the Earth



This is also my story!

2013–2016: Studying physics in Vienna



This is also my story!

2013–2016: Studying physics in Vienna

Learned about plasma physics and nuclear fusion
→ built a simple nuclear fusion reactor at home
(*“Farnsworth-Hirsch fusor”*)



This is also my story!

2013–2016: Studying physics in Vienna

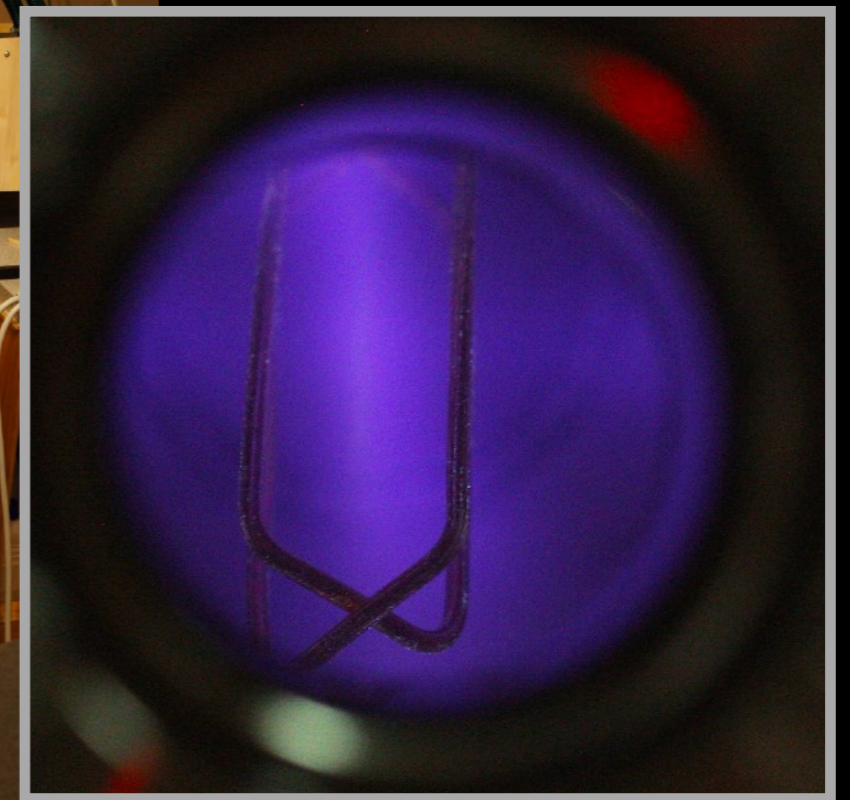
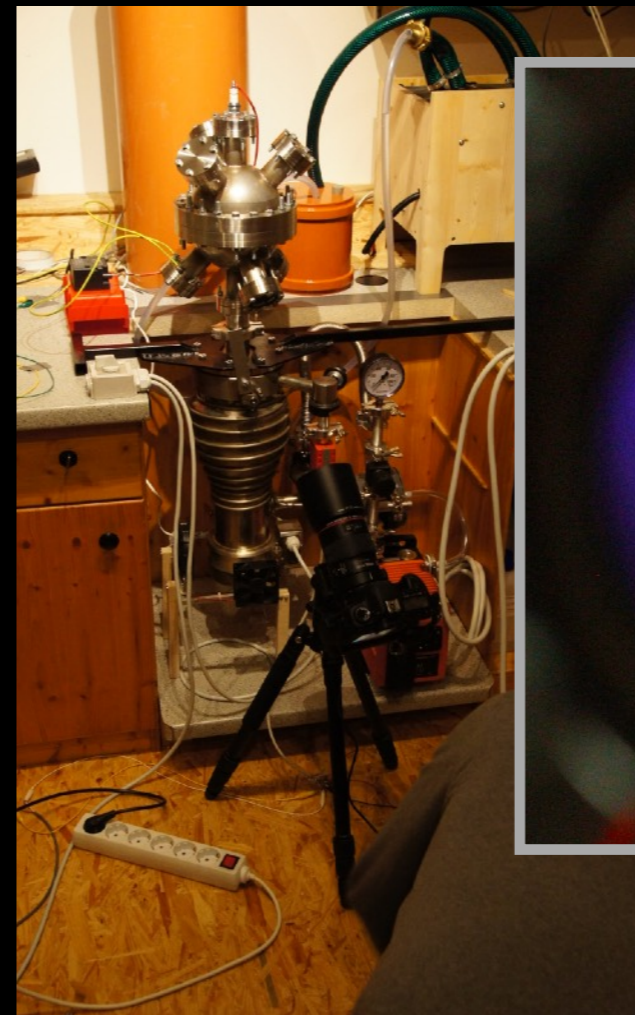
Learned about plasma physics and nuclear fusion
→ built a simple nuclear fusion reactor at home
(*“Farnsworth-Hirsch fusor”*)



