

Title: Physics of Innovation - 1b

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Abstract:

PERIMETER  INSTITUTE FOR THEORETICAL PHYSICS

# Physica Phantastica



THE PHYSICS OF INNOVATION

explore

understand

build

The image features a wireframe human head in profile on the right side, set against a dark blue background filled with digital data points and glowing lines. On the left, there are several molecular models, including a large cluster of spheres and a central sphere with radiating lines. The overall aesthetic is high-tech and scientific.

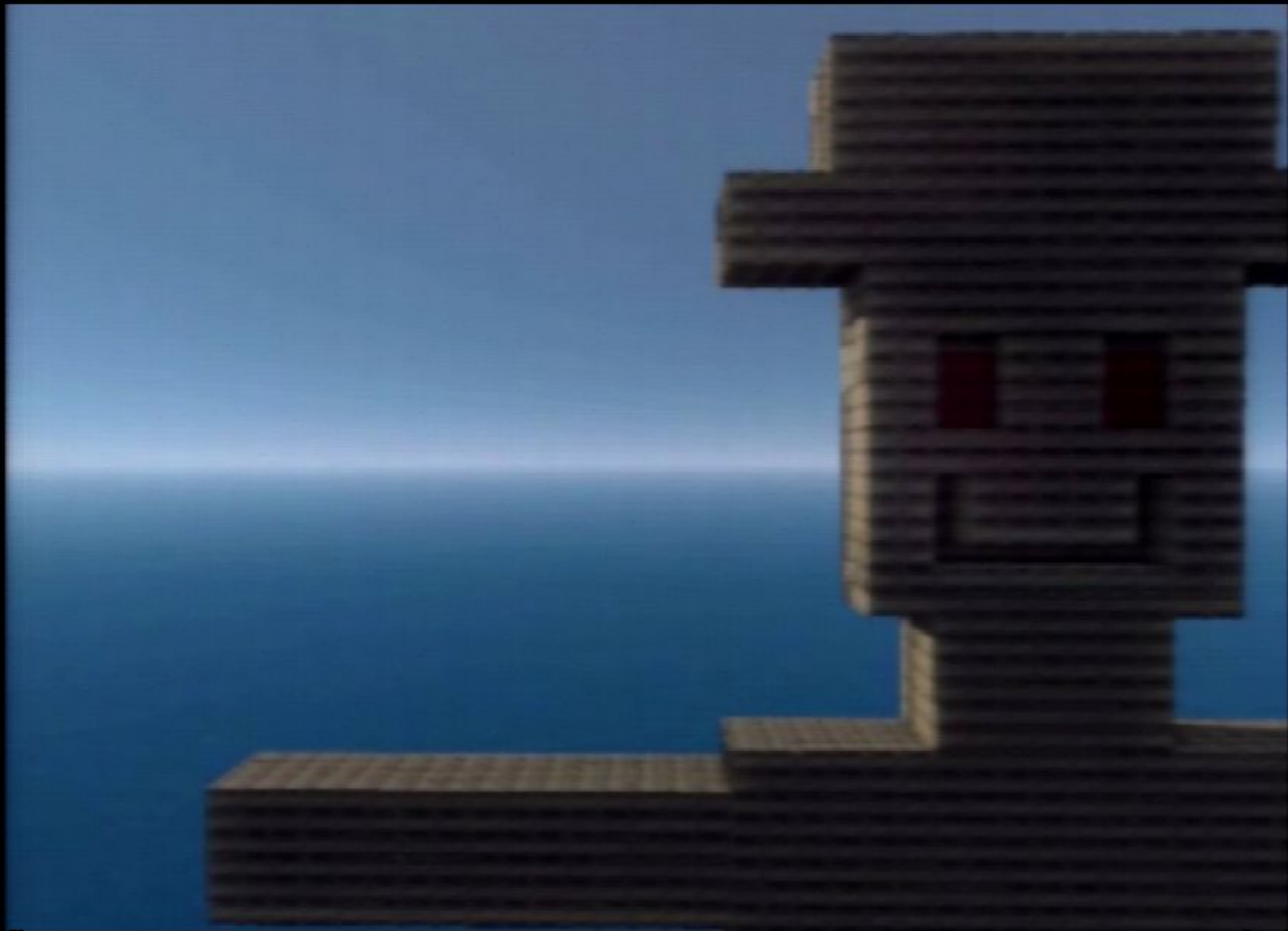
THE PHYSICS OF INNOVATION **INTRODUCTION**



A woman is shown in a dynamic, running pose within a virtual environment. She is wearing a black VR headset with "HTC VIVE" visible on the side, a white t-shirt, a dark blue vest, and light-colored pants. Her feet are in white and blue motion capture shoes. The background is a dark green space with bright green light trails radiating from the center, creating a sense of high-speed movement. A black banner with white and orange text is positioned in the upper right corner.

what is reality?

# Simulated Reality







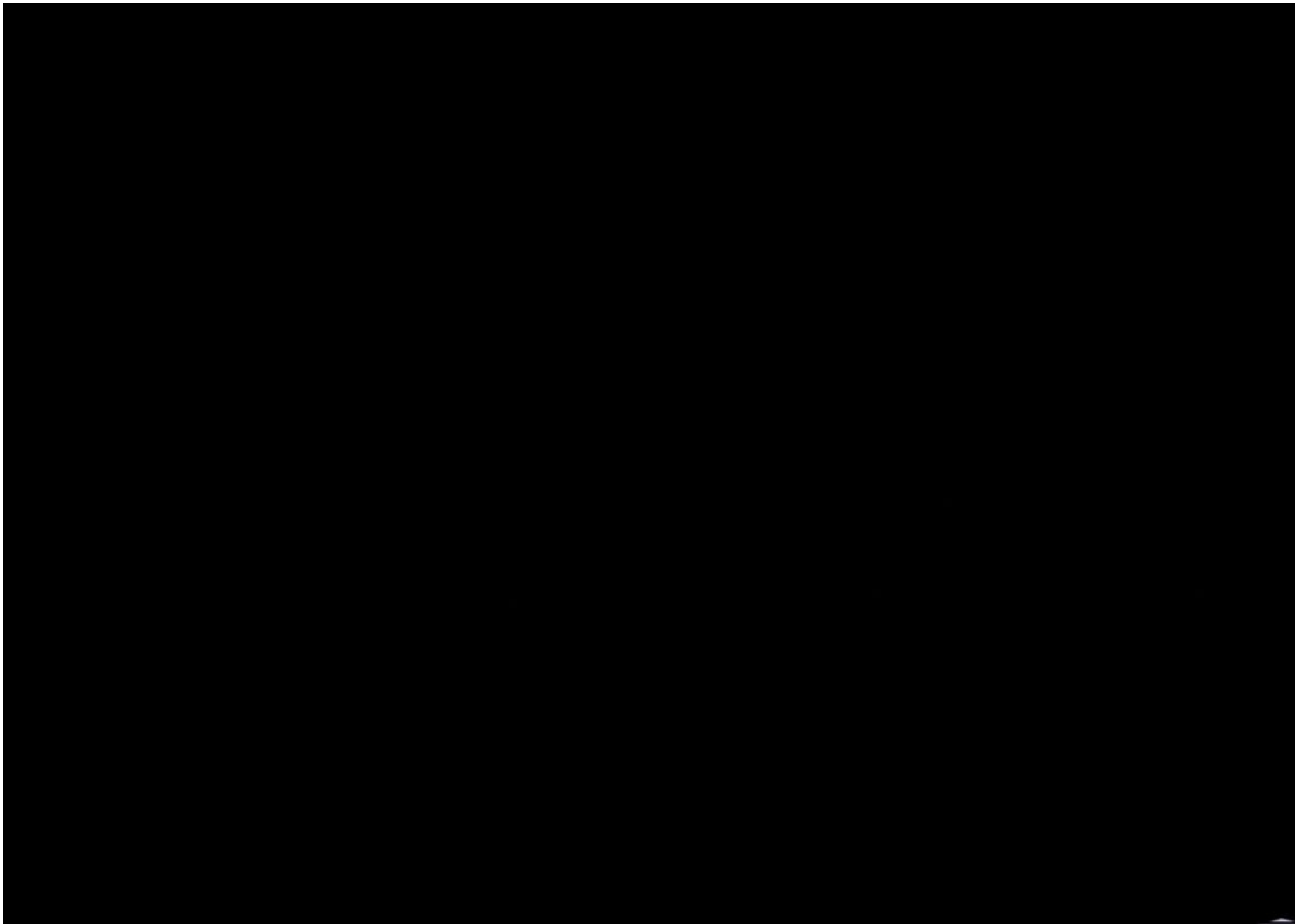


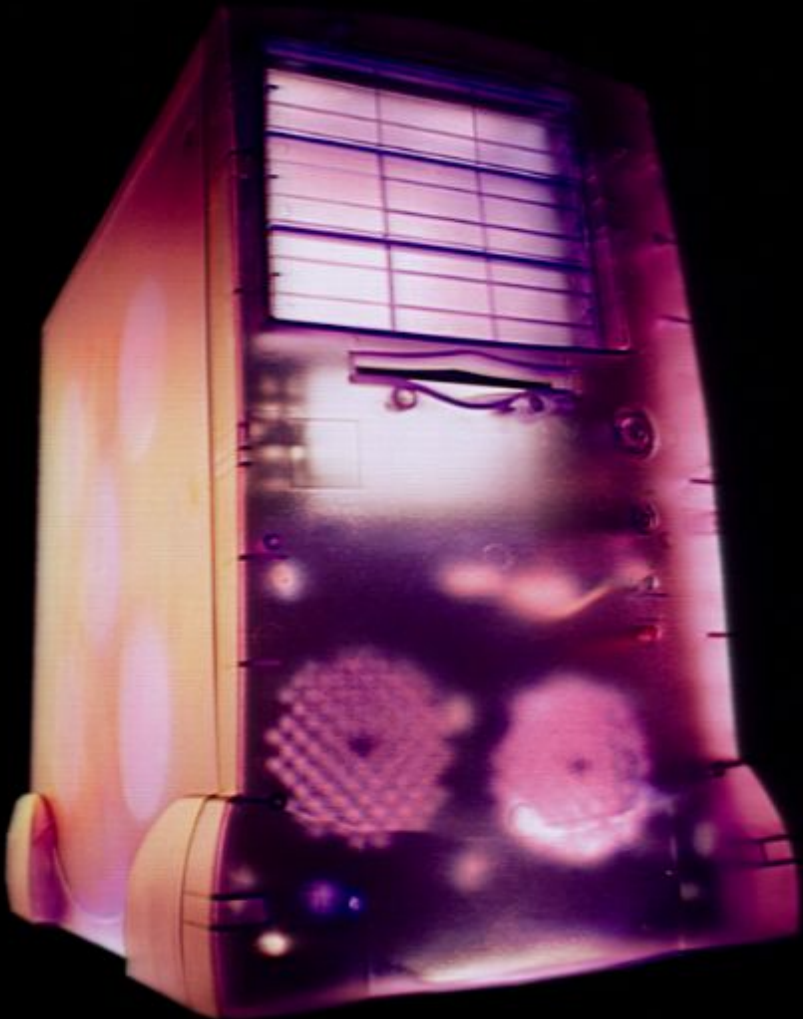






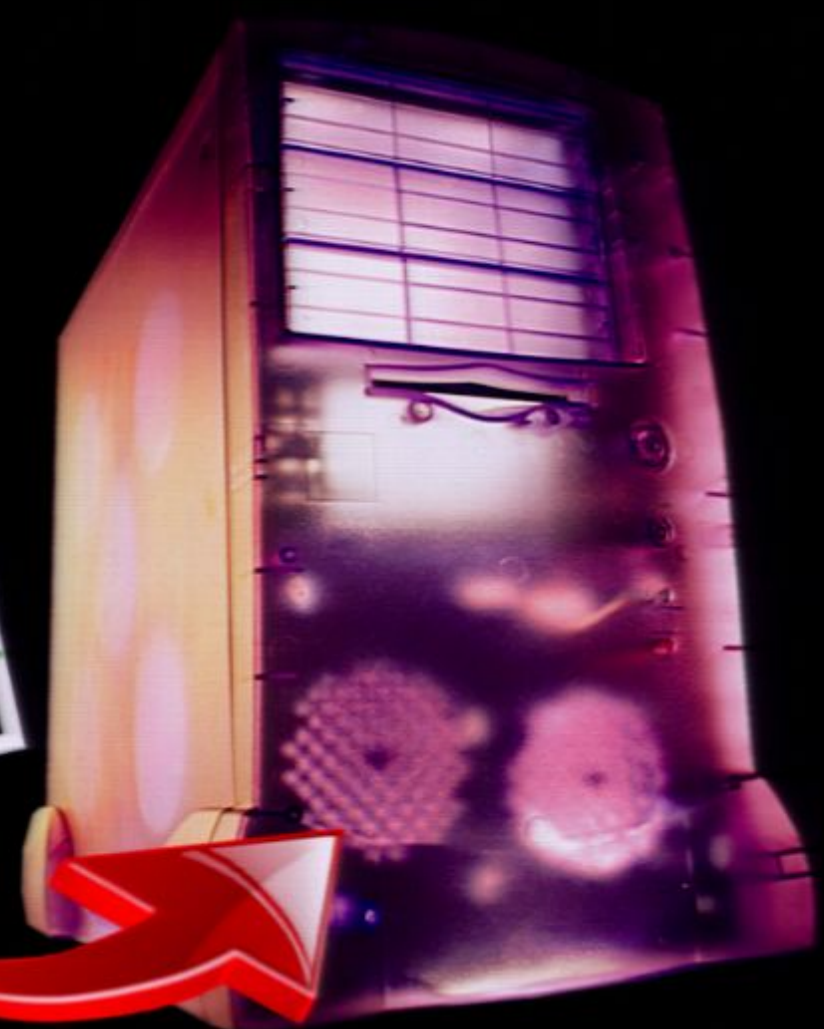
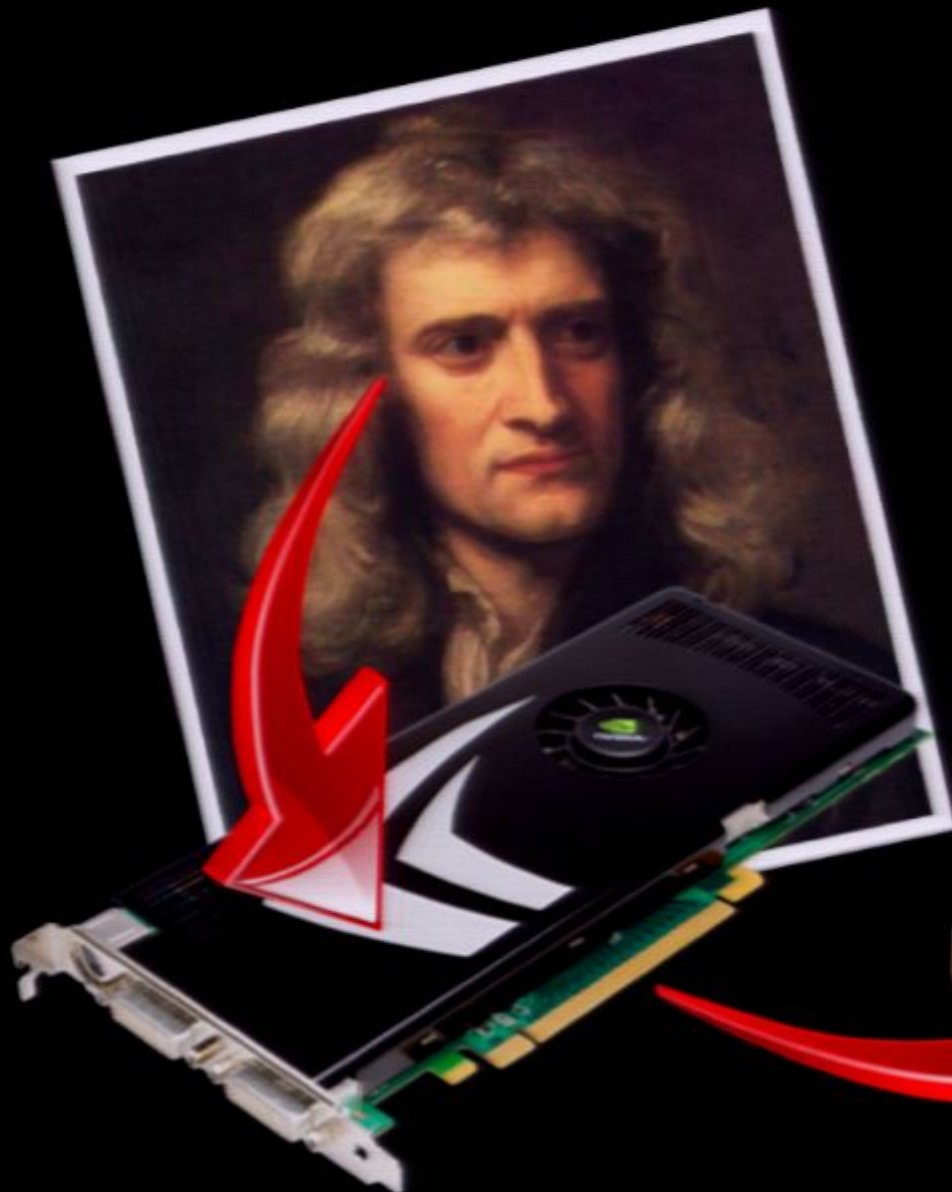














really go



reality goes deeper

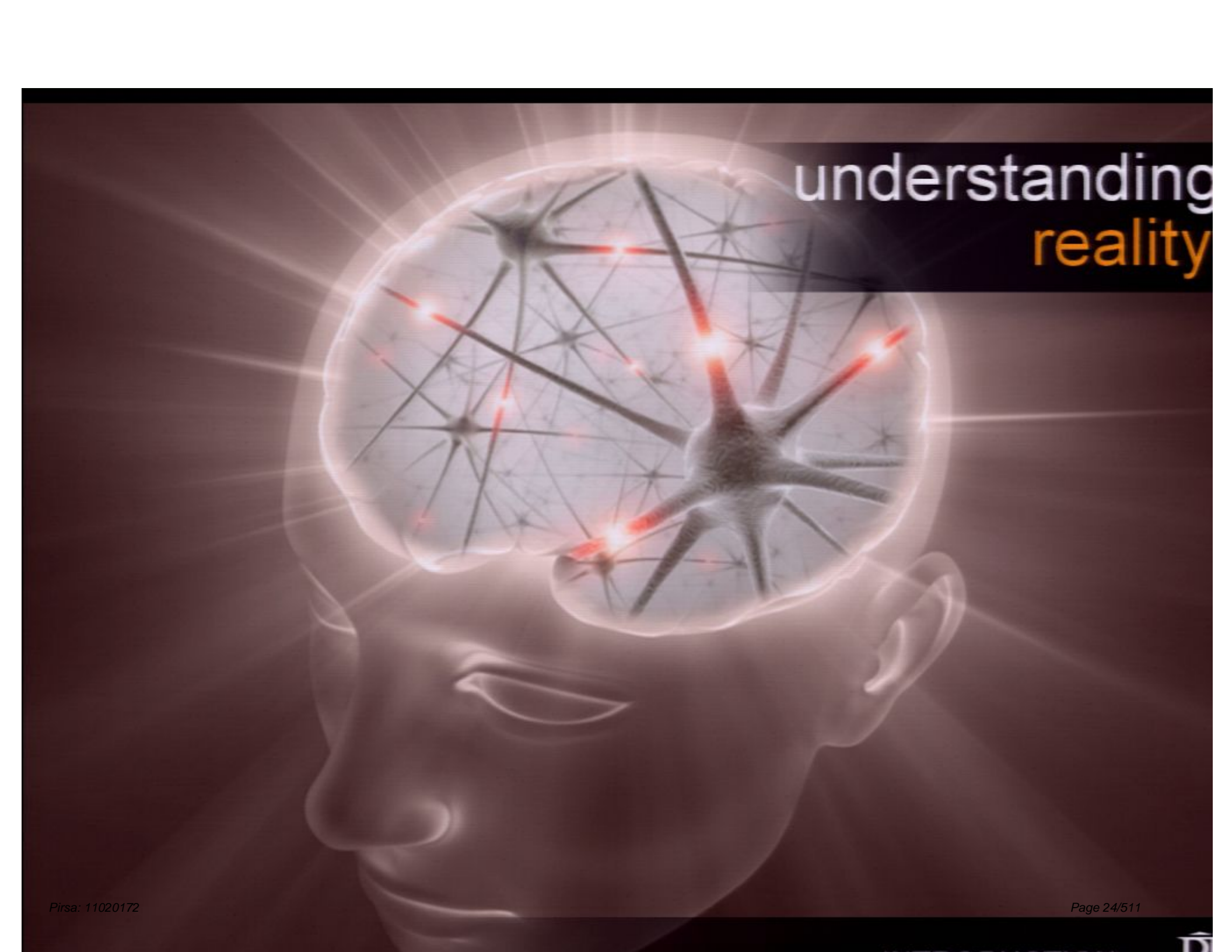
example of  
reality

example of  
reality





understanding  
reality




understanding  
reality



A glowing blue microchip is the central focus, resting on a complex circuit board. The chip's surface is illuminated with a grid of light, and its edges are defined by a bright blue glow. The surrounding circuitry consists of intricate patterns of blue lines and small, glowing nodes, creating a sense of depth and connectivity. The overall color palette is a rich, vibrant blue, with some lighter cyan highlights on the chip's surface. The text 'empowers us to innovate' is positioned in the upper right quadrant, rendered in a clean, sans-serif font that blends with the background's aesthetic.