This is also my story!

2013–2016: Studying physics in Vienna

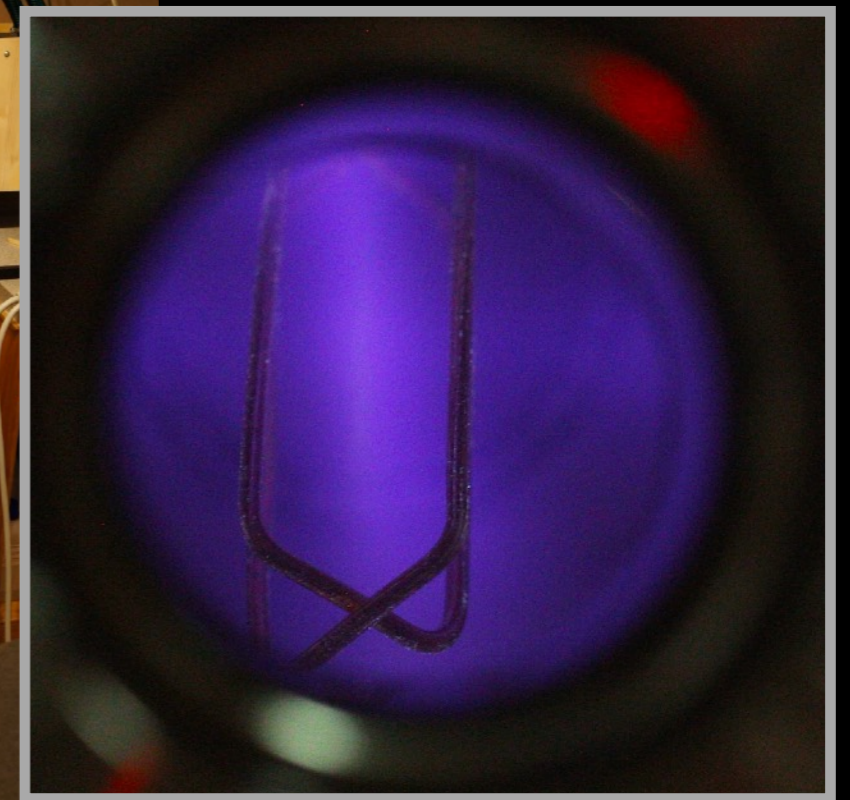
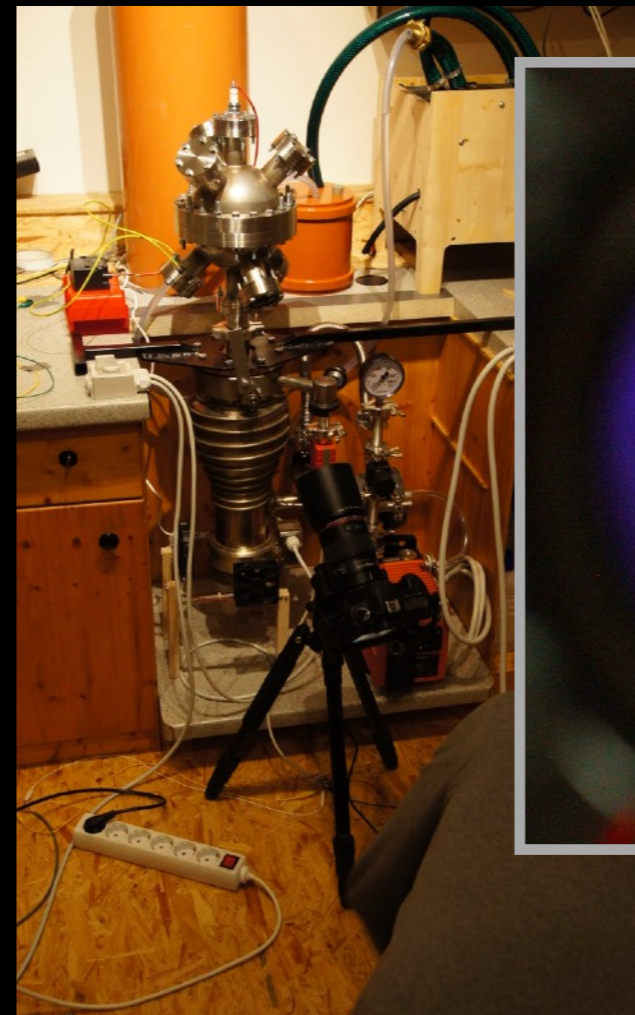
Learned about plasma physics and nuclear fusion
→ built a simple nuclear fusion reactor at home
(*“Farnsworth-Hirsch fusor”*)



This is also my story!

2013–2016: Studying physics in Vienna

Learned about plasma physics and nuclear fusion
→ built a simple nuclear fusion reactor at home
(*"Farnsworth-Hirsch fusor"*)

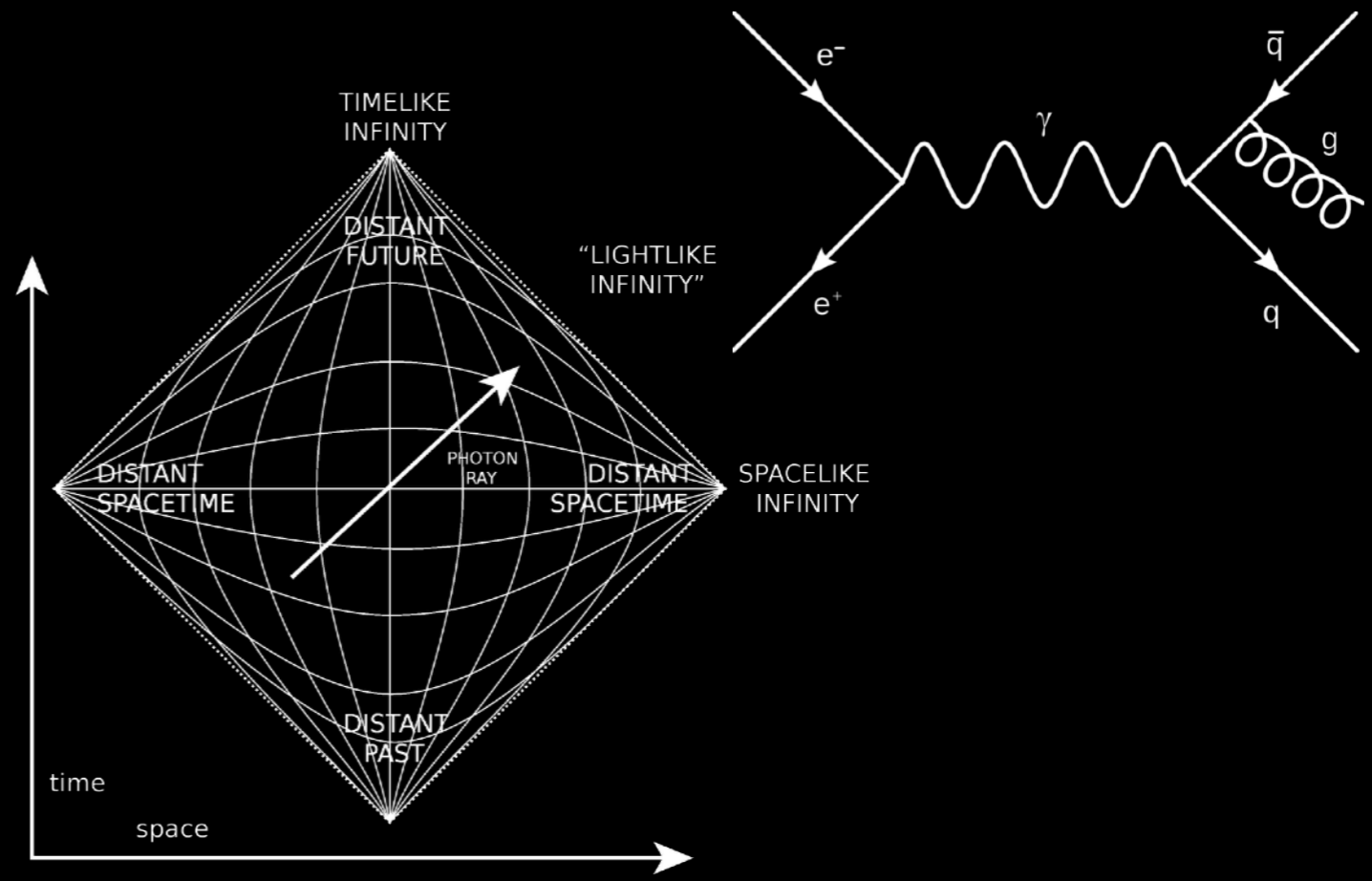
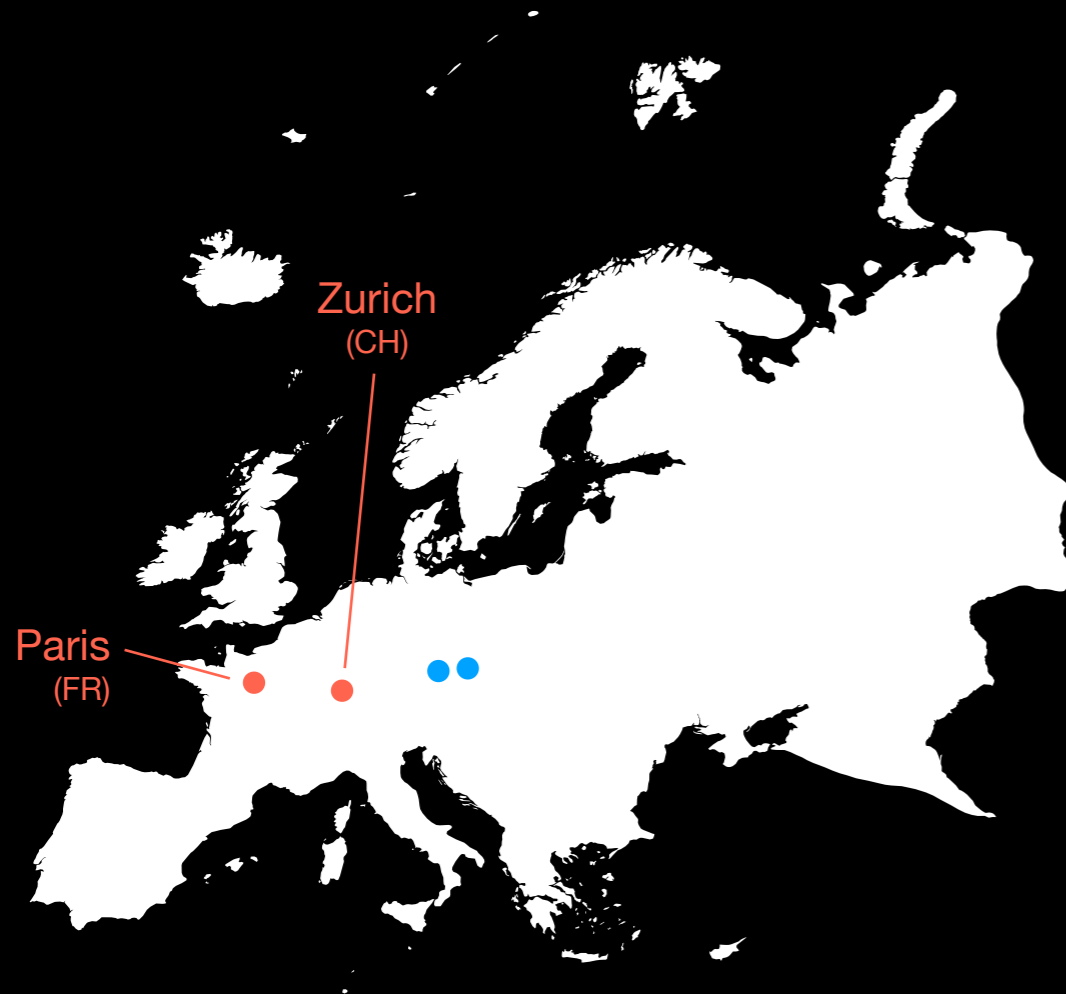