empowers us to  
innovate

The image features a central, glowing blue microchip mounted on a circuit board. The chip's surface is illuminated with a grid of light blue lines and dots, giving it a digital, data-driven appearance. The surrounding circuit board is also glowing with blue light, showing intricate patterns of traces and components. In the upper right corner, the text 'empowers us to' is written in white, and 'innovate' is written in a bold, orange font. The overall aesthetic is futuristic and technological.

empowers us to  
innovate

the physics of innovation:

the physics of innovation:



explore mystery

# the physics of innovation:



explore mystery



understand reality

# the physics of innovation:



explore mystery



understand reality



build cool stuff

# 4 ideas that changed the world

electromagnetism

quantum

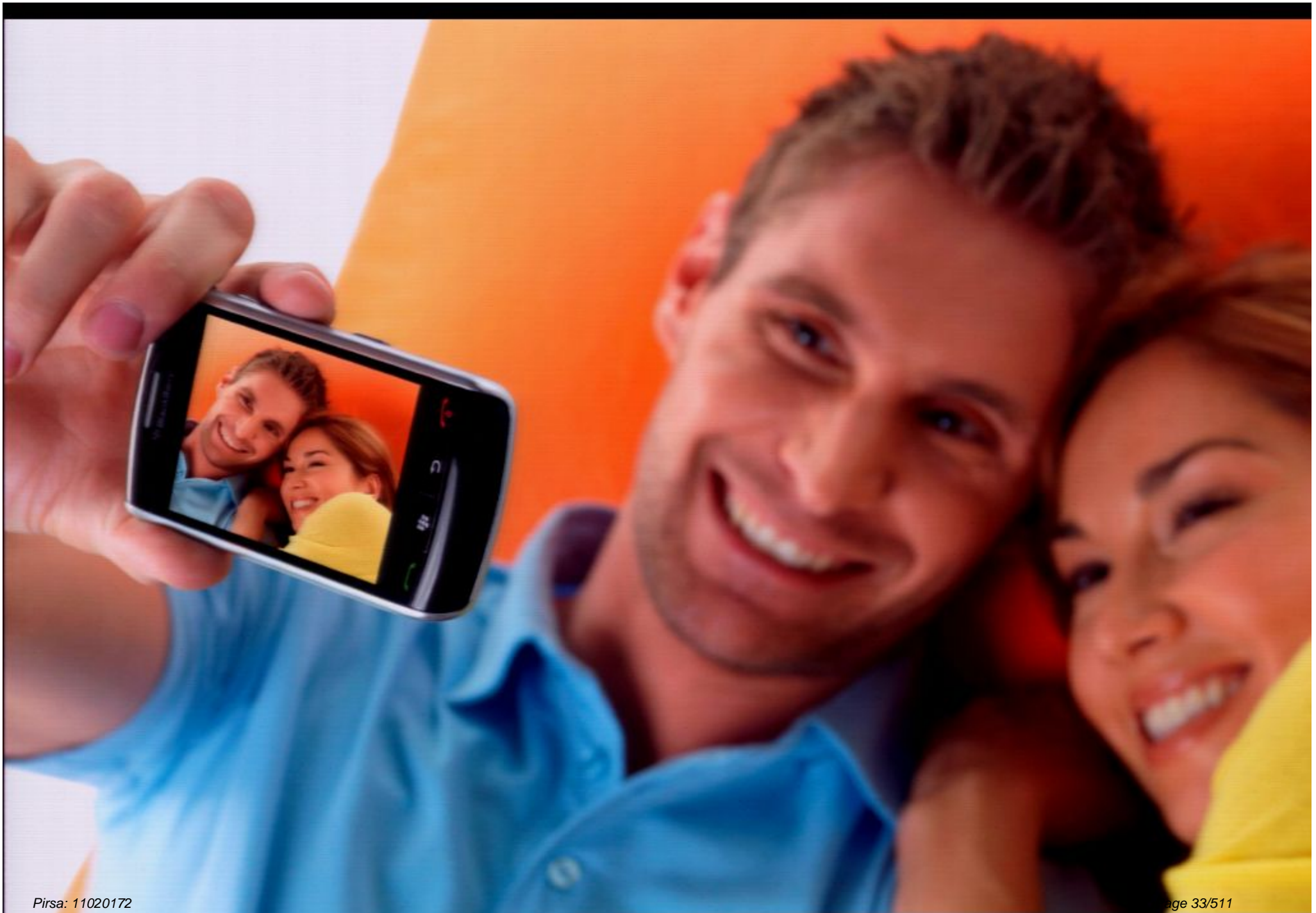
special relativity

general relativity

The image features a dark blue background with a grid of glowing blue squares. In the foreground, a wireframe human head is shown in profile, facing left. To the left of the head, there are several molecular models consisting of grey spheres connected by lines. A central grey sphere is surrounded by radiating lines, resembling a sun or a data point. The overall aesthetic is high-tech and scientific.

THE PHYSICS OF INNOVATION **ELECTROMAGNETISM**





where does  
this come from?





explore mysteries

electricity & magnetism

 explore electricity

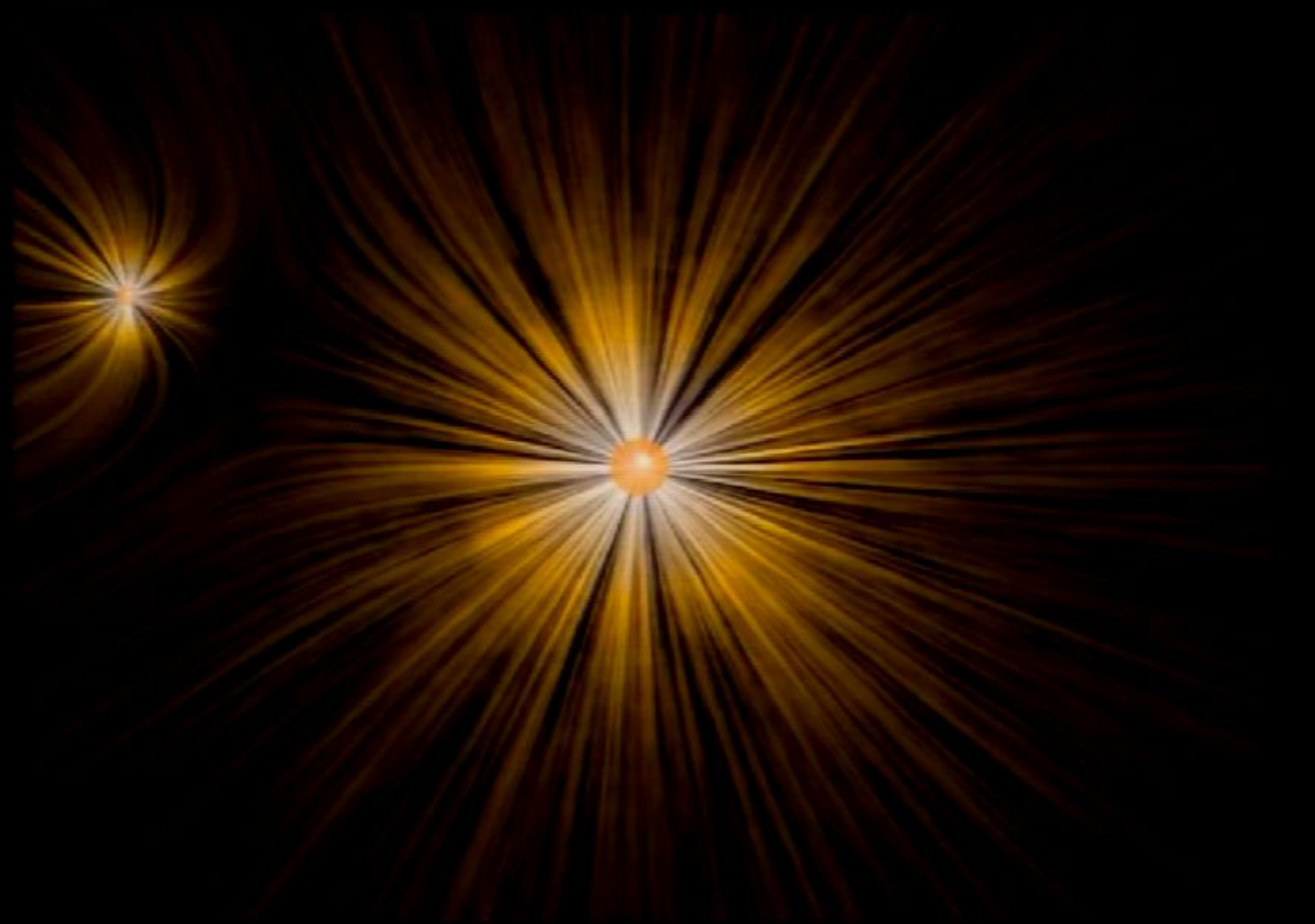


 explore electricity



# Simulated Reality

 explore electricity

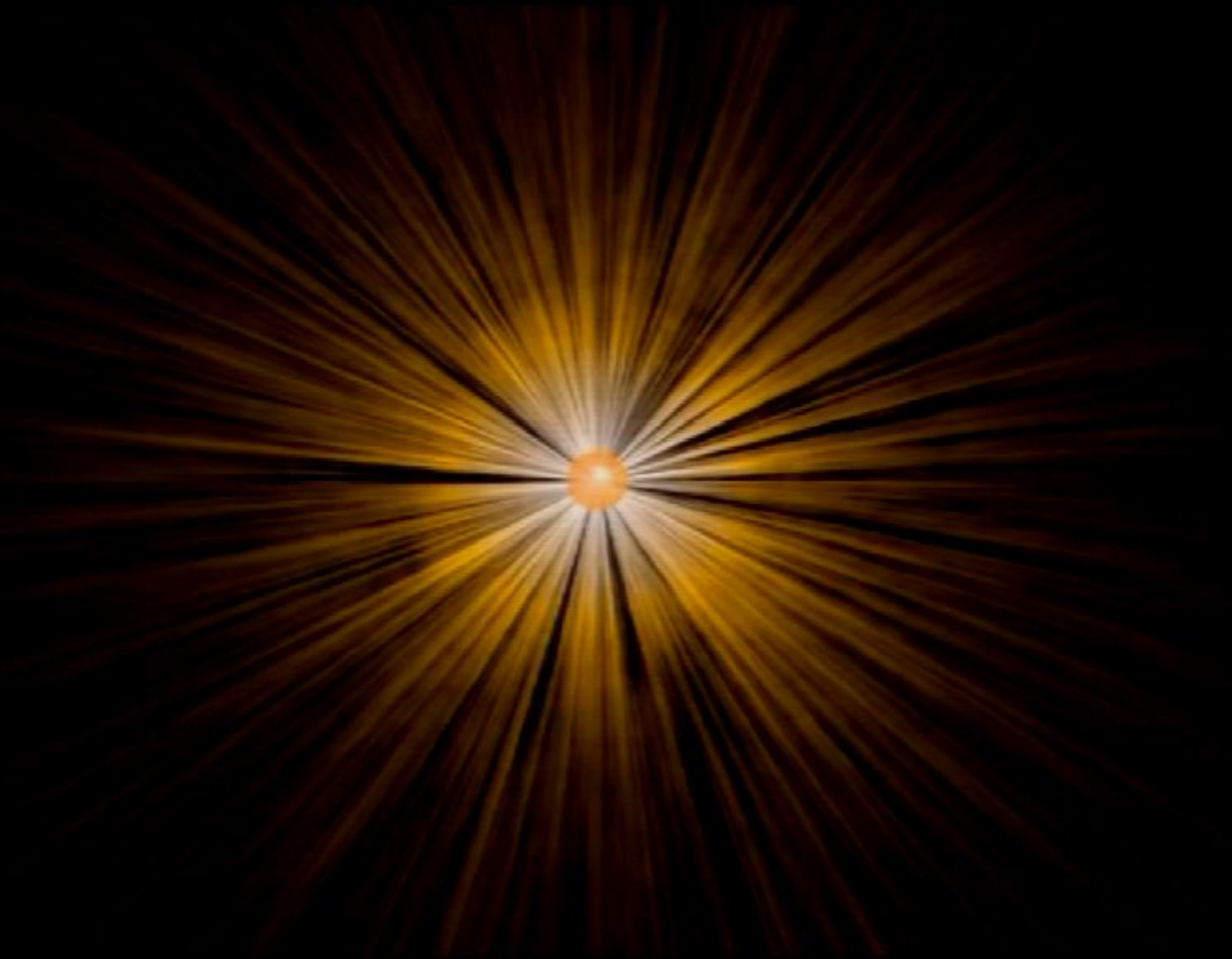


 explore electricity

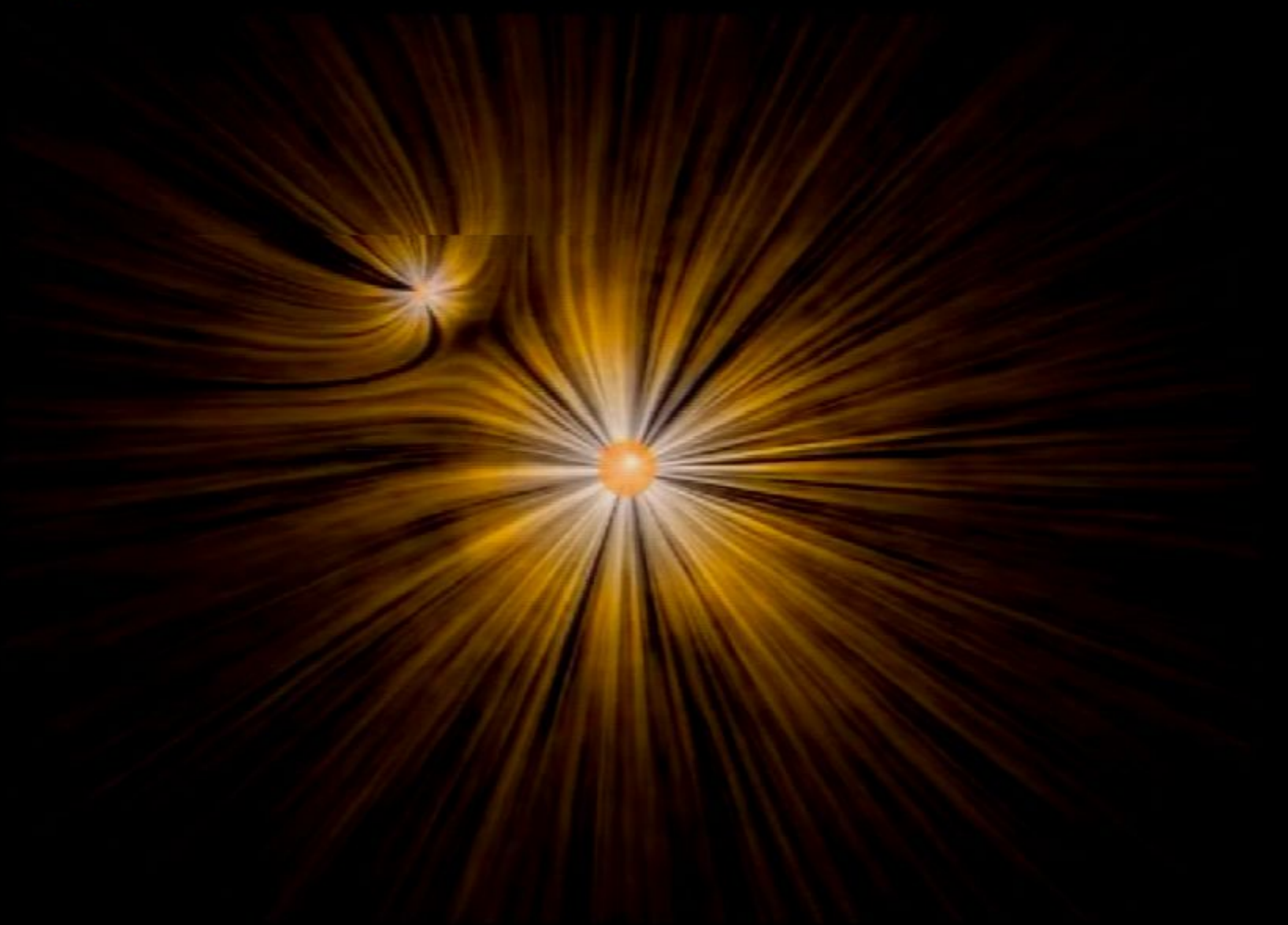




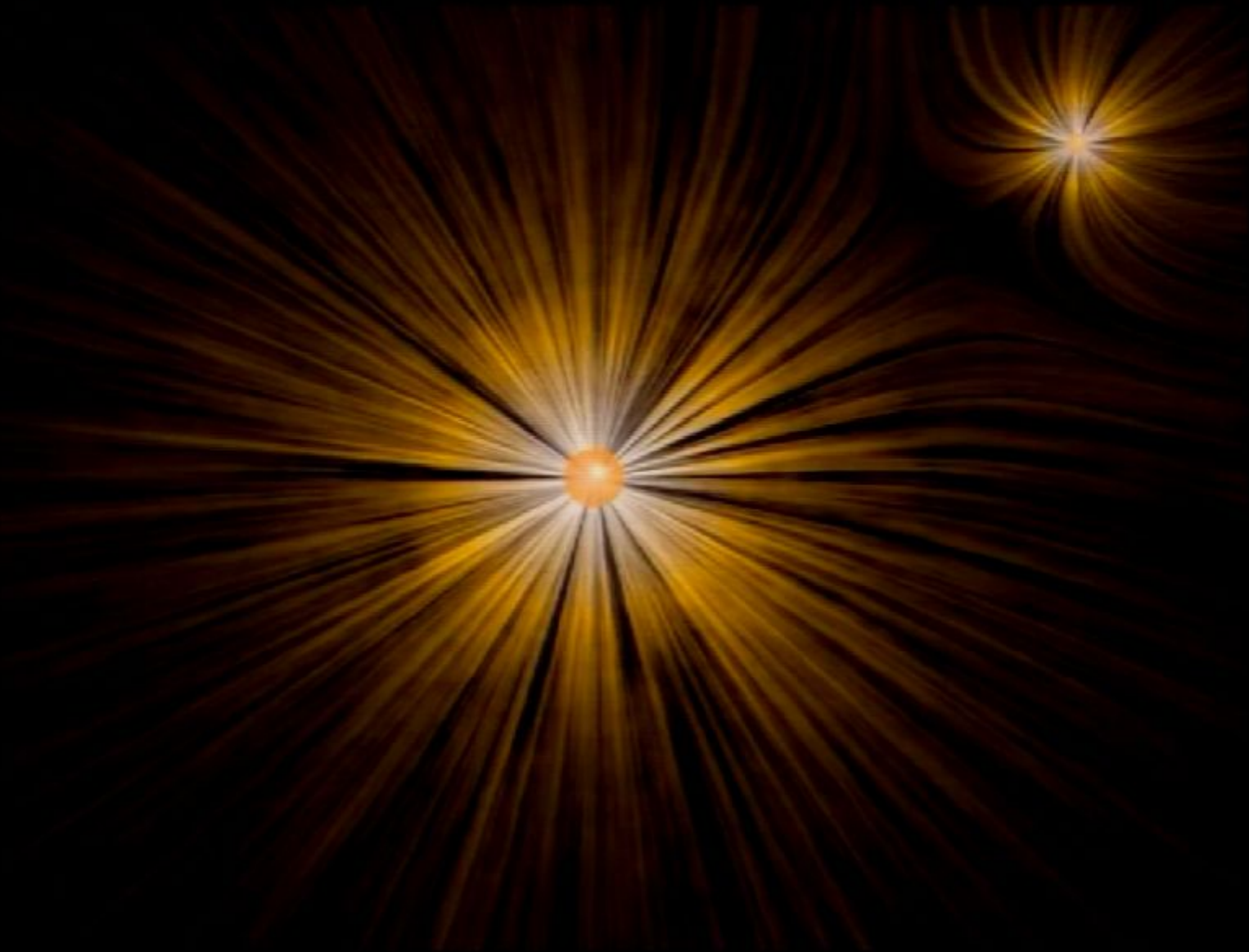
 explore electricity



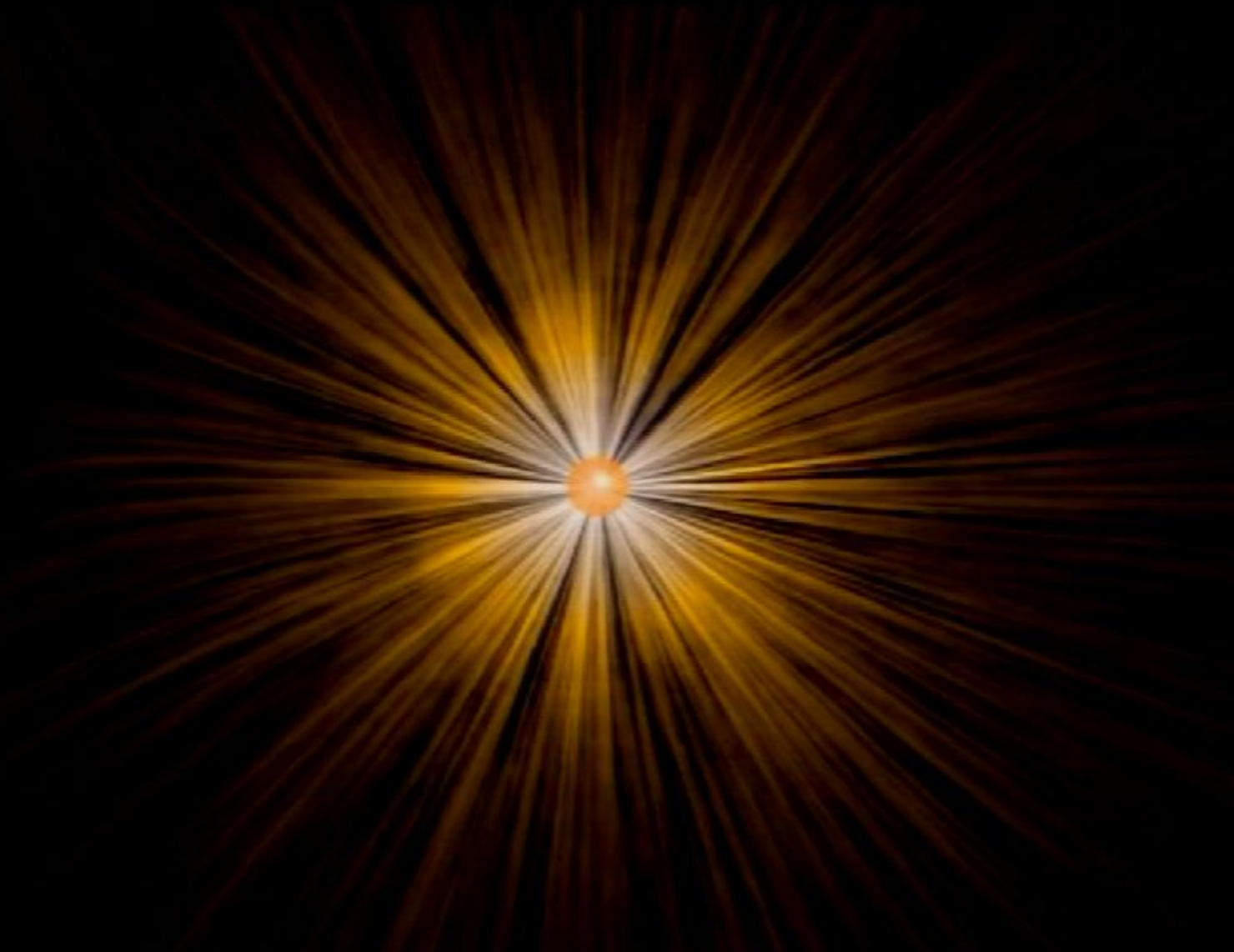
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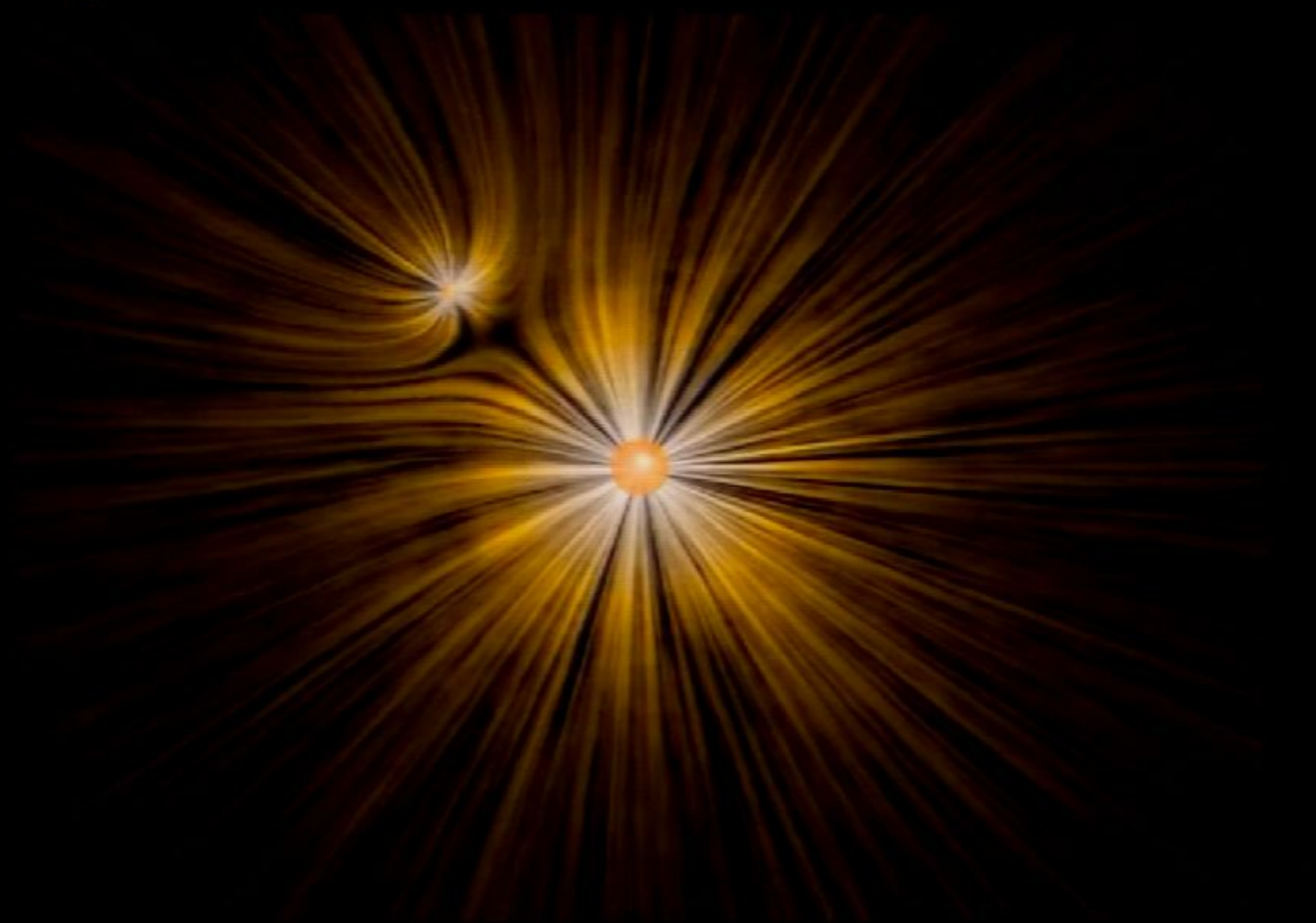
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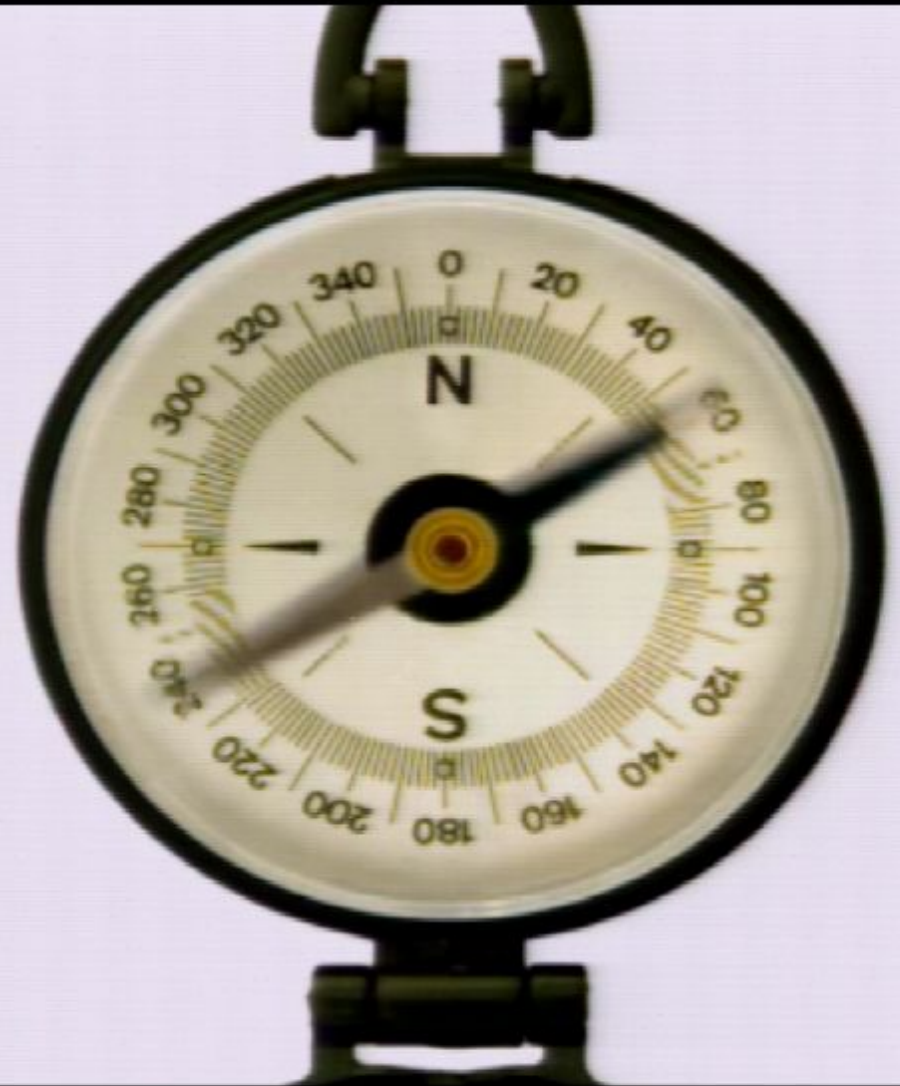
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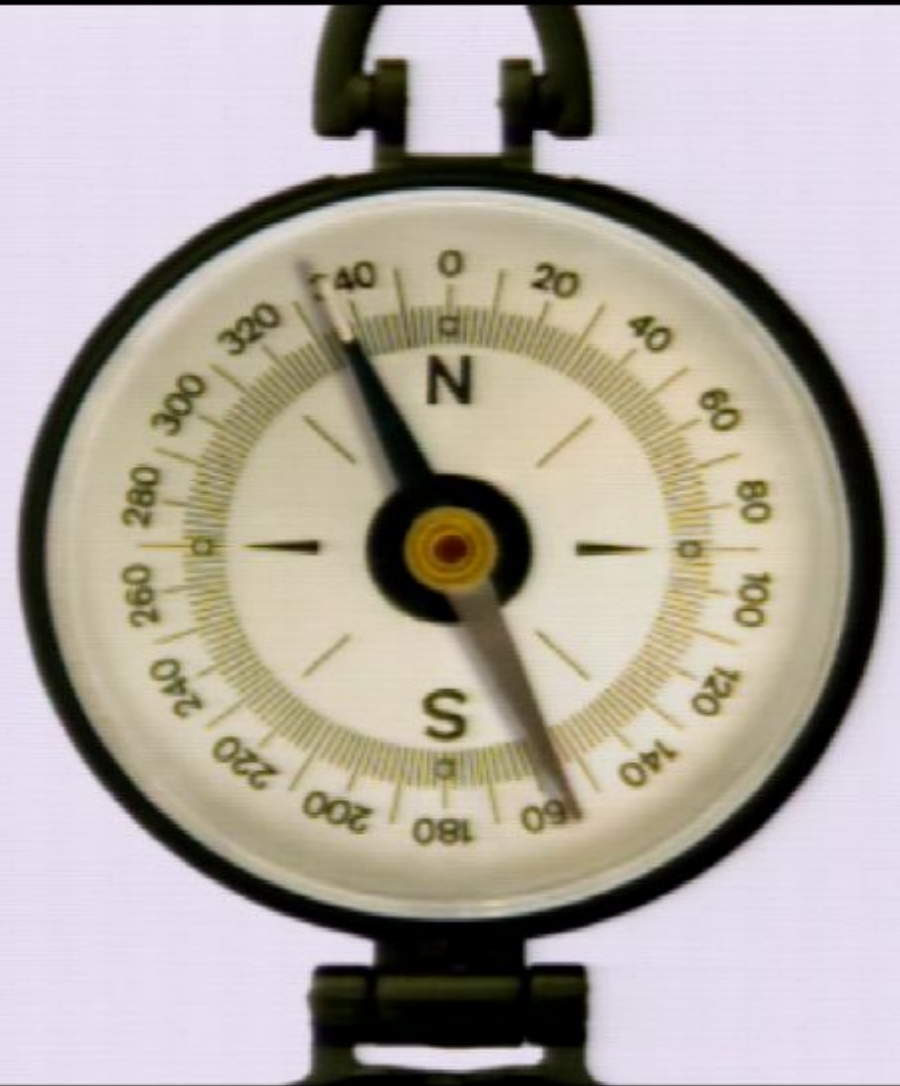
 explore electricity