Convincing mum that it's safe wasn't easy ...

This is also my story!

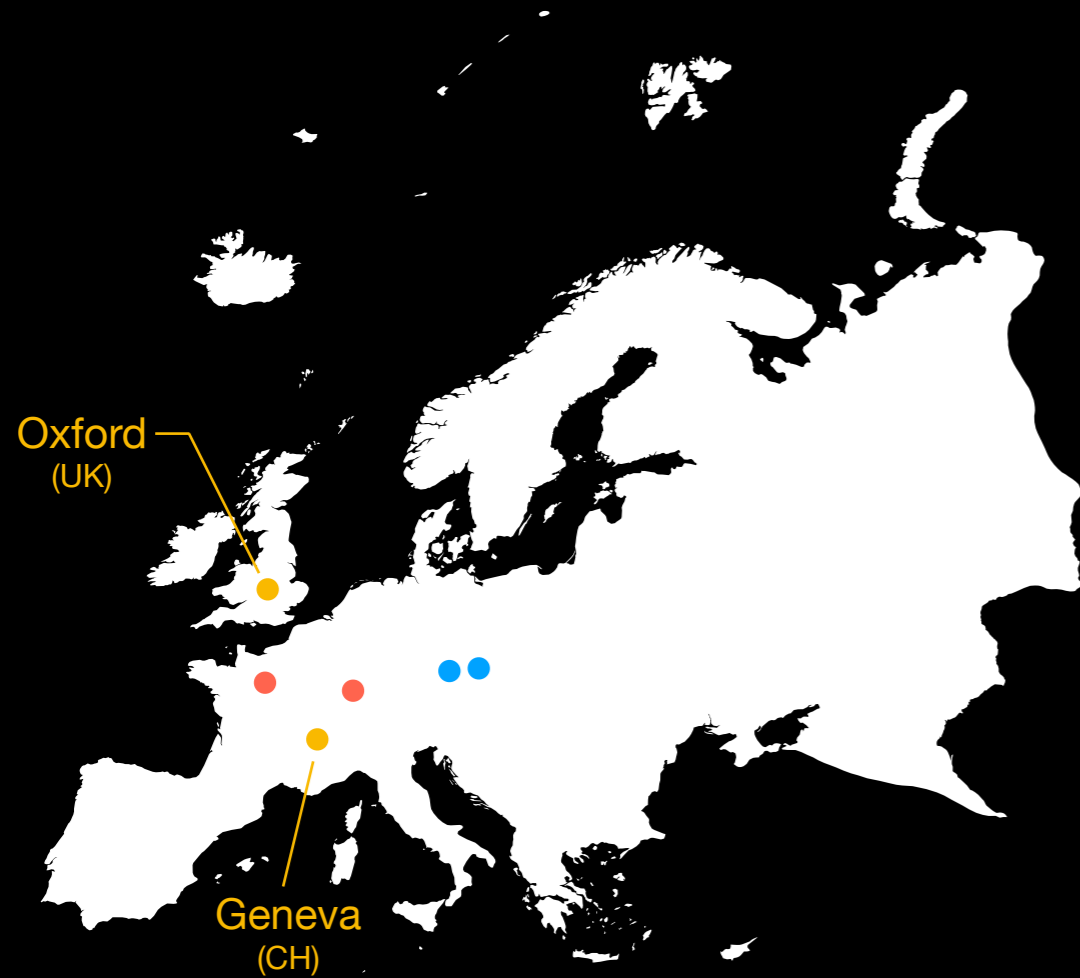
2016–2018: Studying physics in Zurich and Paris

Learned a lot about theoretical physics:
from the very large to the very small



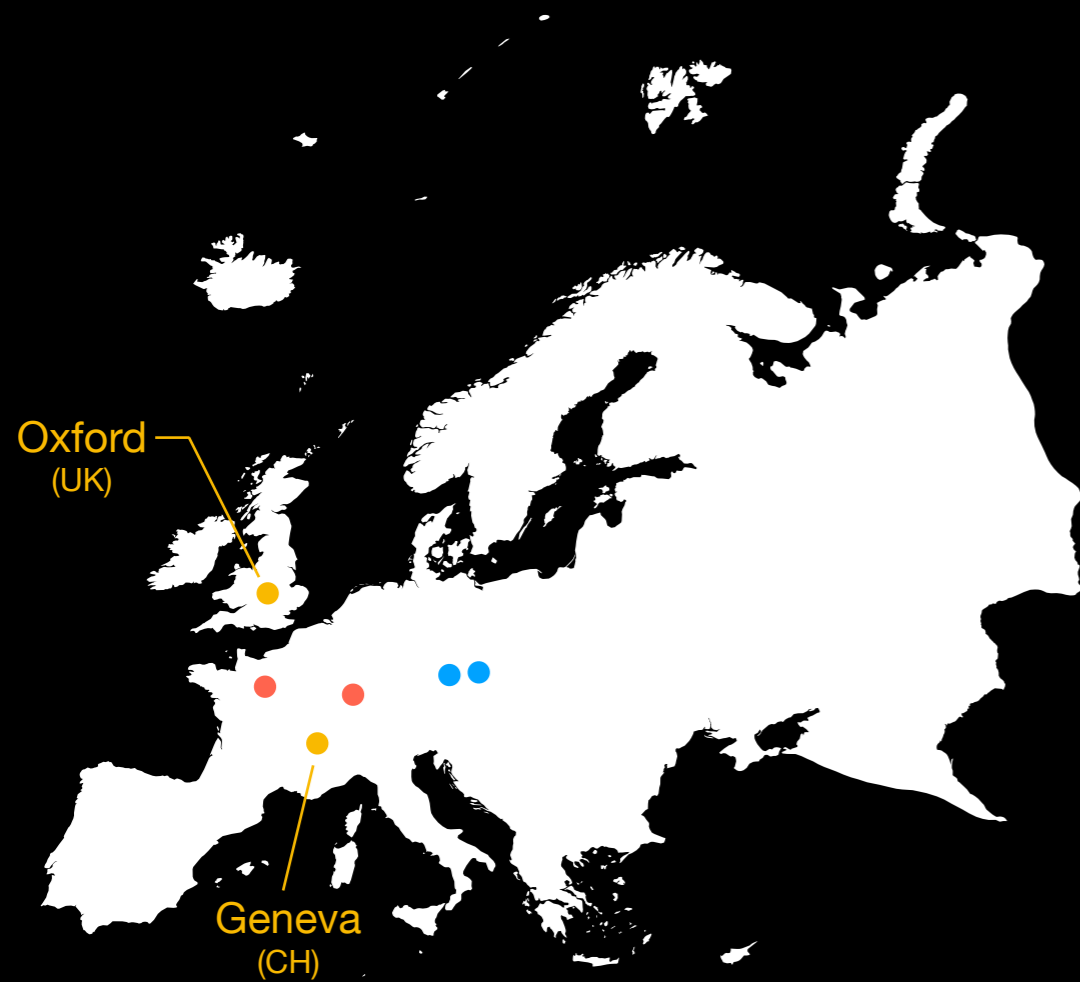
This is also my story!