 explore magnetism



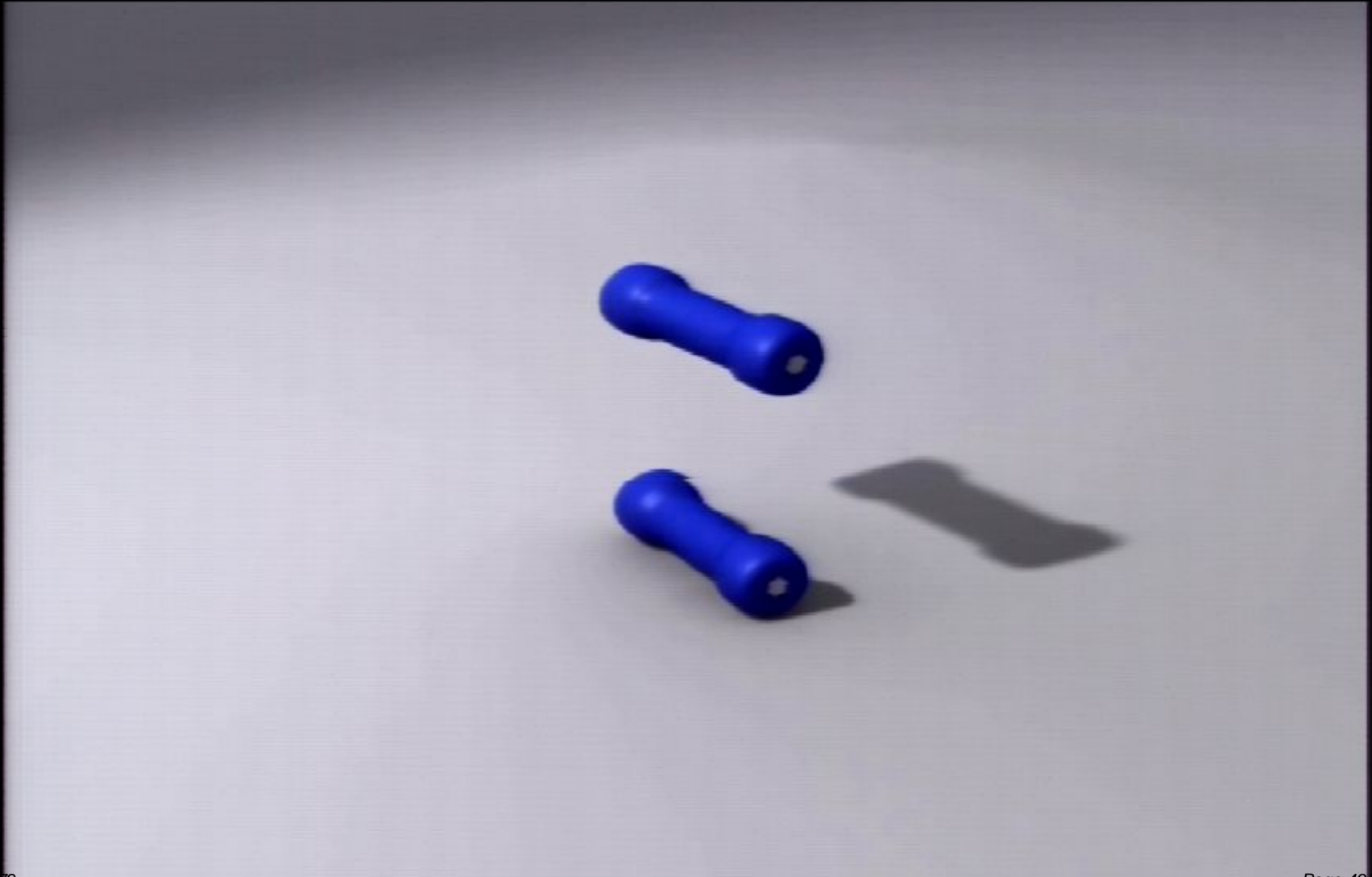
 explore magnetism



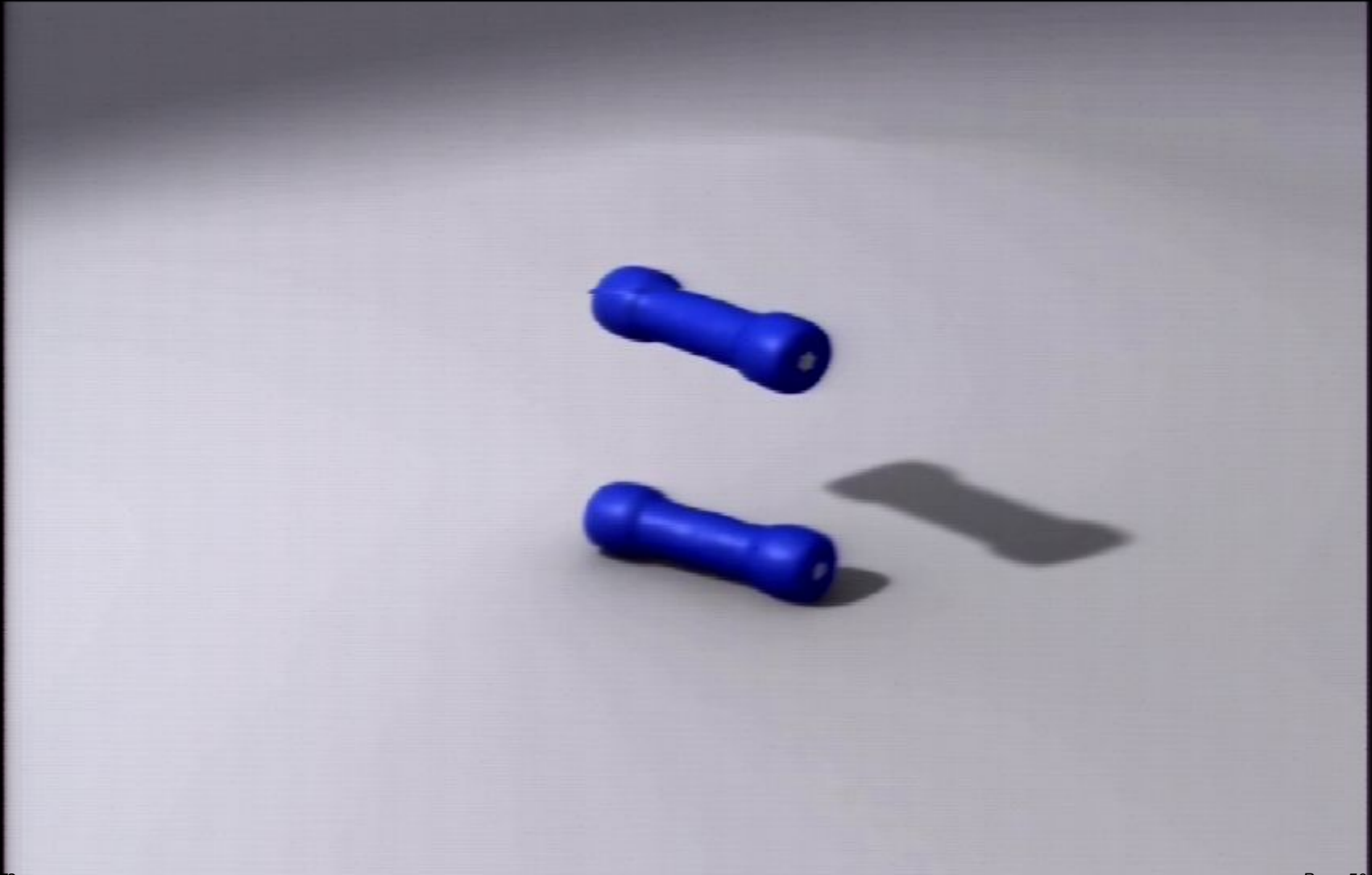
# Simulated Reality



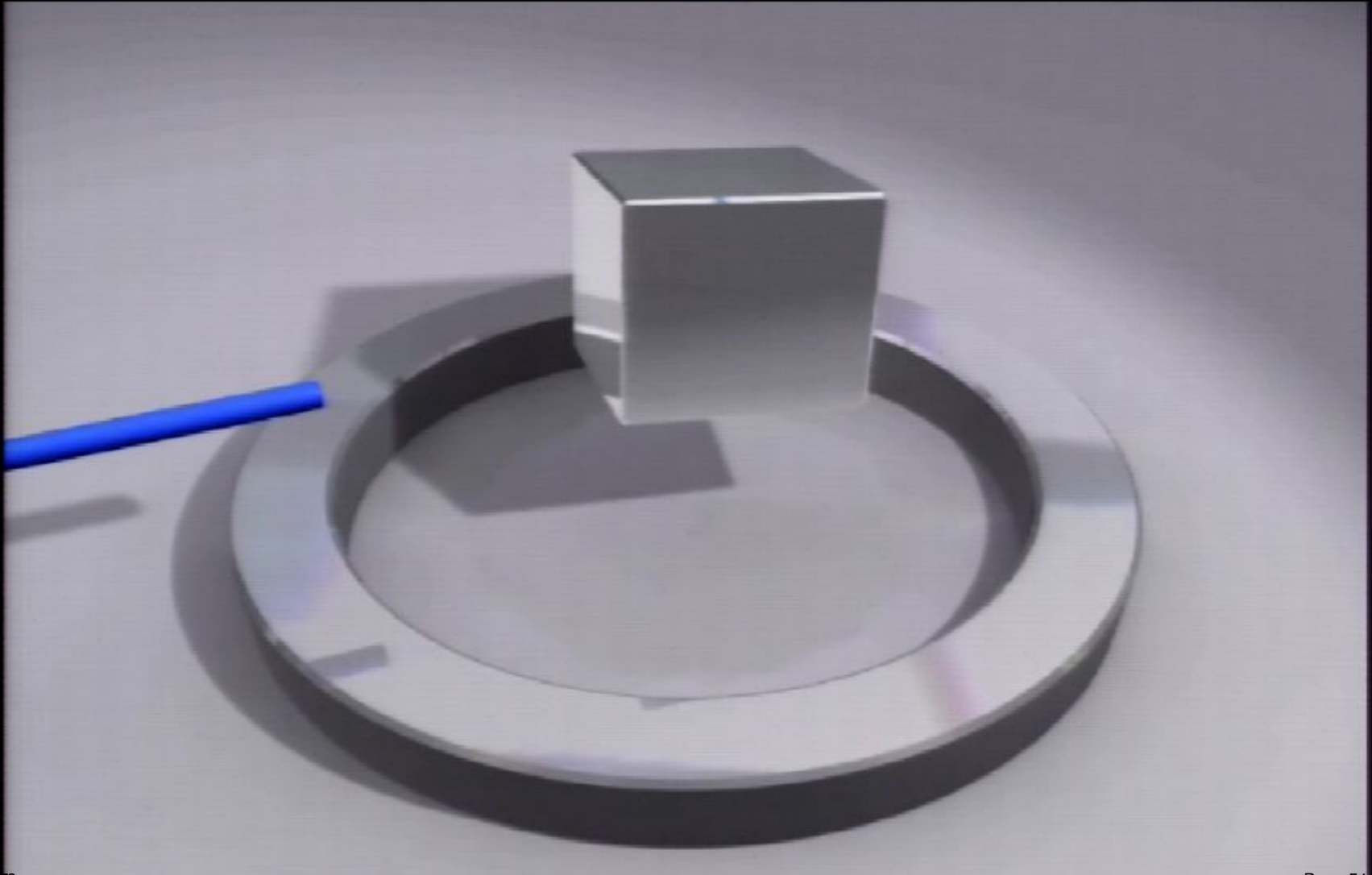
 explore magnetism



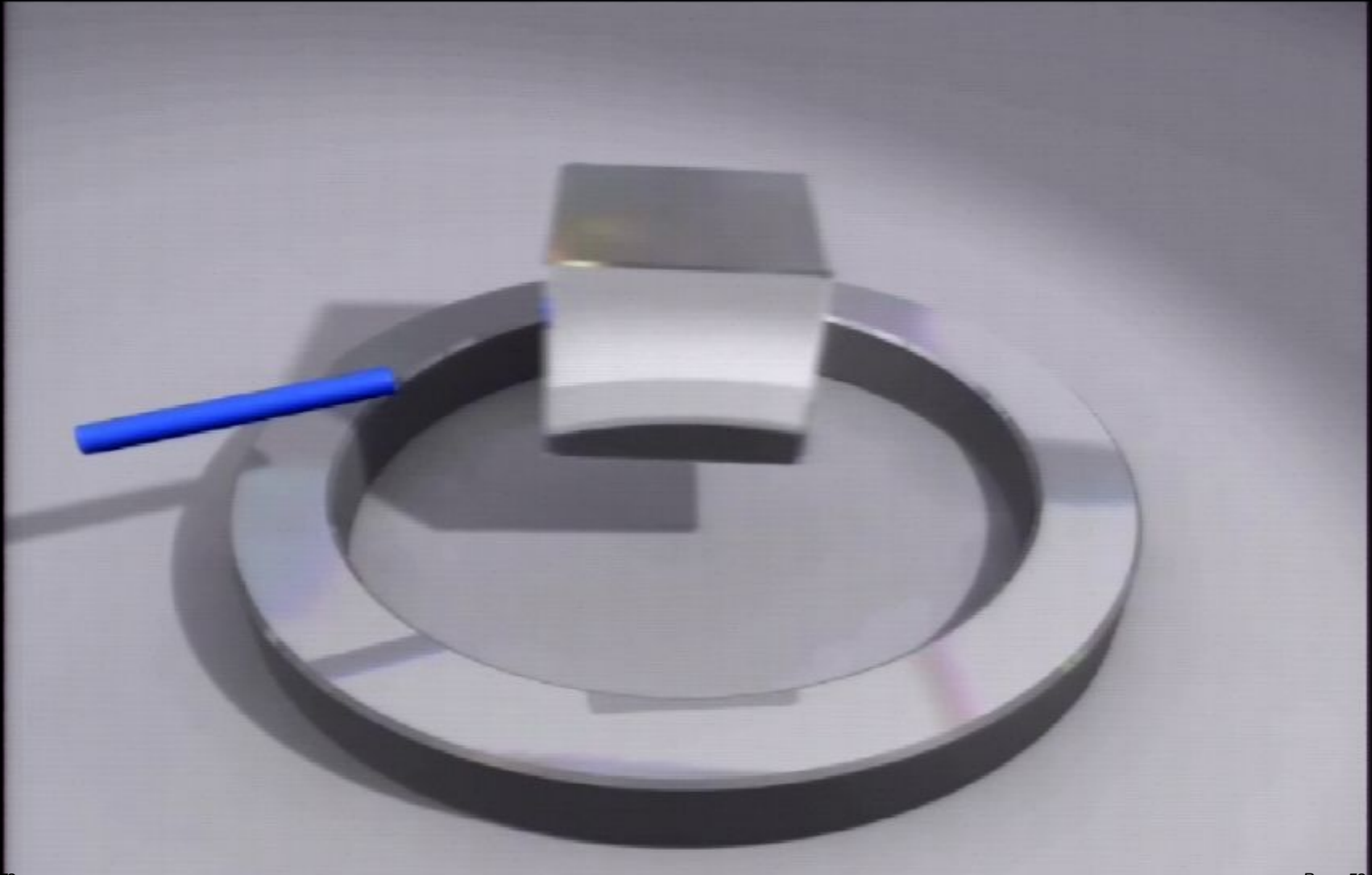
 explore magnetism



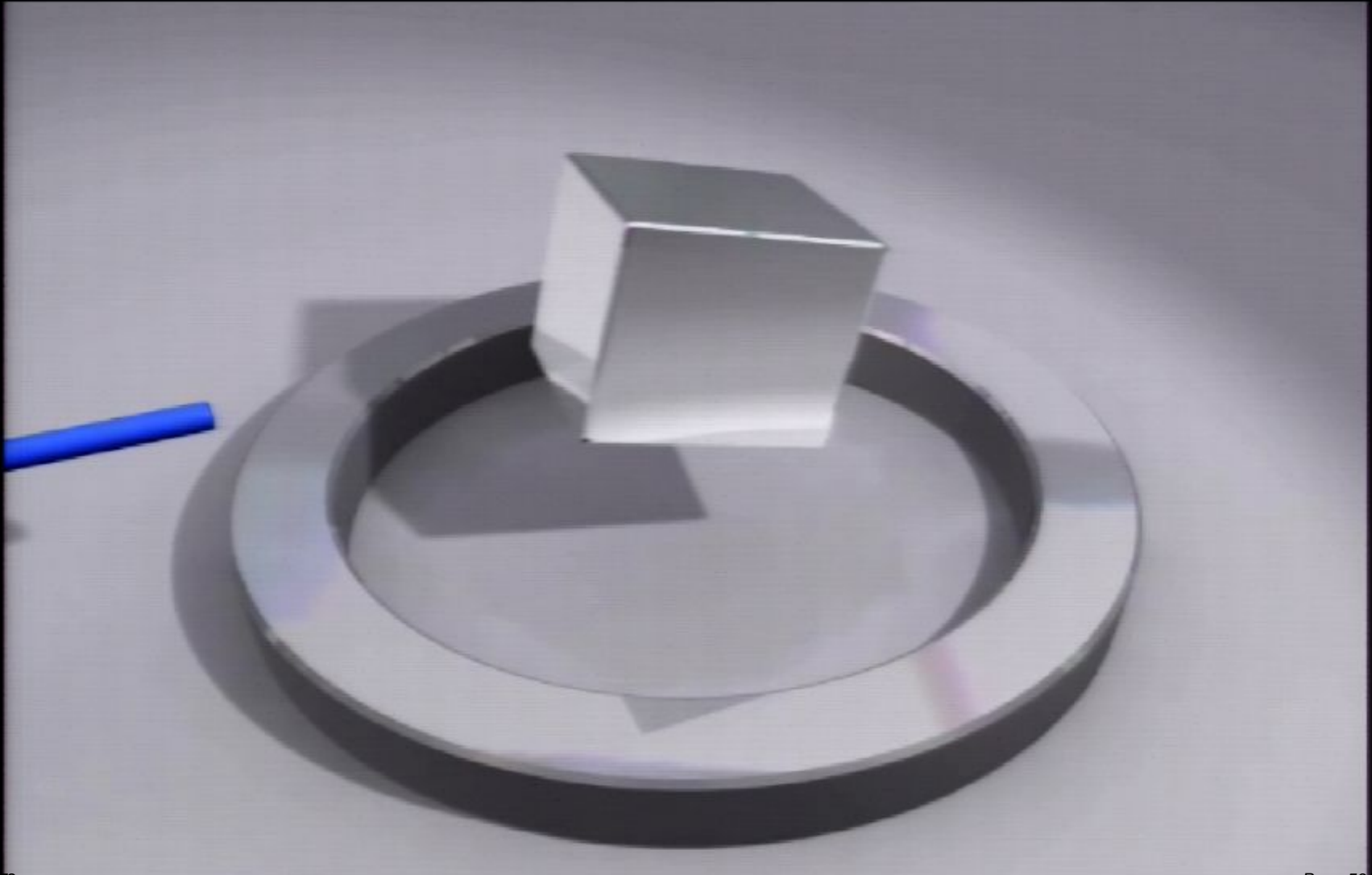
 explore magnetism




 explore magnetism




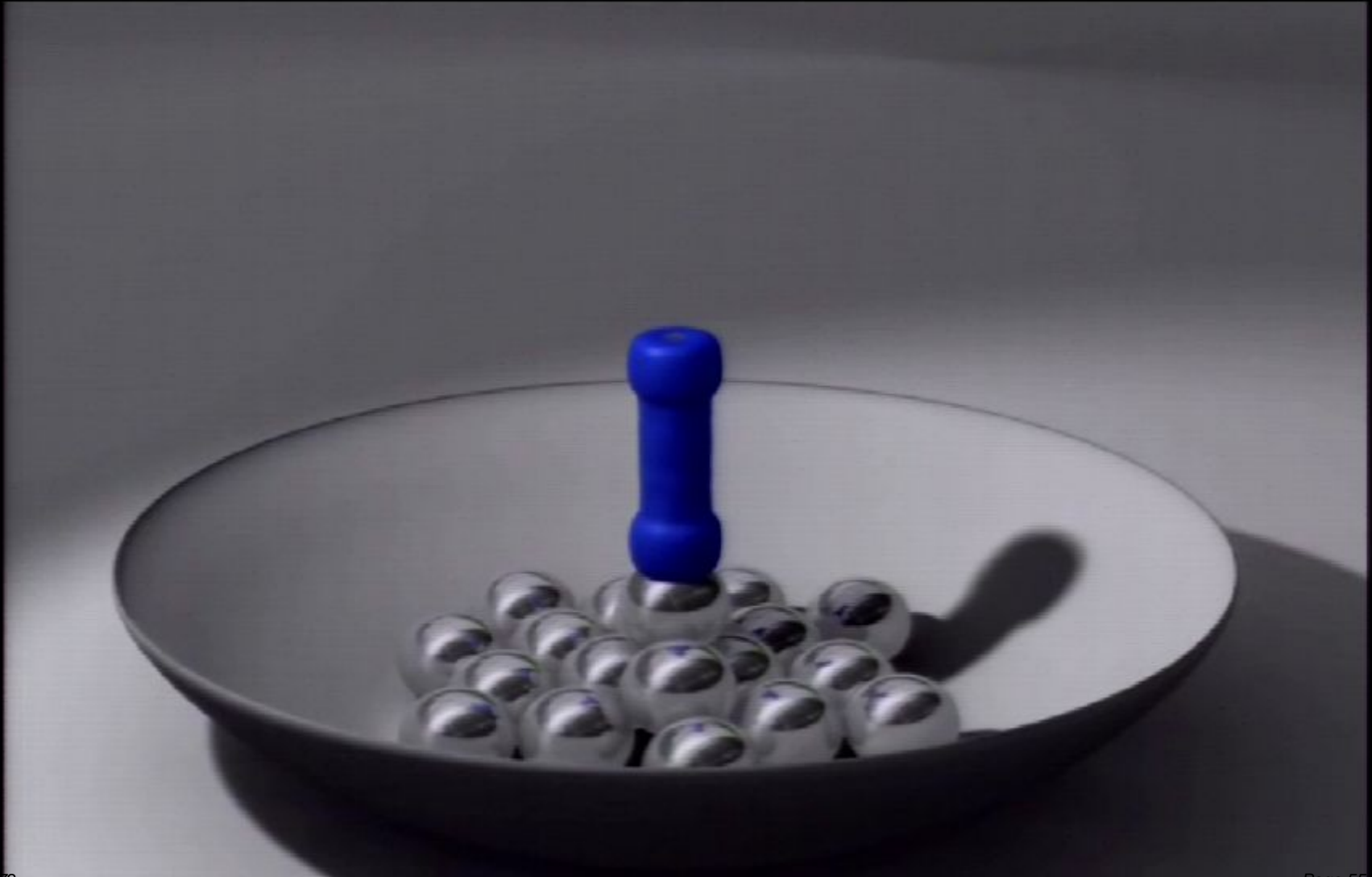
 explore magnetism




 explore magnetism



 explore magnetism




 explore magnetism







 explore magnetism

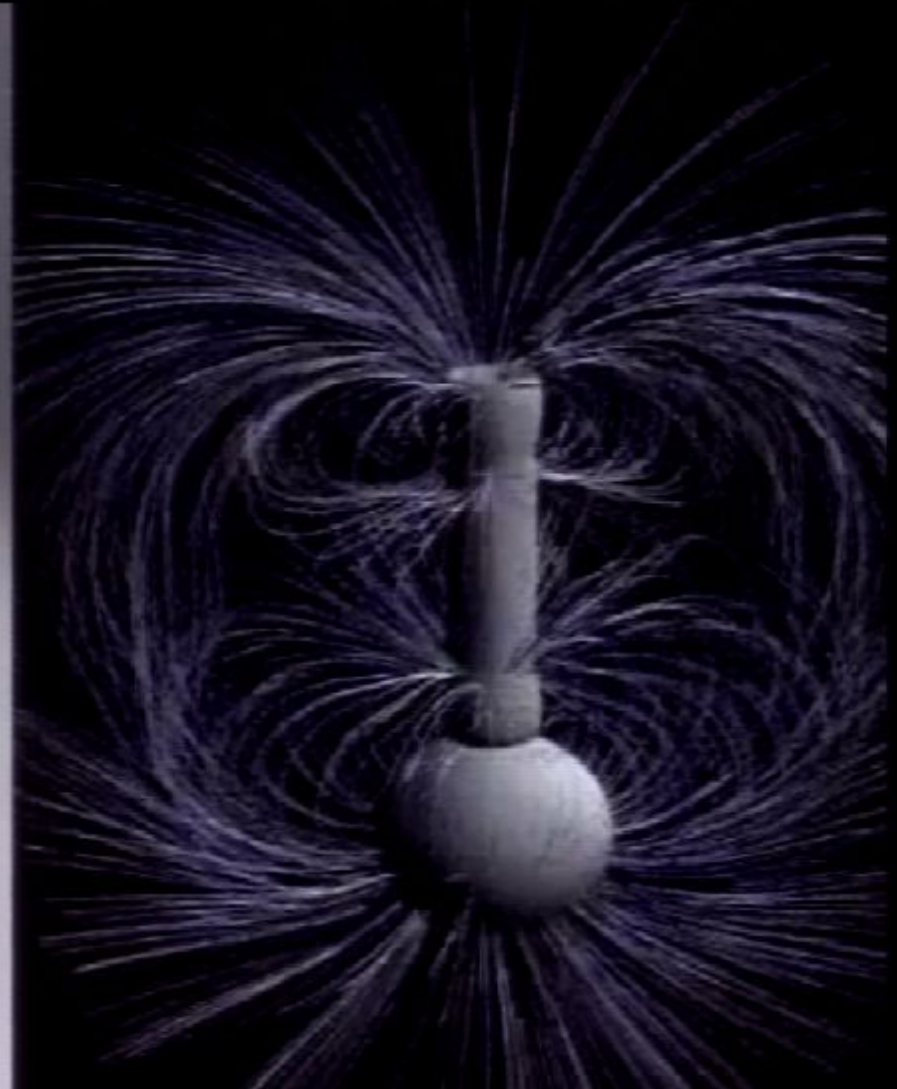


 explore magnetism

 explore magnetism




 explore magnetism





understand reality  
electromagnetism

 understand electromagnetism

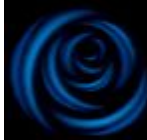


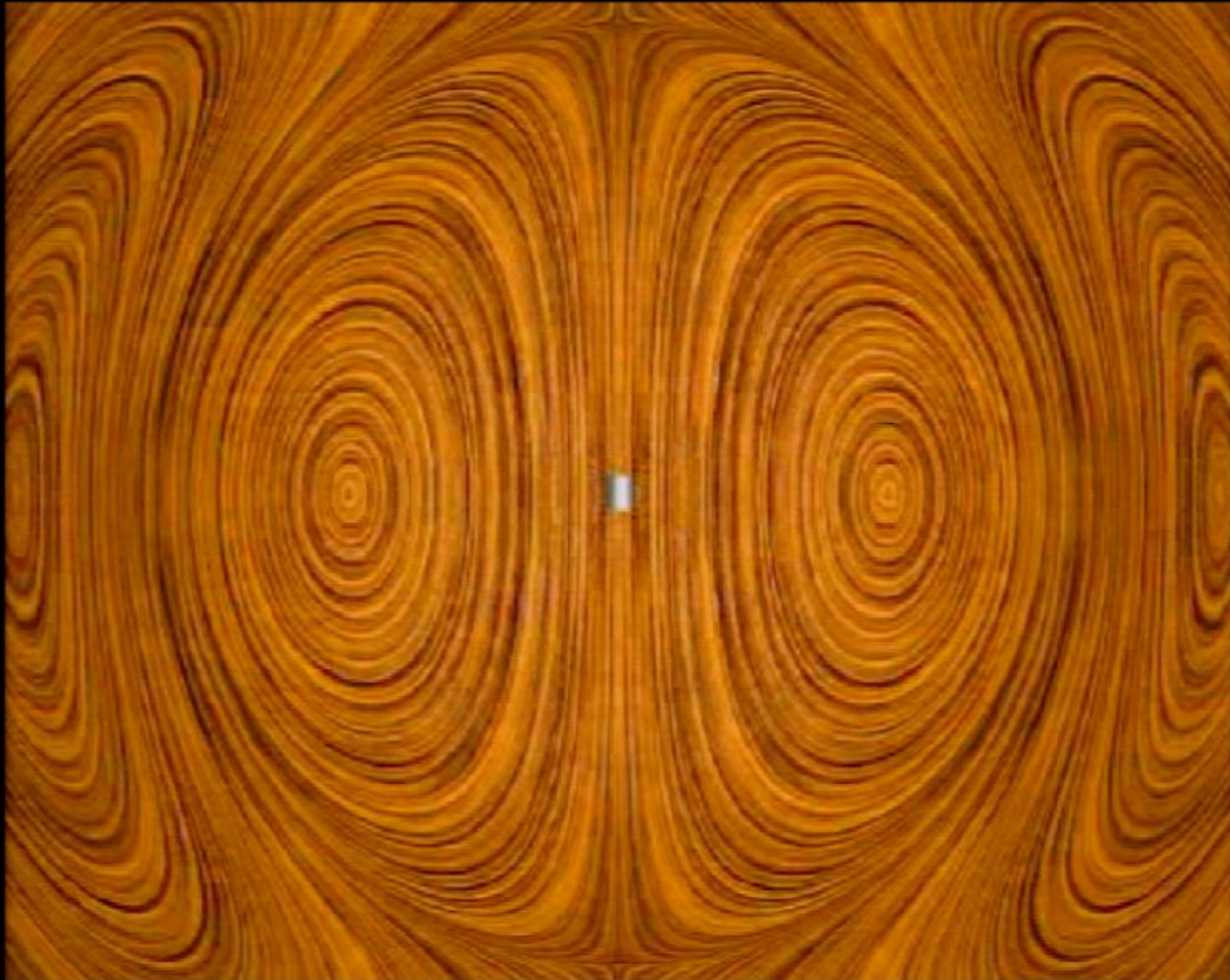
$$\nabla \cdot \mathbf{D} = \rho$$

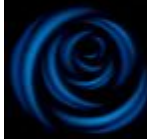
$$\nabla \cdot \mathbf{B} = 0$$

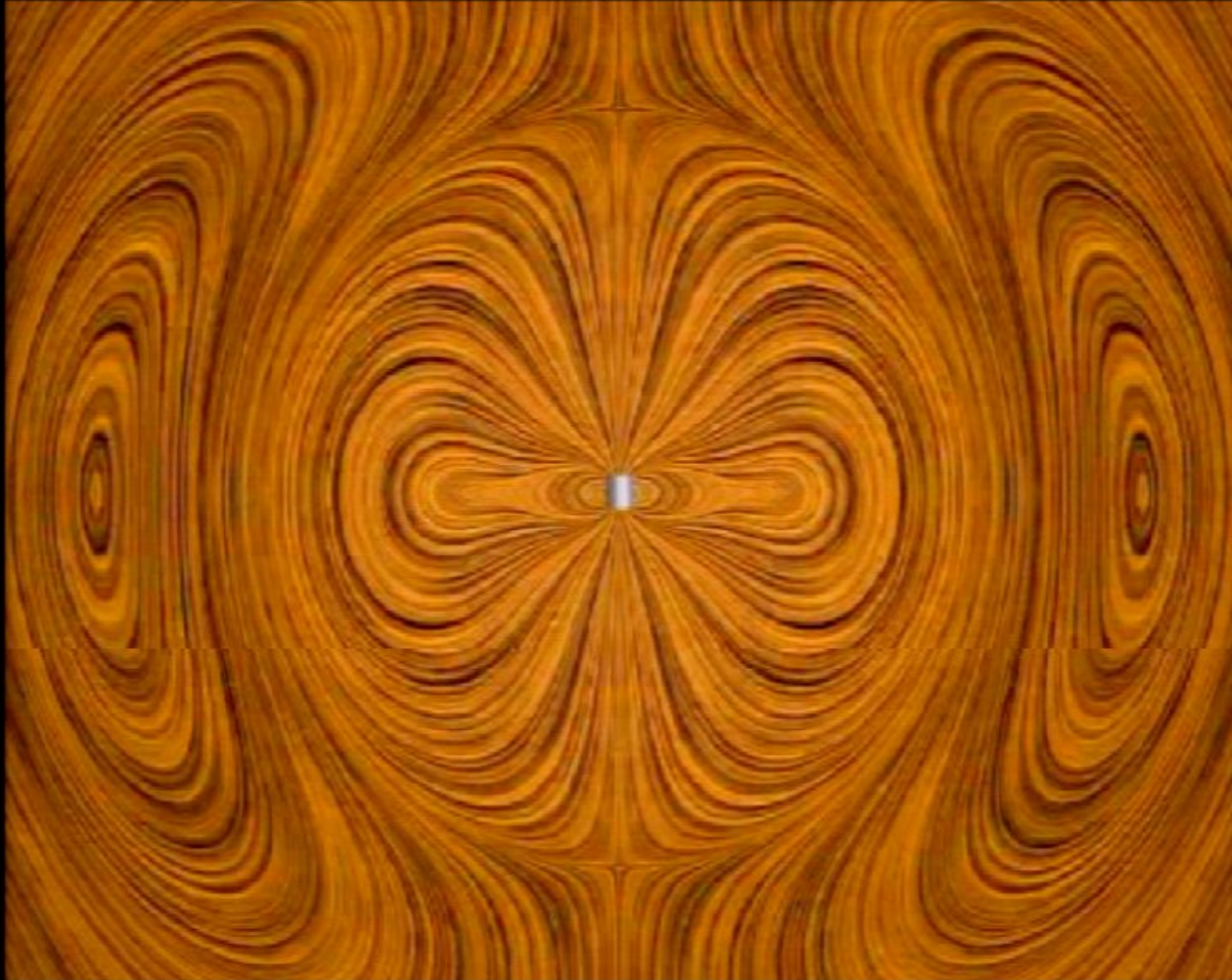
$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{H} = \mathbf{j} + \frac{\partial \mathbf{D}}{\partial t}$$


 understand electromagnetism



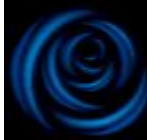
 understand electromagnetism



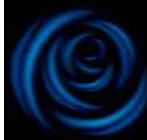


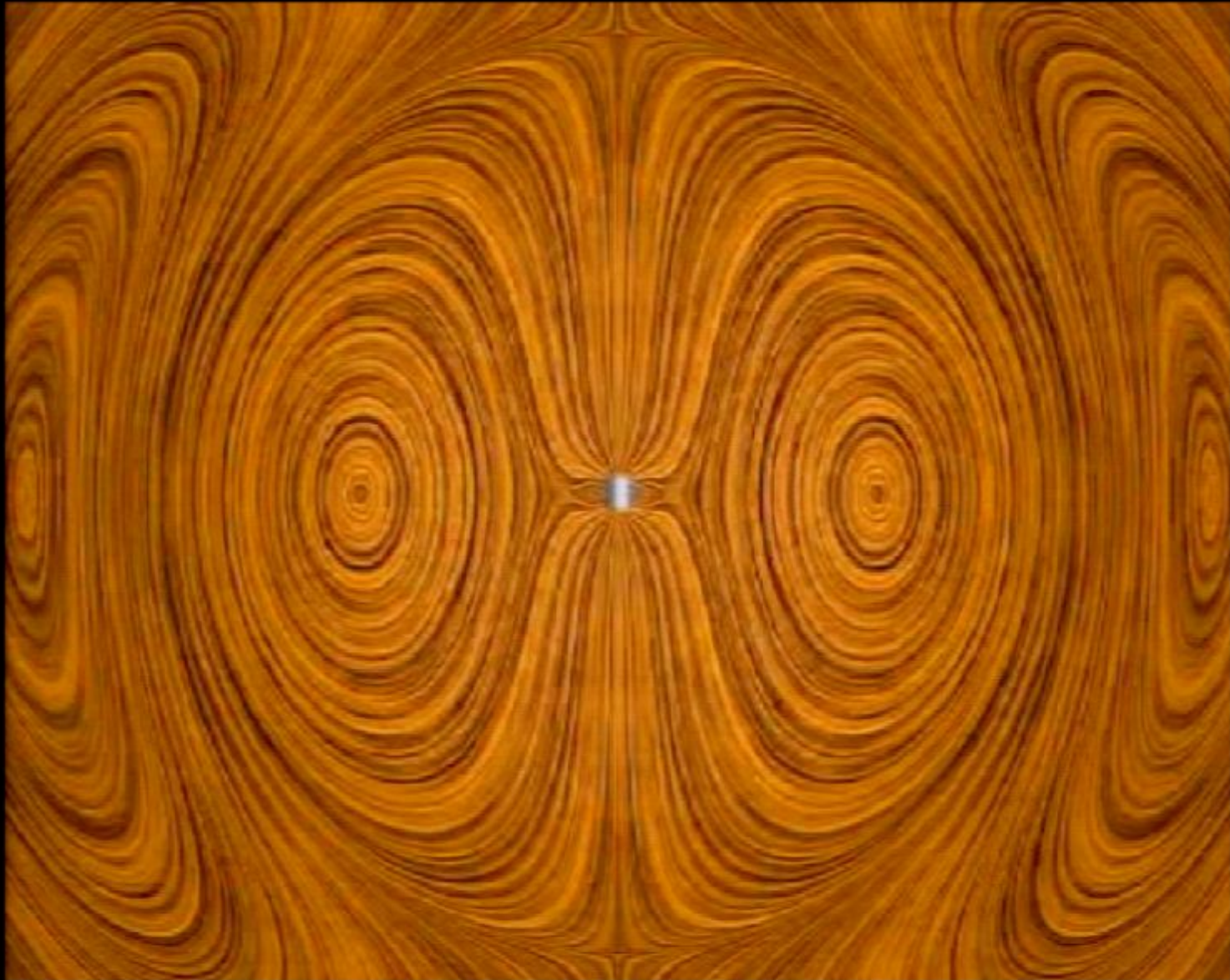
 understand electromagnetism




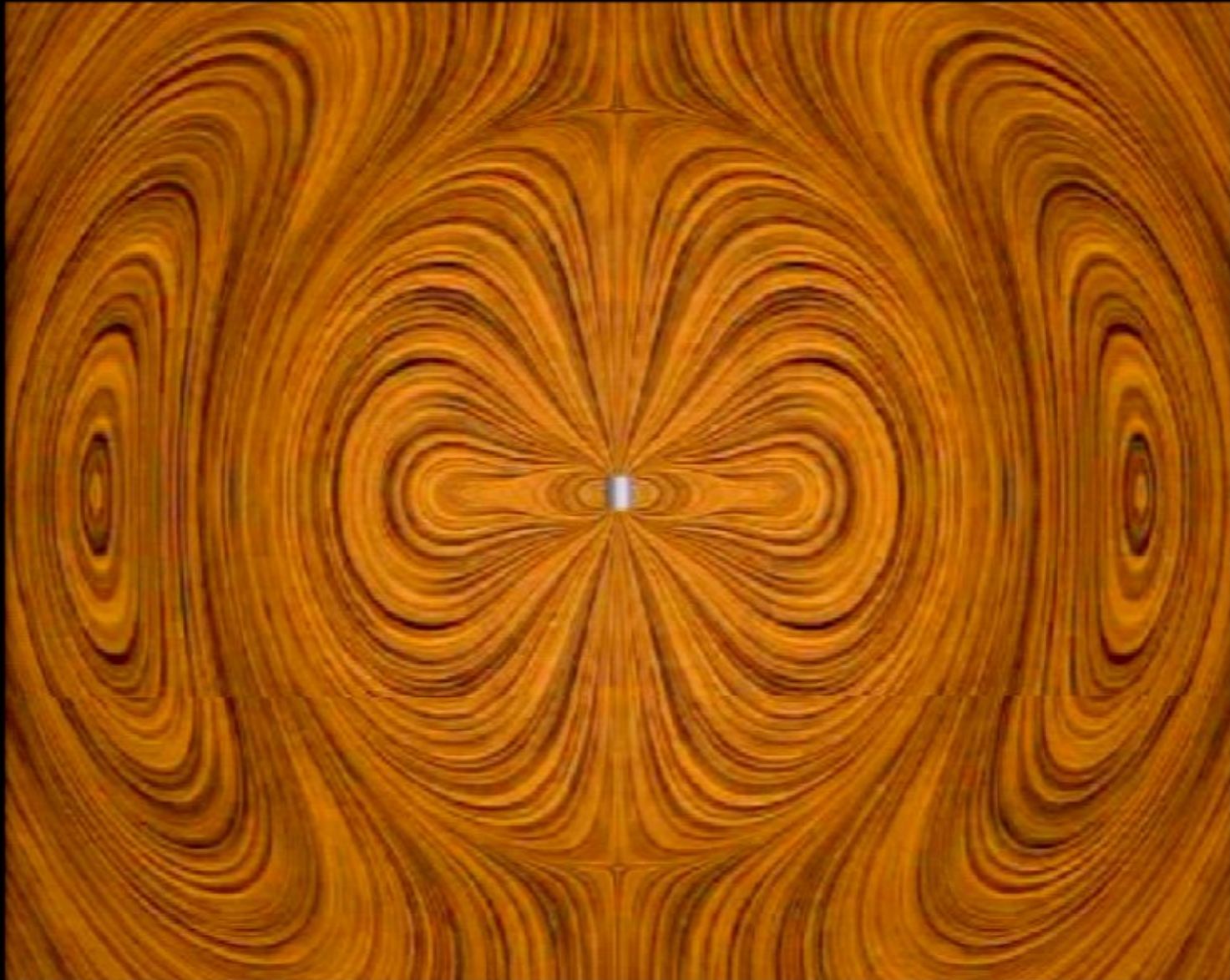
 understand electromagnetism

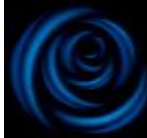


 understand electromagnetism

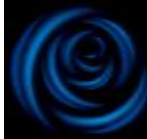


 understand electromagnetism

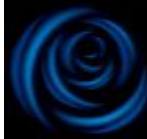


 understand electromagnetism




 understand electromagnetism



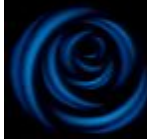
 understand electromagnetism




 understand electromagnetism






 understand electromagnetism

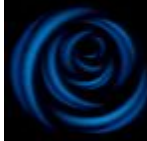


 understand electromagnetism




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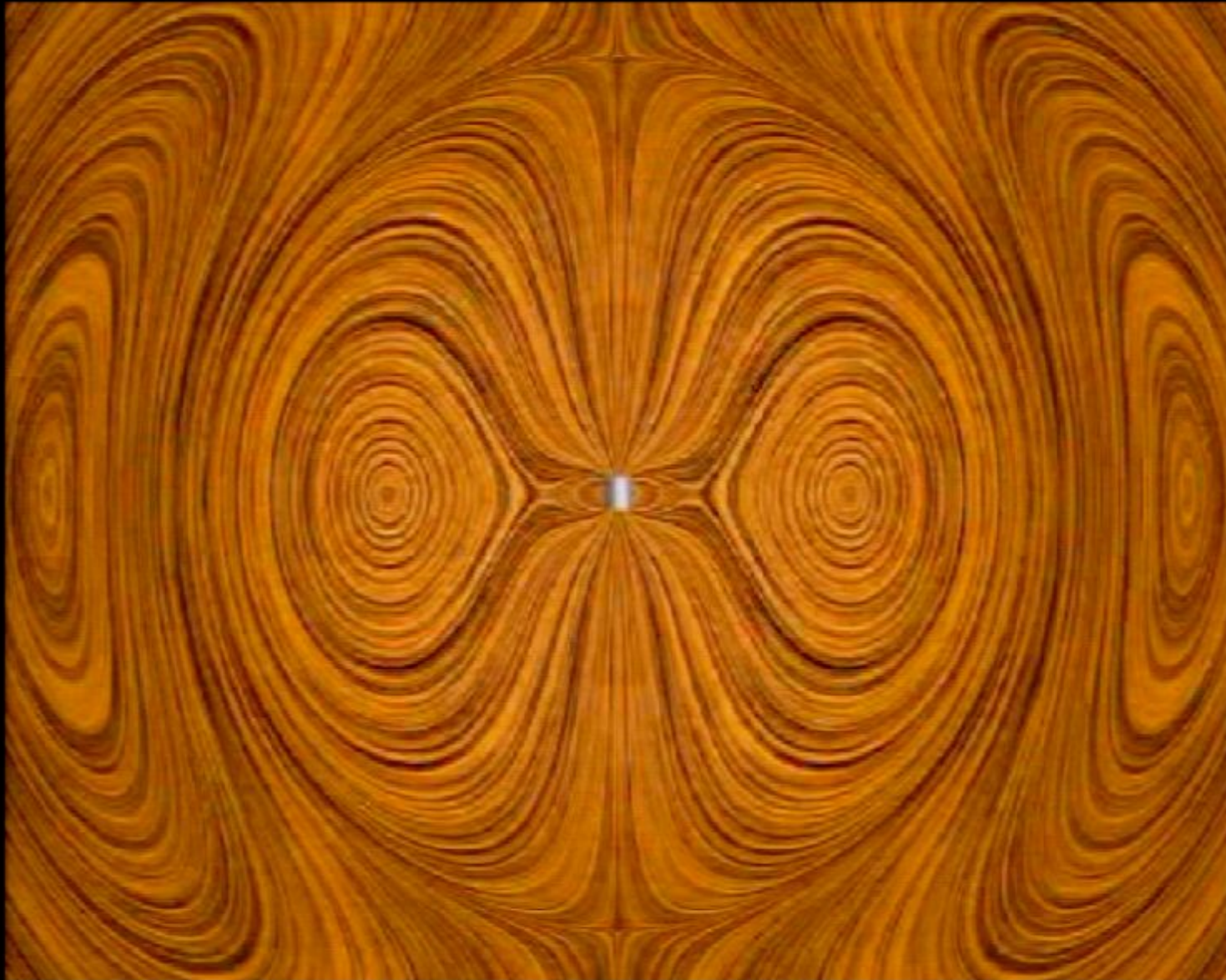
 understand electromagnetism