2018–2022: PhD at Oxford, with long stays at CERN in Geneva: back to experiment!



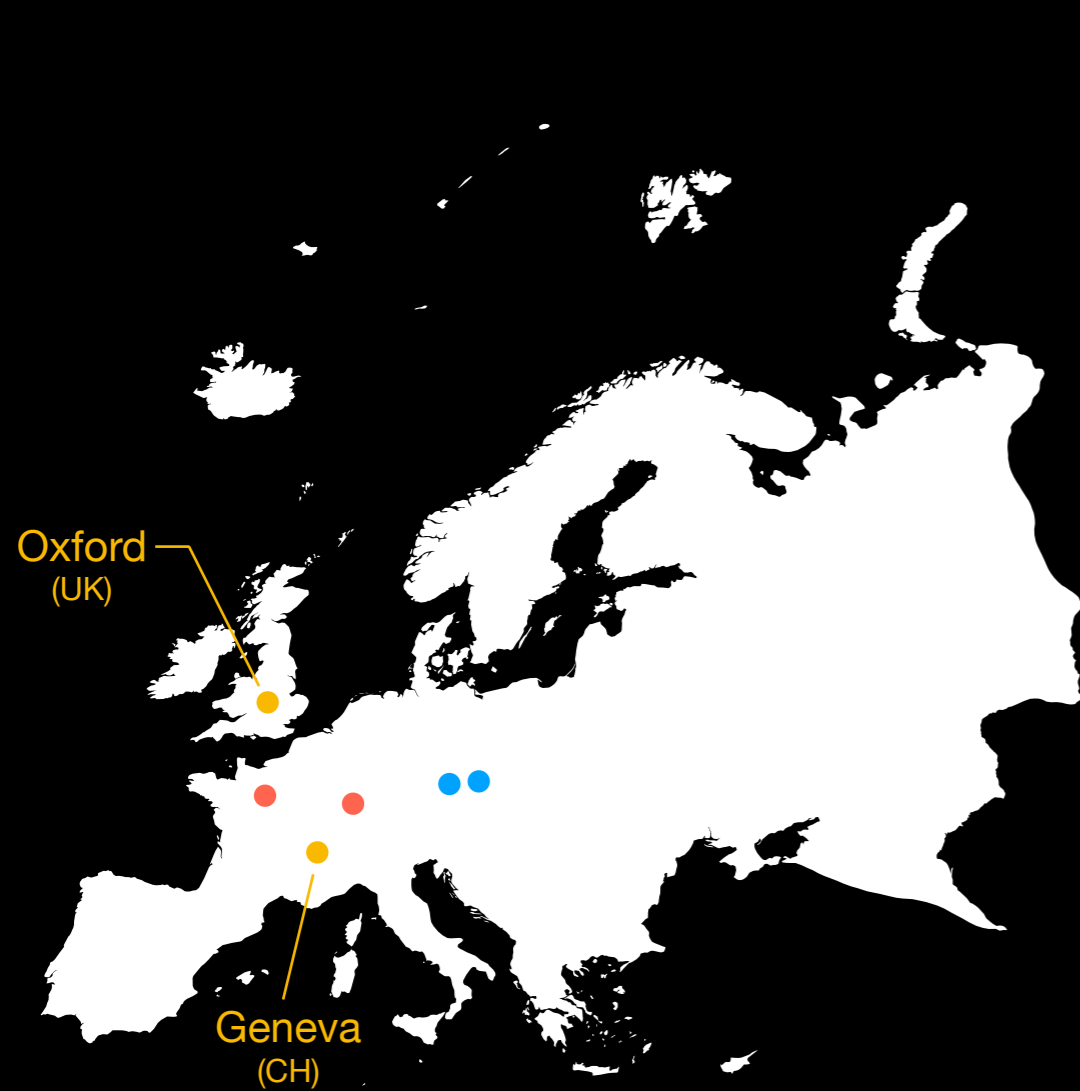
This is also my story!