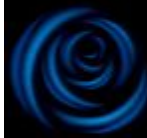
 understand electromagnetism

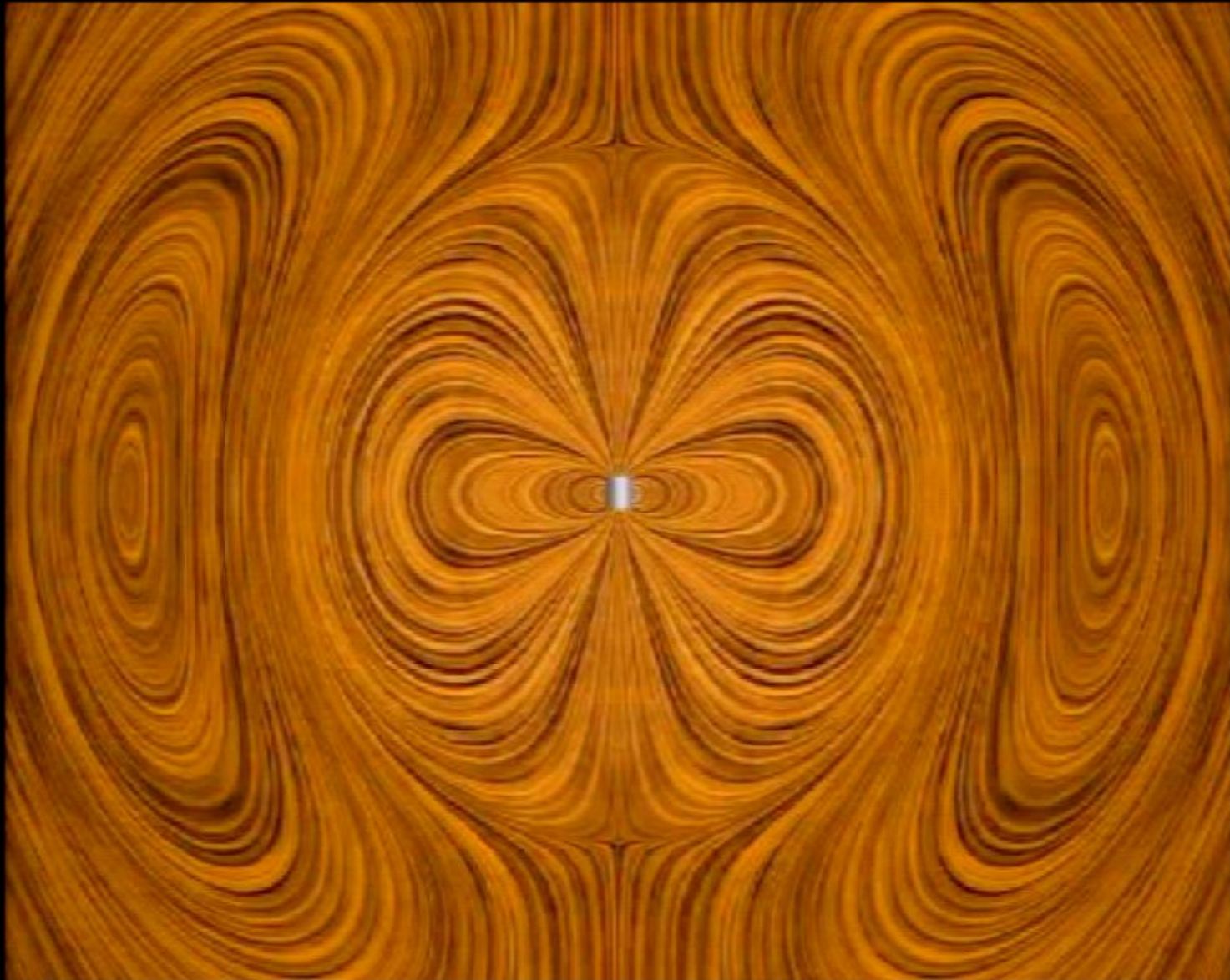


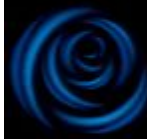
 understand electromagnetism






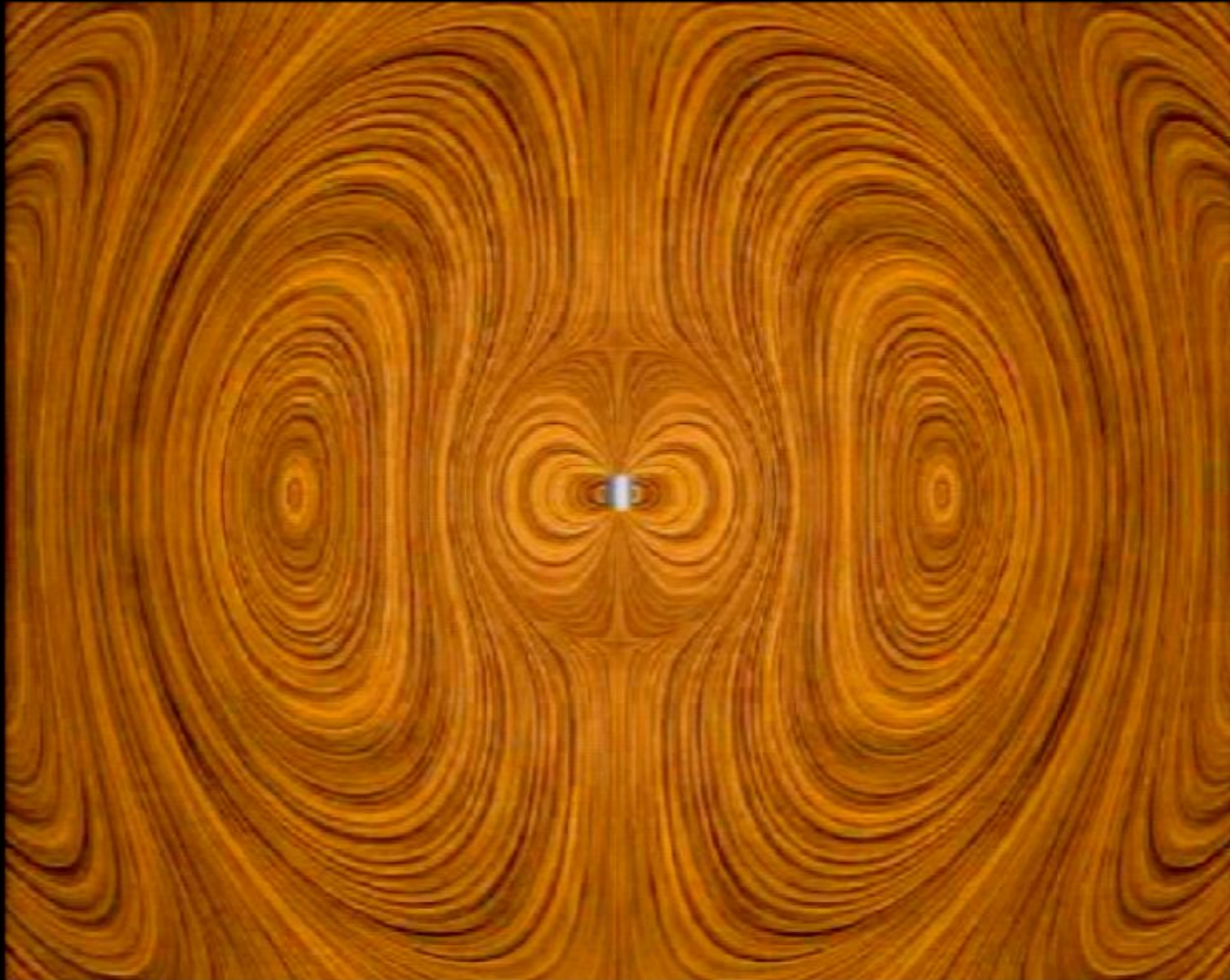
 understand electromagnetism




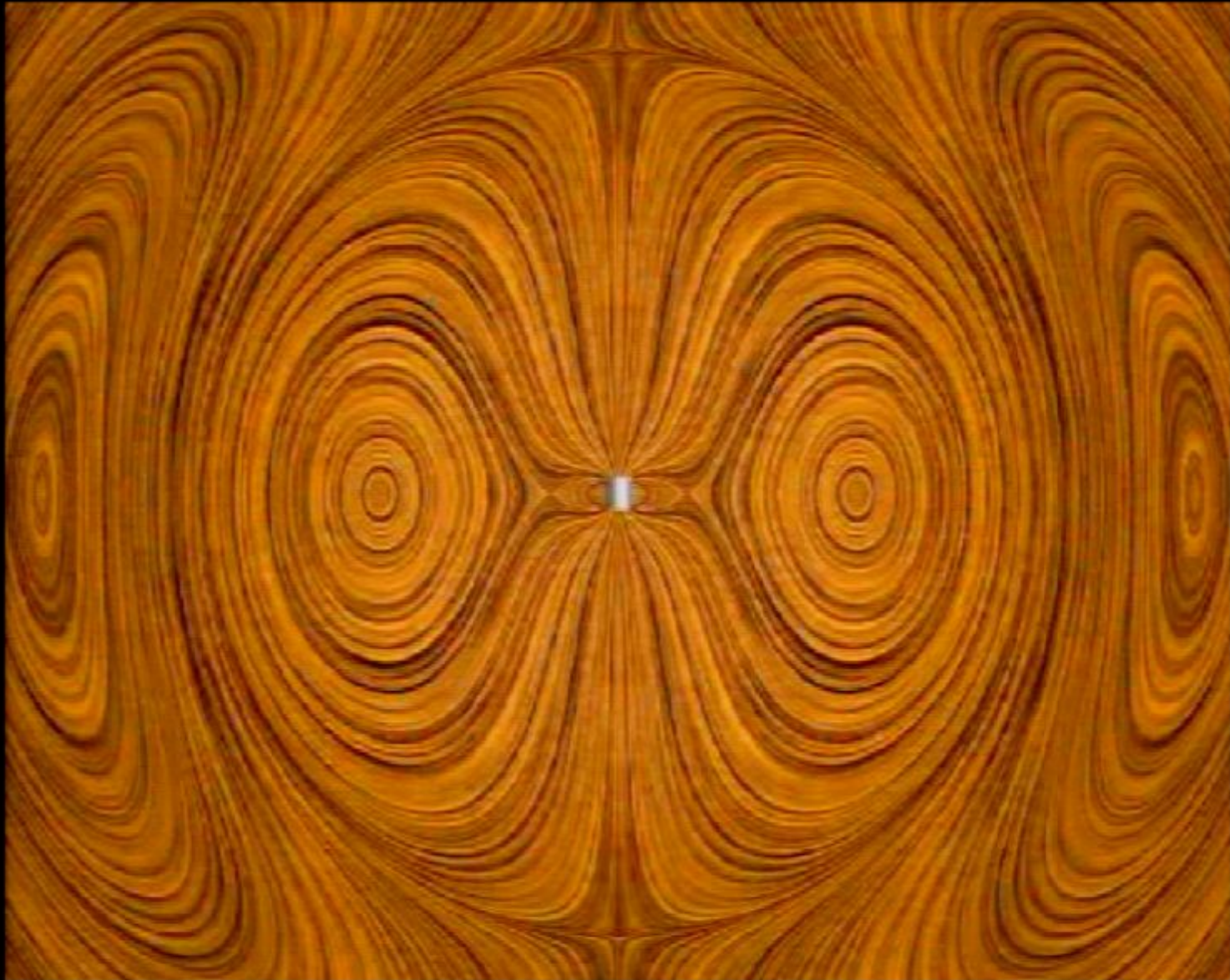
 understand electromagnetism

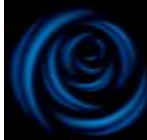


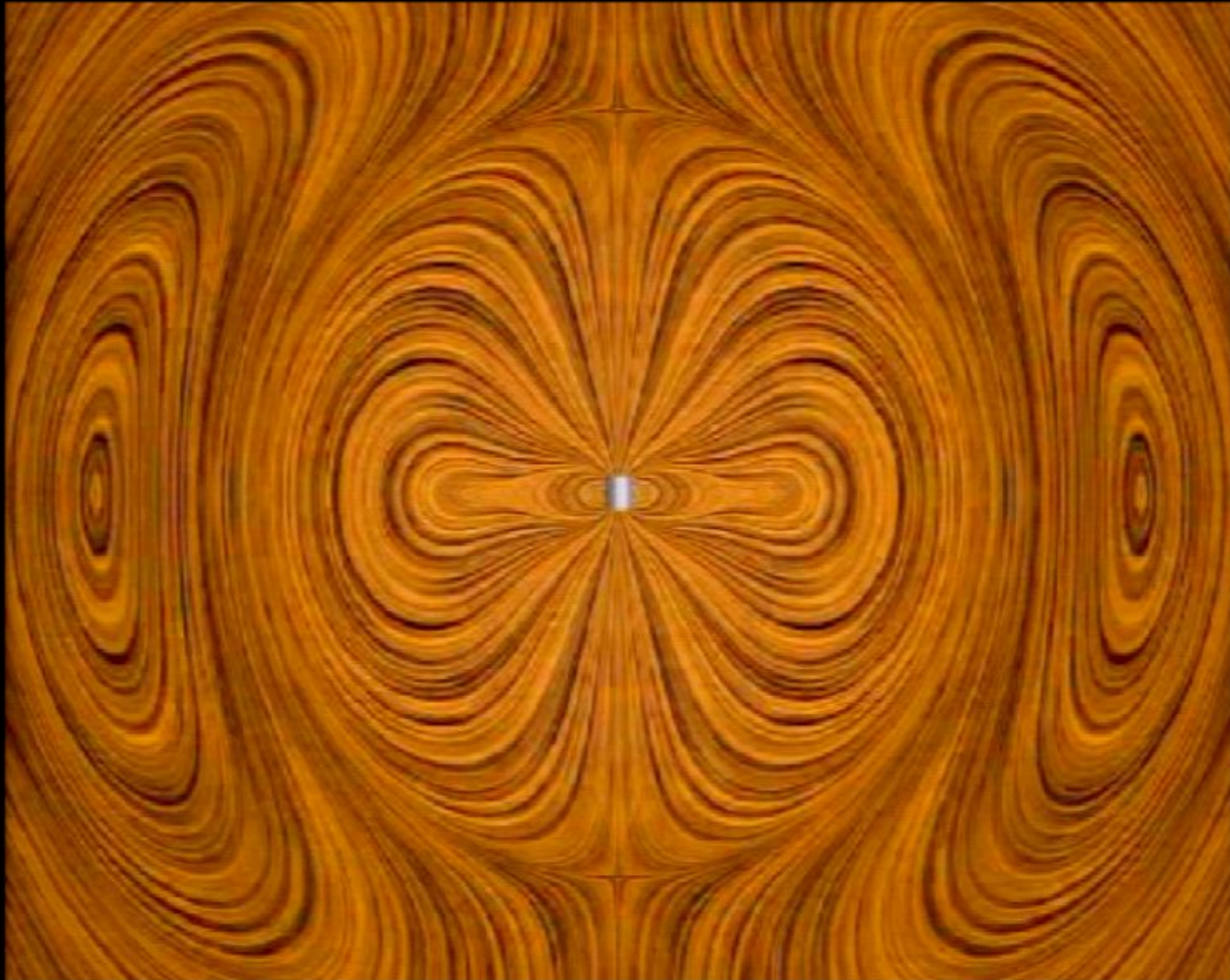
 understand electromagnetism




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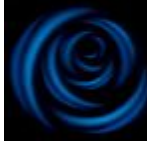


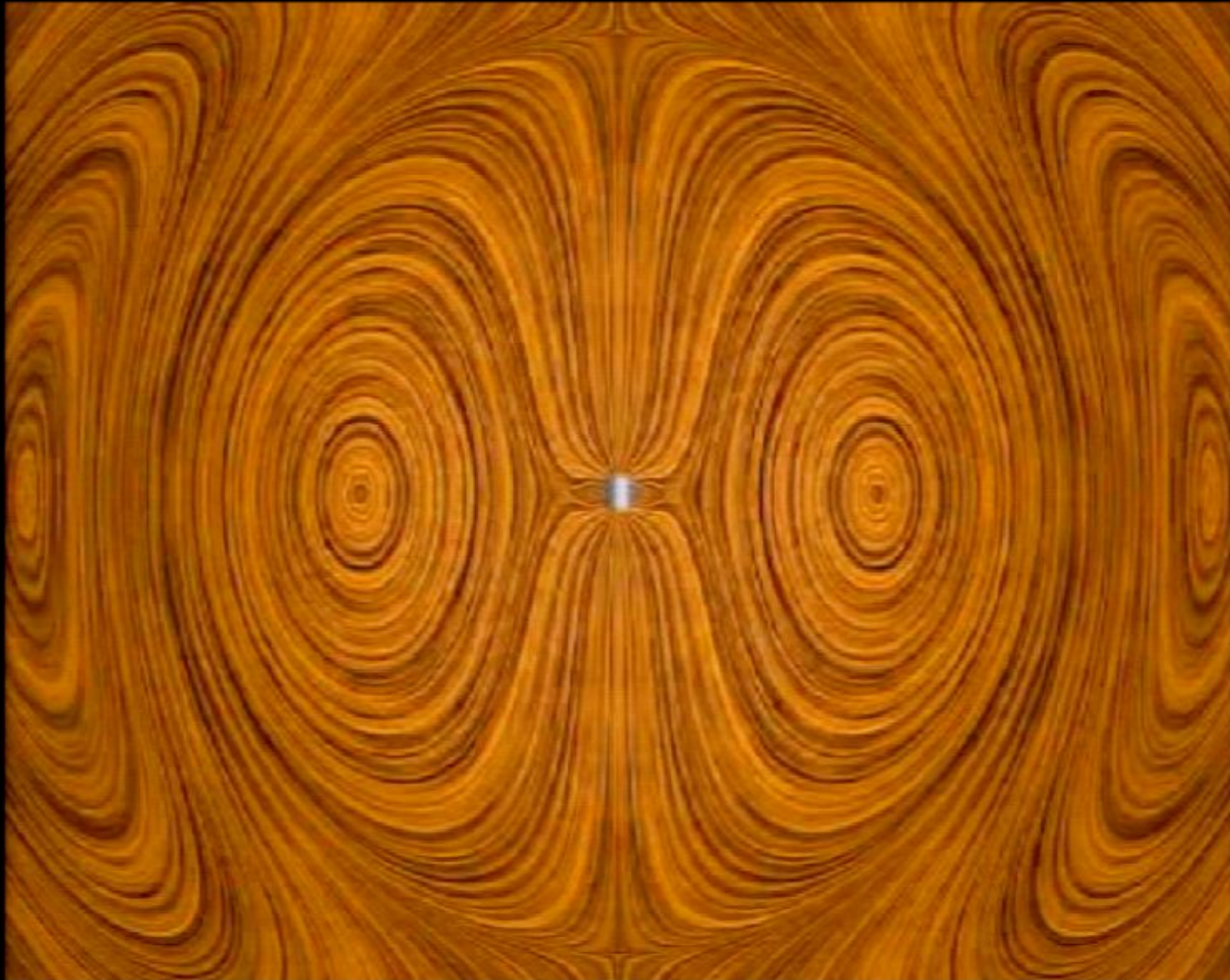
 understand electromagnetism




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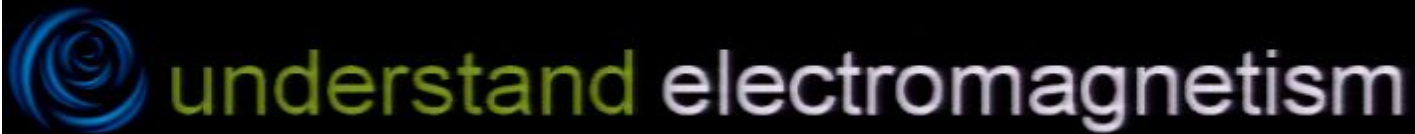
 understand electromagnetism






understand electromagnetism





 understand electromagnetism



how nature transports pure energy  
... at one billion km/h



build cool stuff

telecommunication devices



build cool stuff

telecommunication devices



build radio







build radio





build television





build television



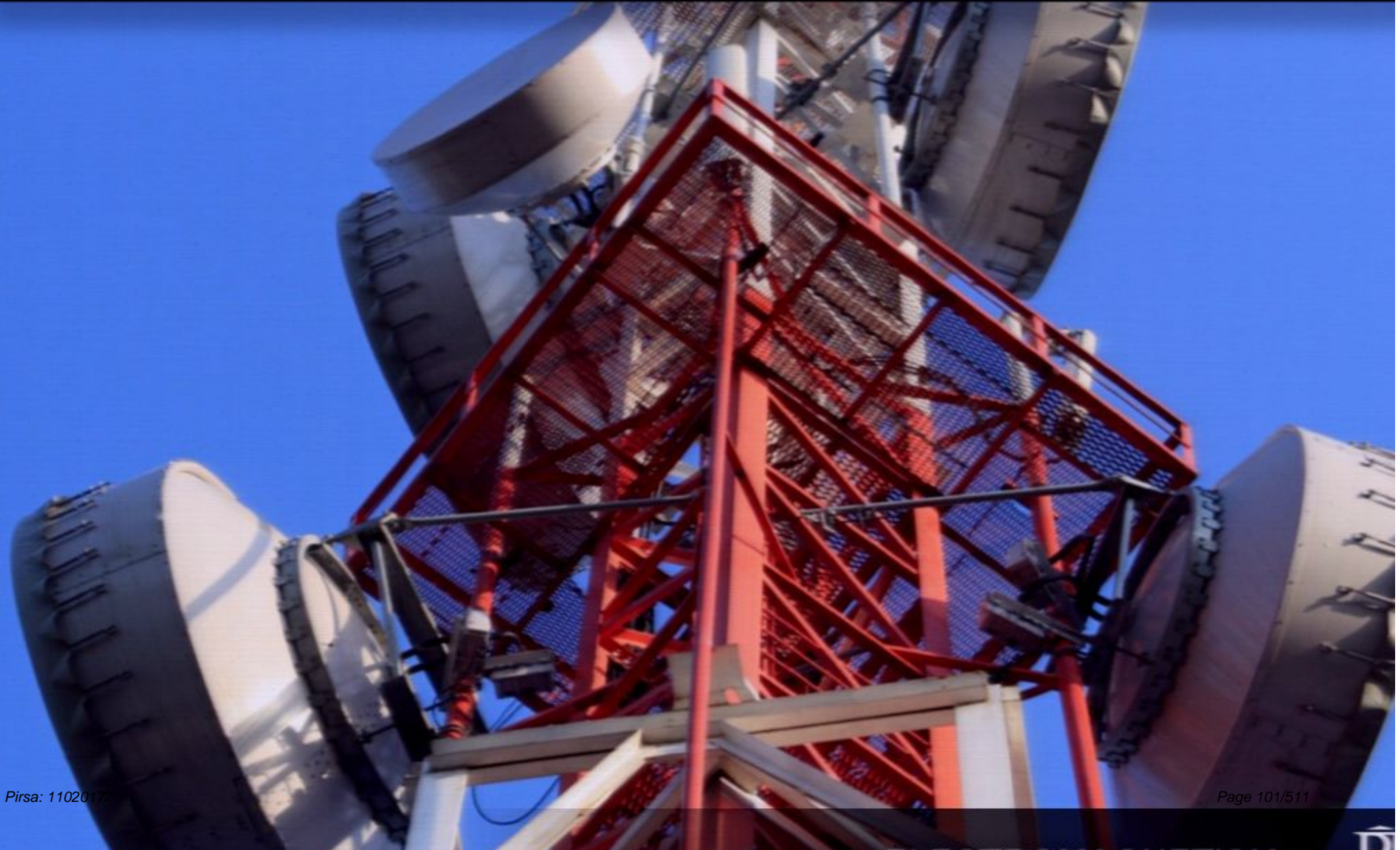


# build cable network





# build microwave network



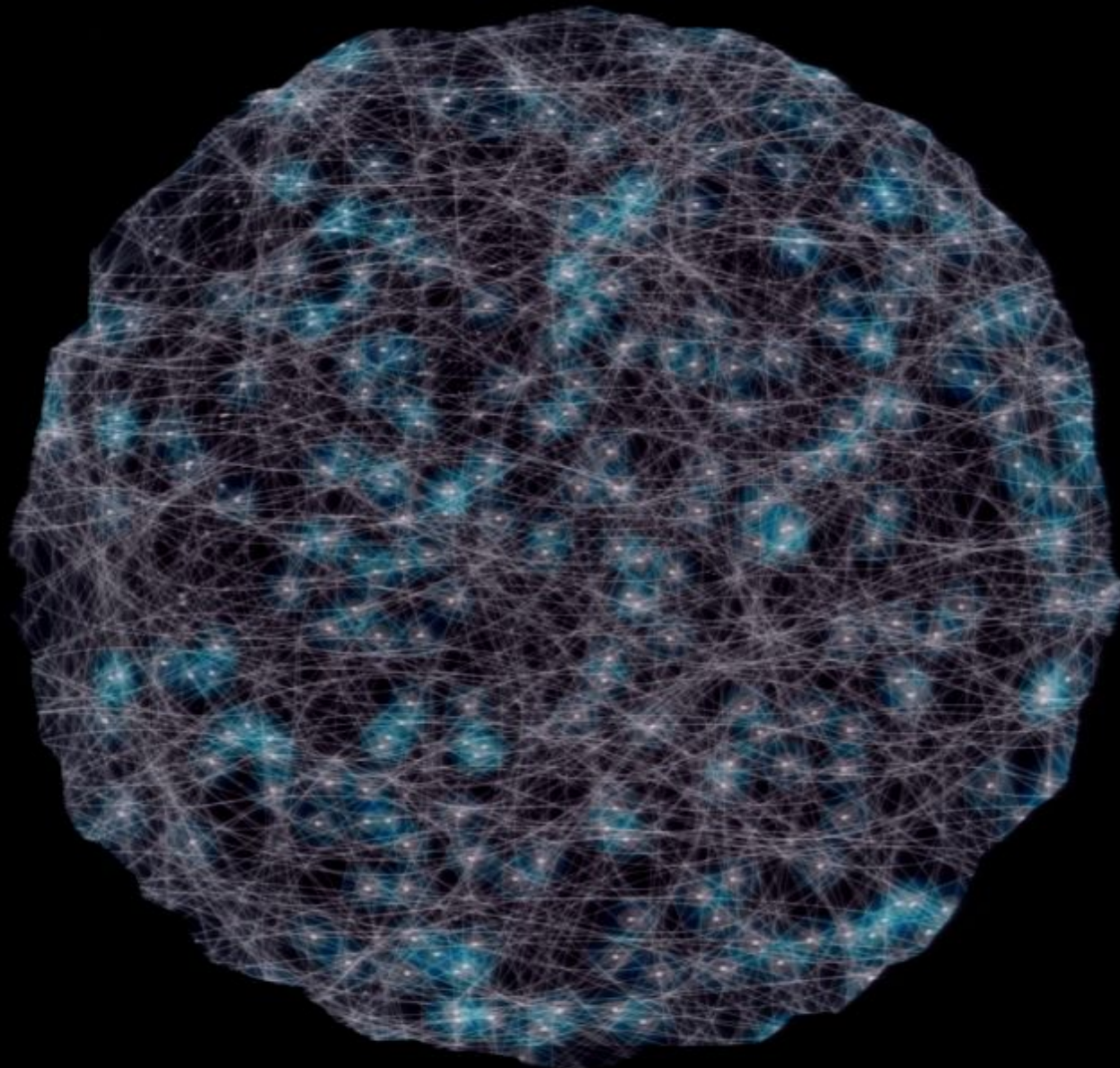


# build satellite network



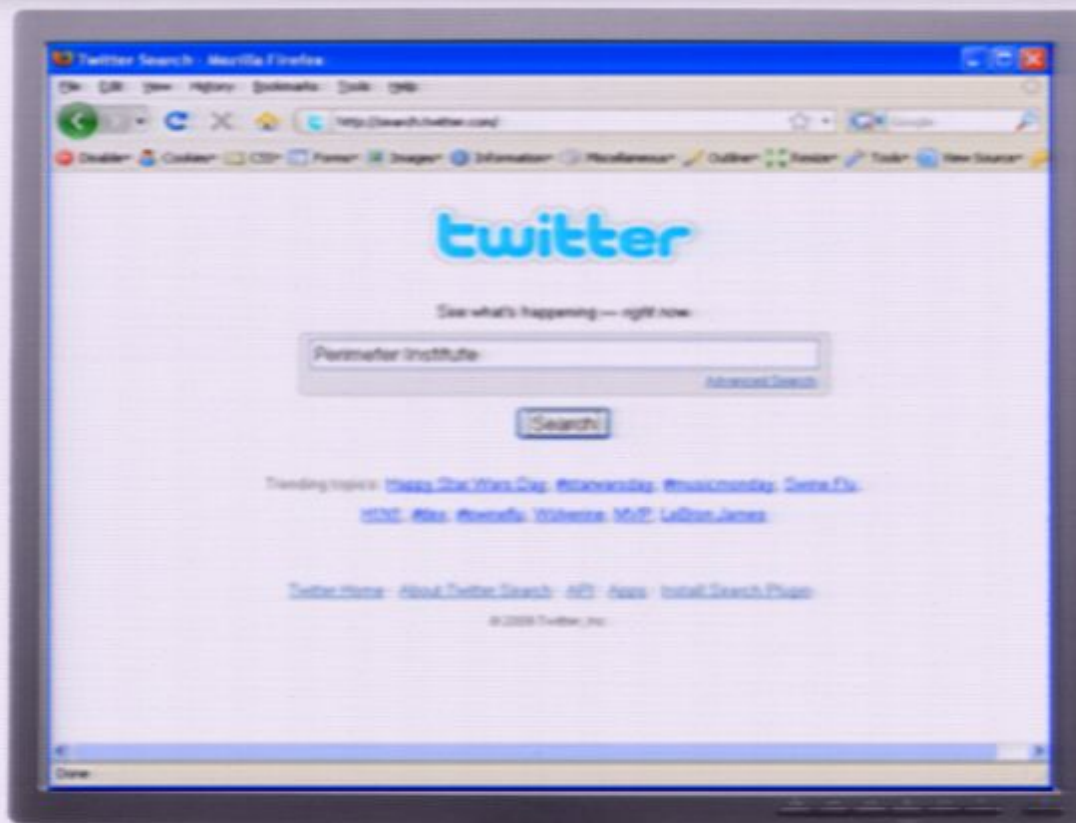


build satellite network





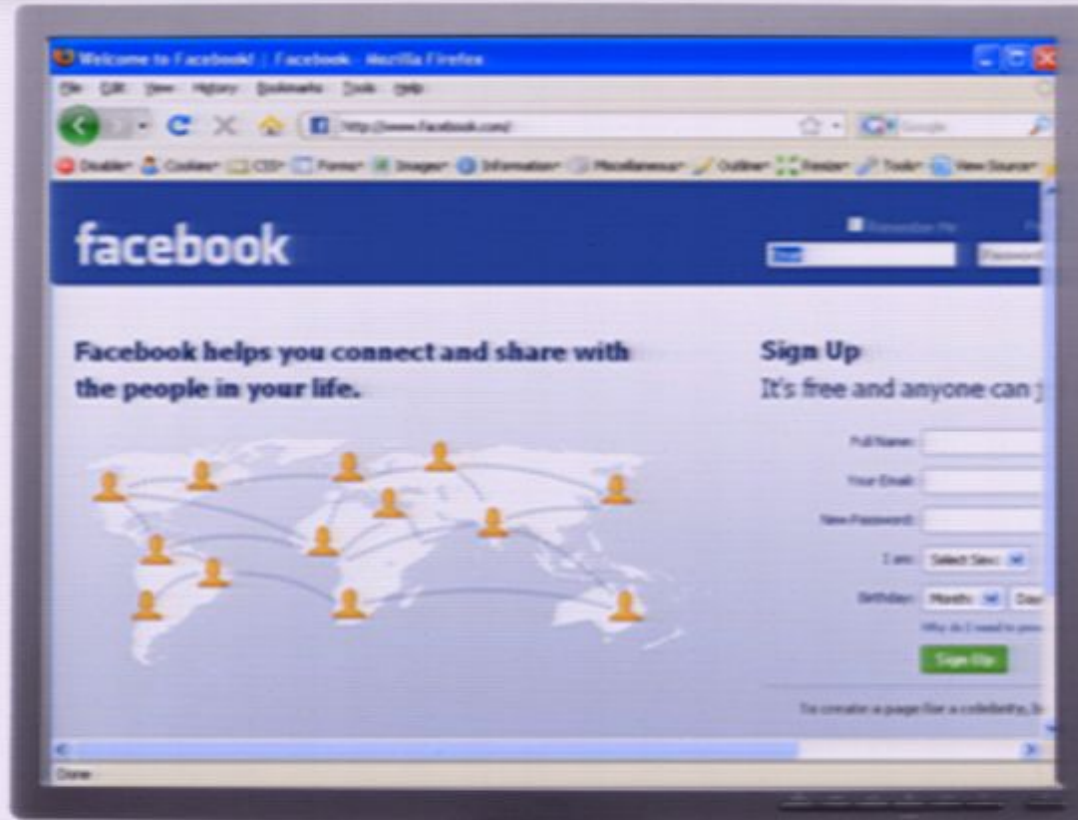
build internet





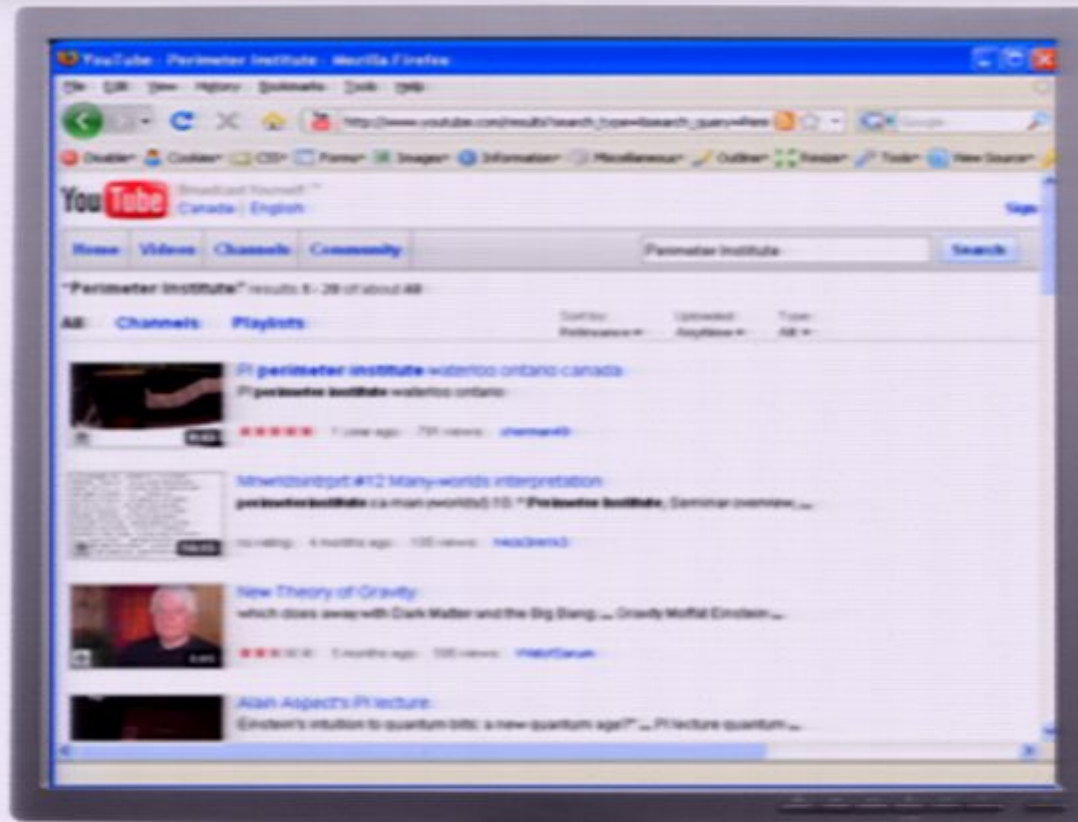


build internet





build internet



$$\nabla \cdot D = \rho$$

$$\nabla \cdot B = 0$$

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

$$\nabla \times H = j + \frac{\partial D}{\partial t}$$

power of ideas

$$\nabla \cdot \mathbf{D} = \rho$$

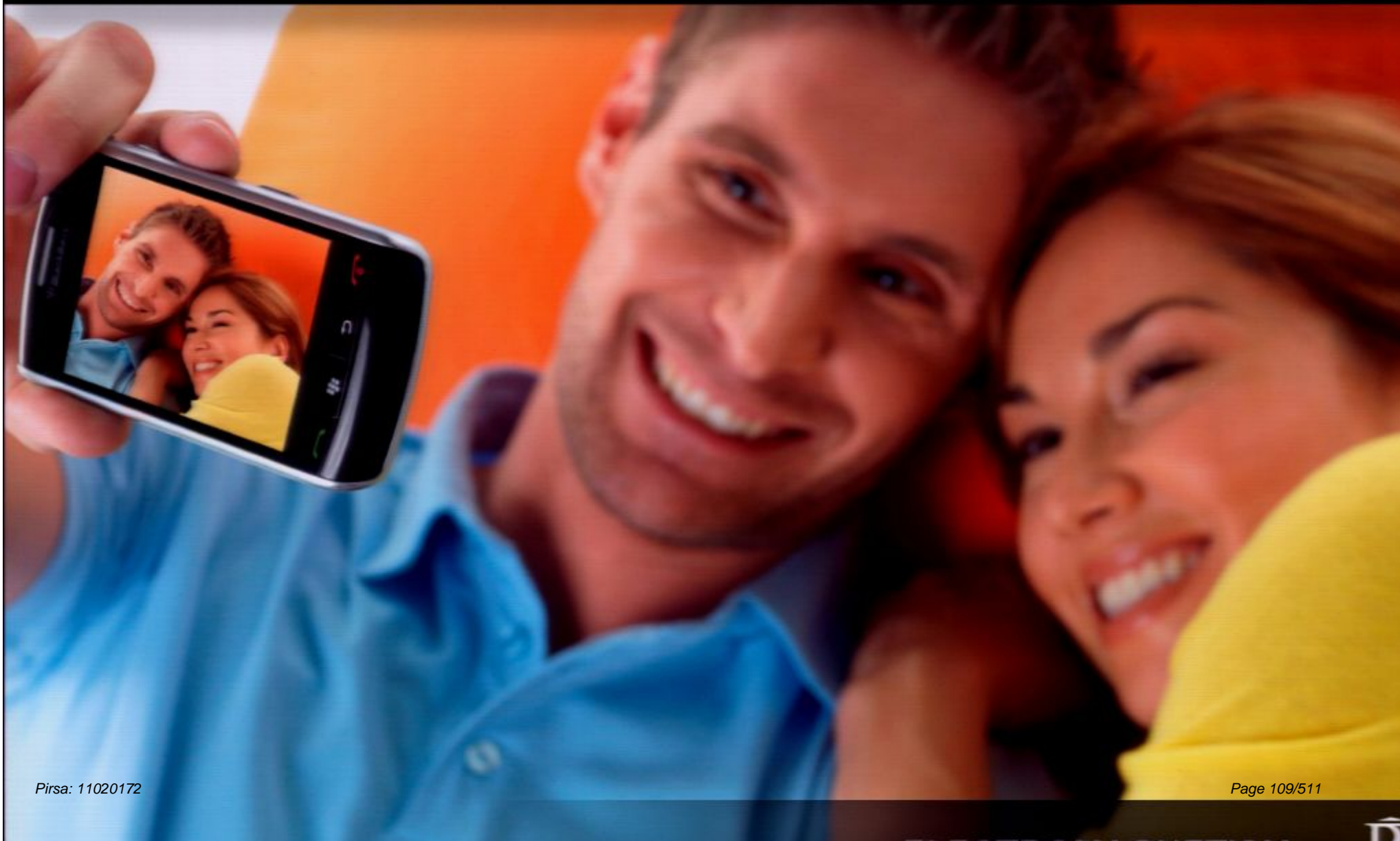
$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{H} = \mathbf{j} + \frac{\partial \mathbf{D}}{\partial t}$$