2018–2022: PhD at Oxford, with long stays at CERN in Geneva: back to experiment!



This is also my story!

2018–2022: PhD at Oxford, with long stays at CERN in Geneva: back to experiment!

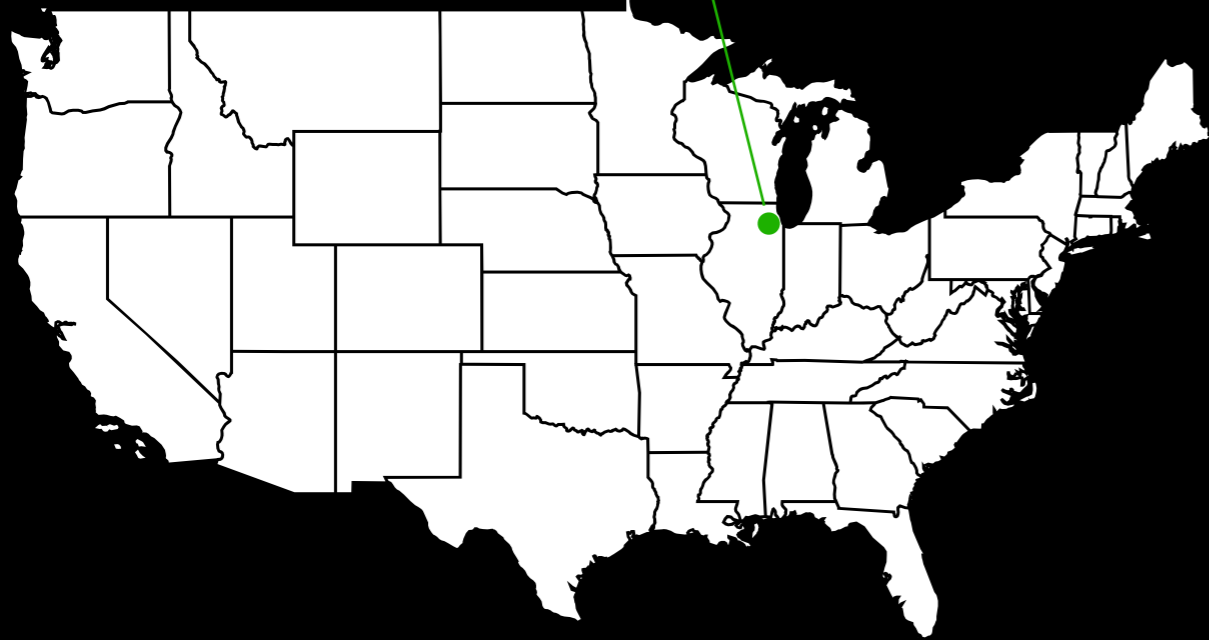


This is also my story!

Since **September 2022**:

Postdoc at the Enrico Fermi Institute

Chicago
(IL)



Studying the laws
of the microcosm,
and particles from
outer space



How did we get that far?



SOUTH SIDE
SCIENCE
FESTIVAL
WHERE SCIENCE IS FOR EVERYONE

Right outside this lecture hall

Until 6:00 pm today