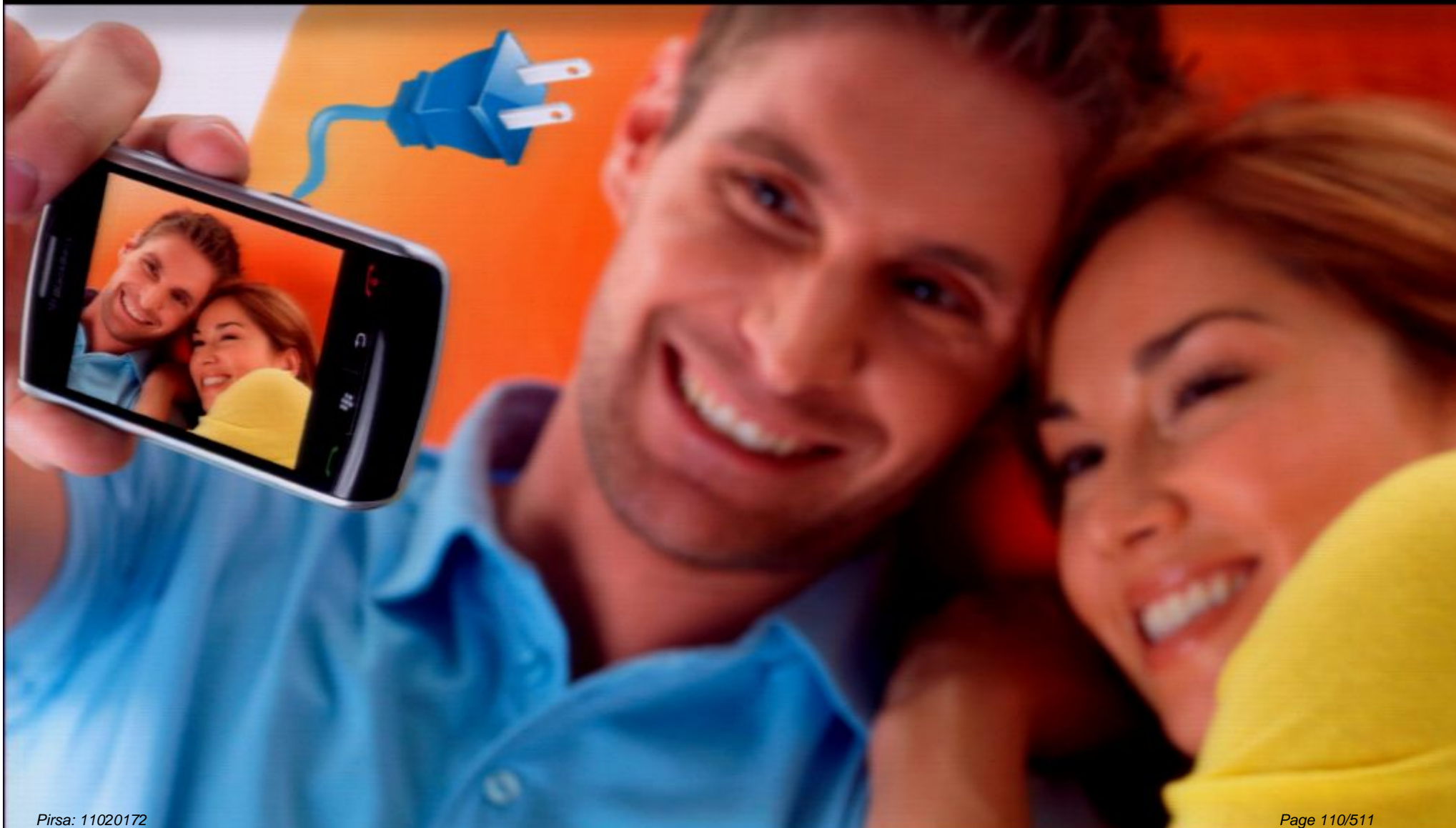


build cell phones





# build cell phones





build everything we plug in





build everything we plug in







**build** everything we plug in





build everything we plug in



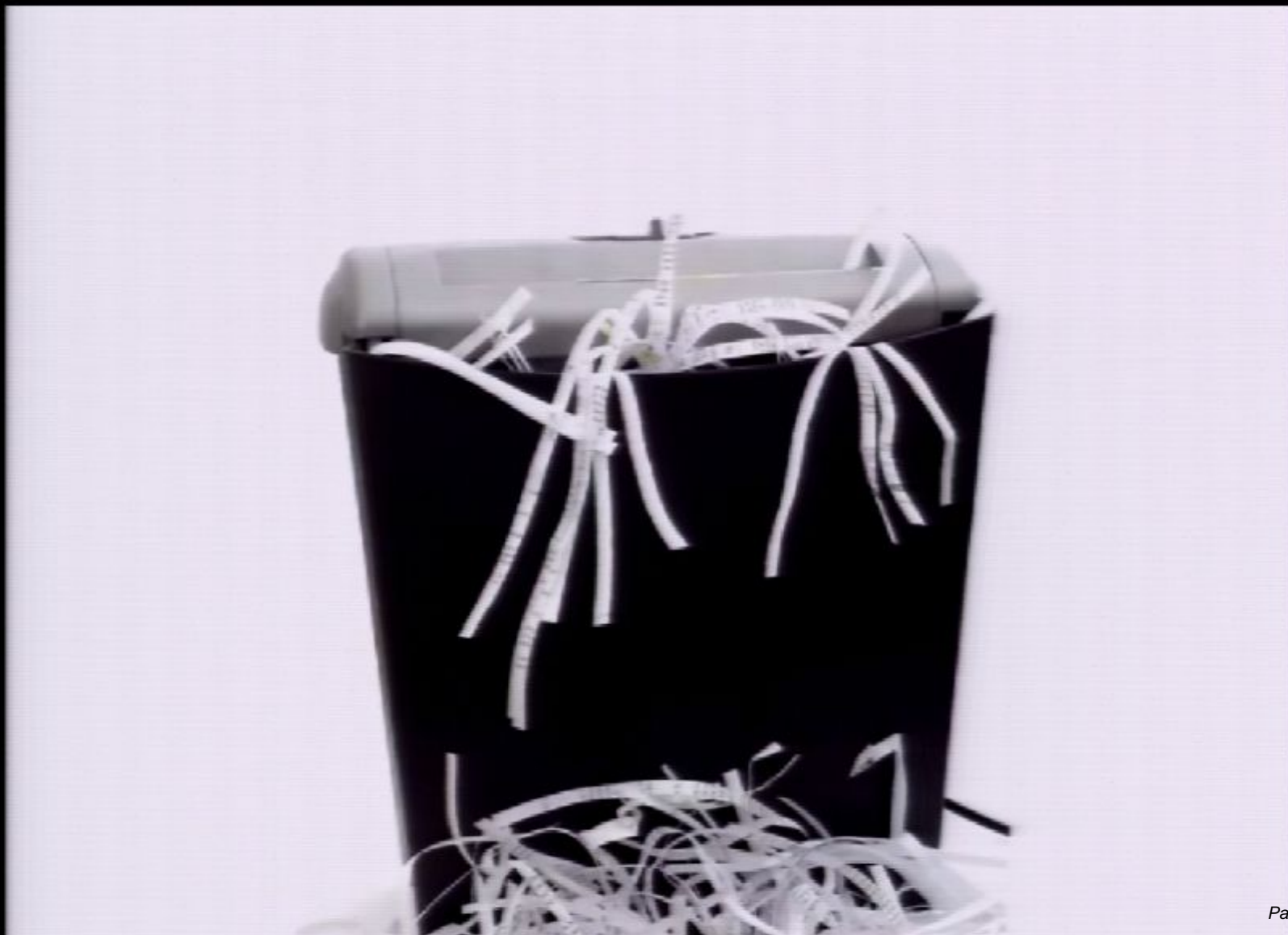


**build** everything we plug in





**build** everything we plug in





**build** everything we plug in





**build** everything we plug in





build everything we plug in





build everything we plug in







build everything we plug in





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build everything we plug in





build everything we plug in







build everything we plug in



build everything we plug in





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build everything we plug in



$$\nabla \cdot D = \rho$$

$$\nabla \cdot B = 0$$

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

$$\nabla \times H = j + \frac{\partial D}{\partial t}$$

power of ideas

$$\nabla \cdot \mathbf{D} = \rho$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

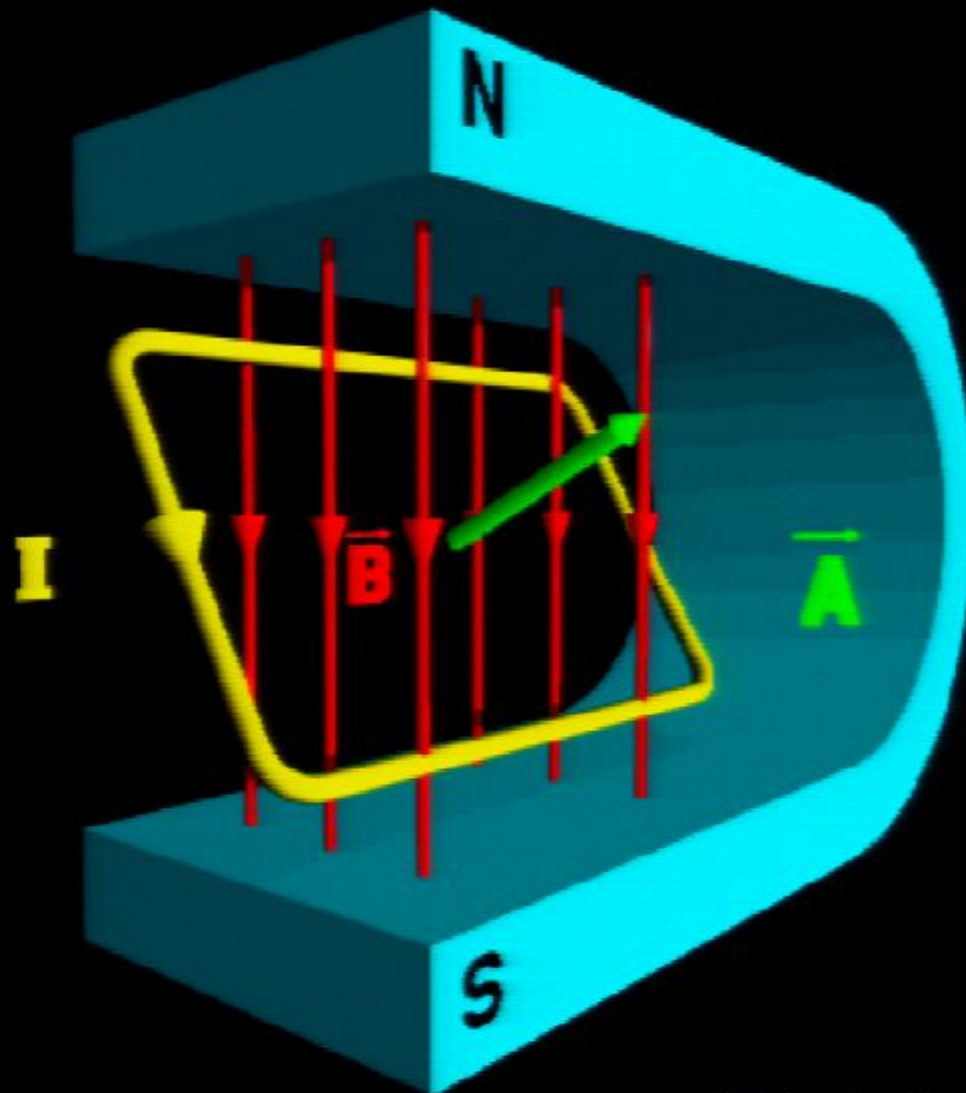
$$\nabla \times \mathbf{H} = \mathbf{j} + \frac{\partial \mathbf{D}}{\partial t}$$



build cool stuff  
electric power generators



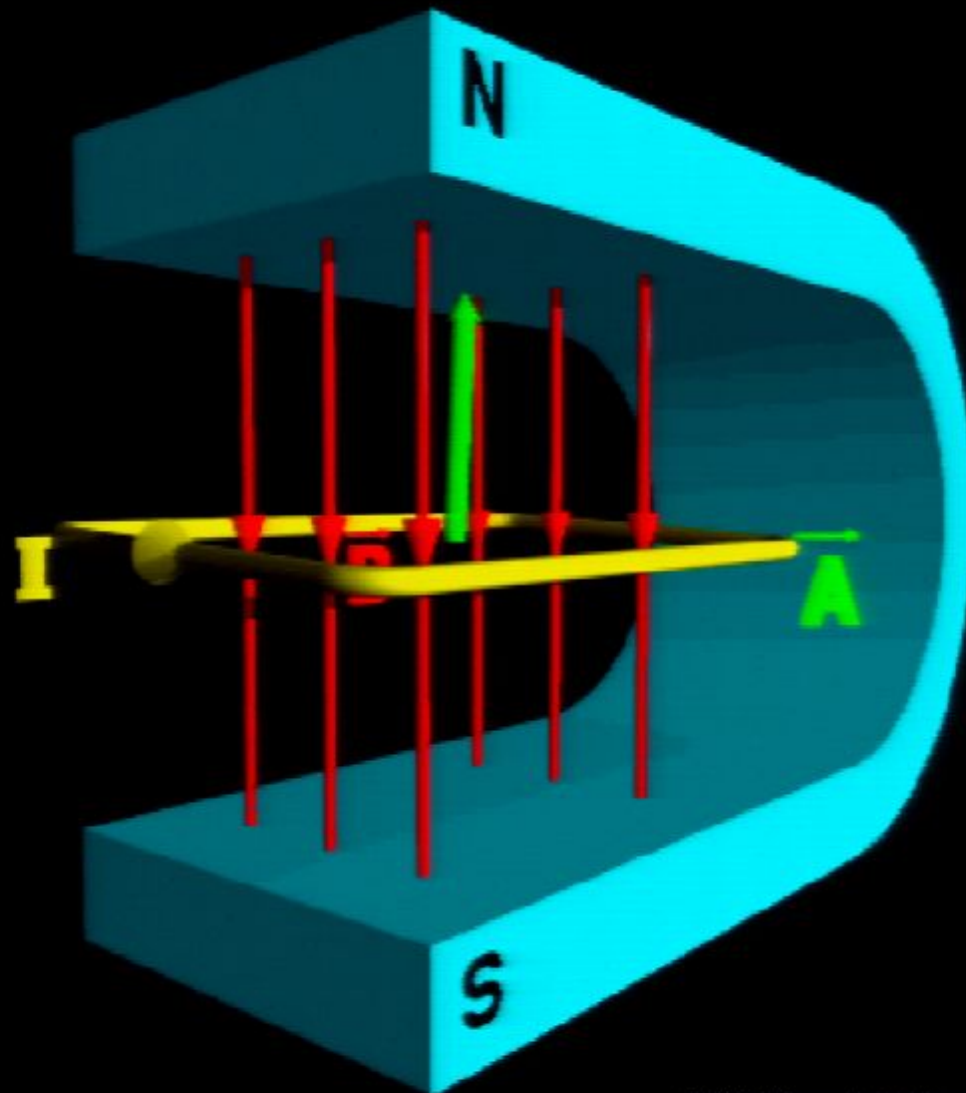
# build power generators





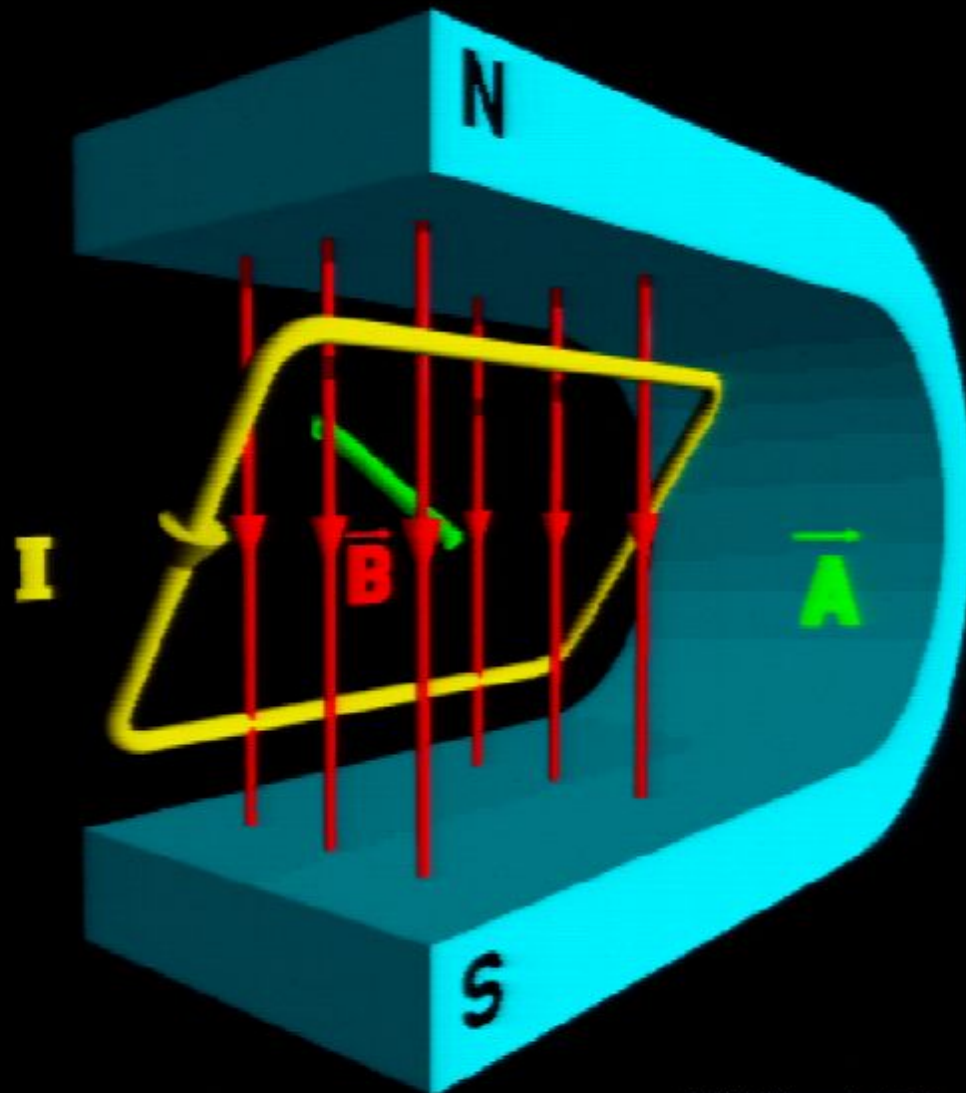


# build power generators



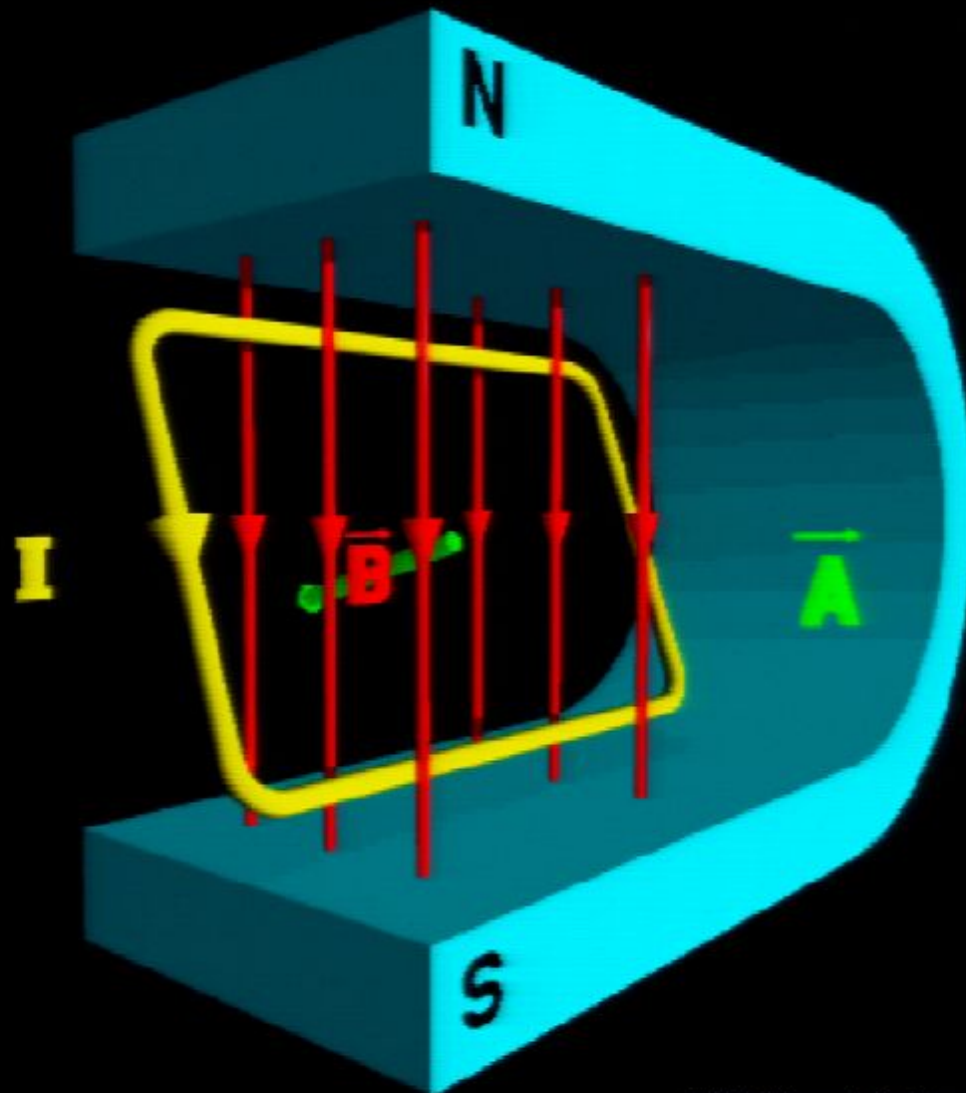


# build power generators



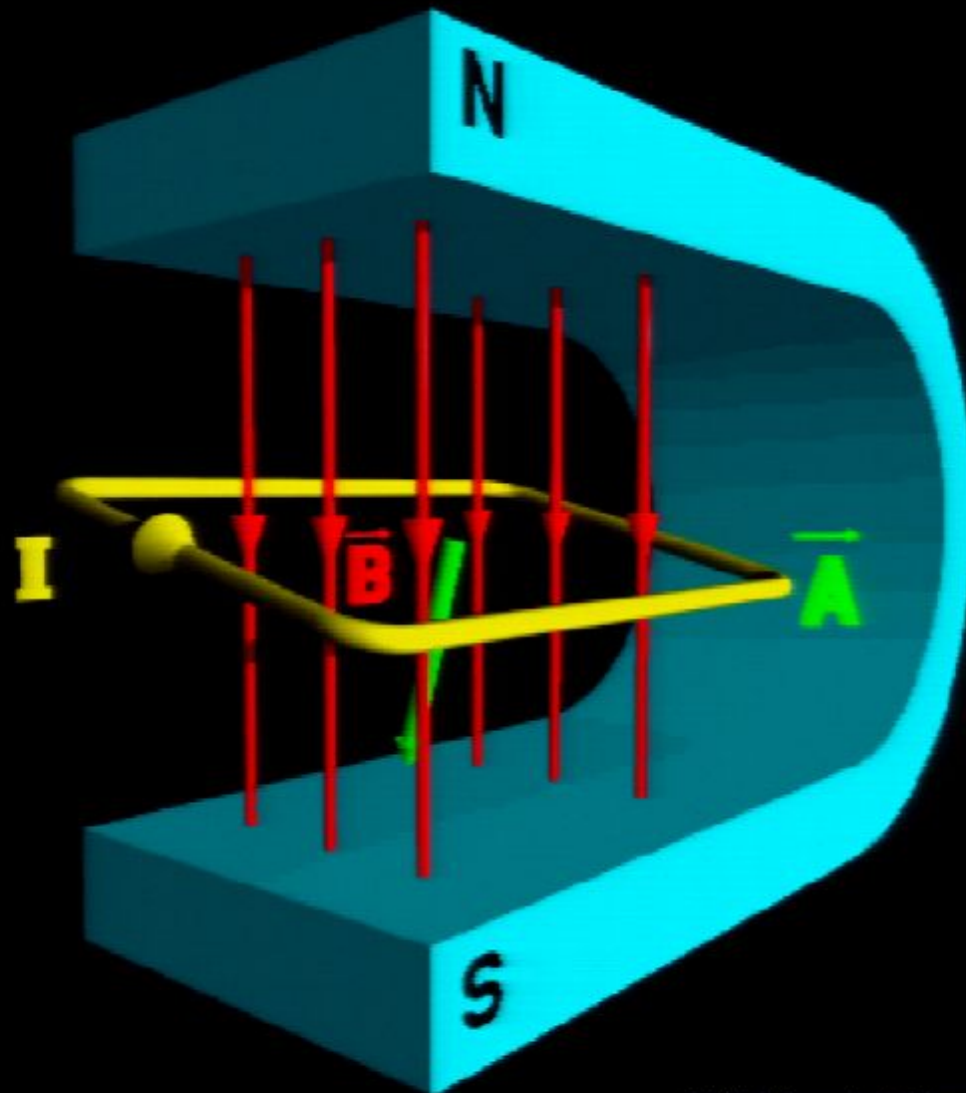


# build power generators



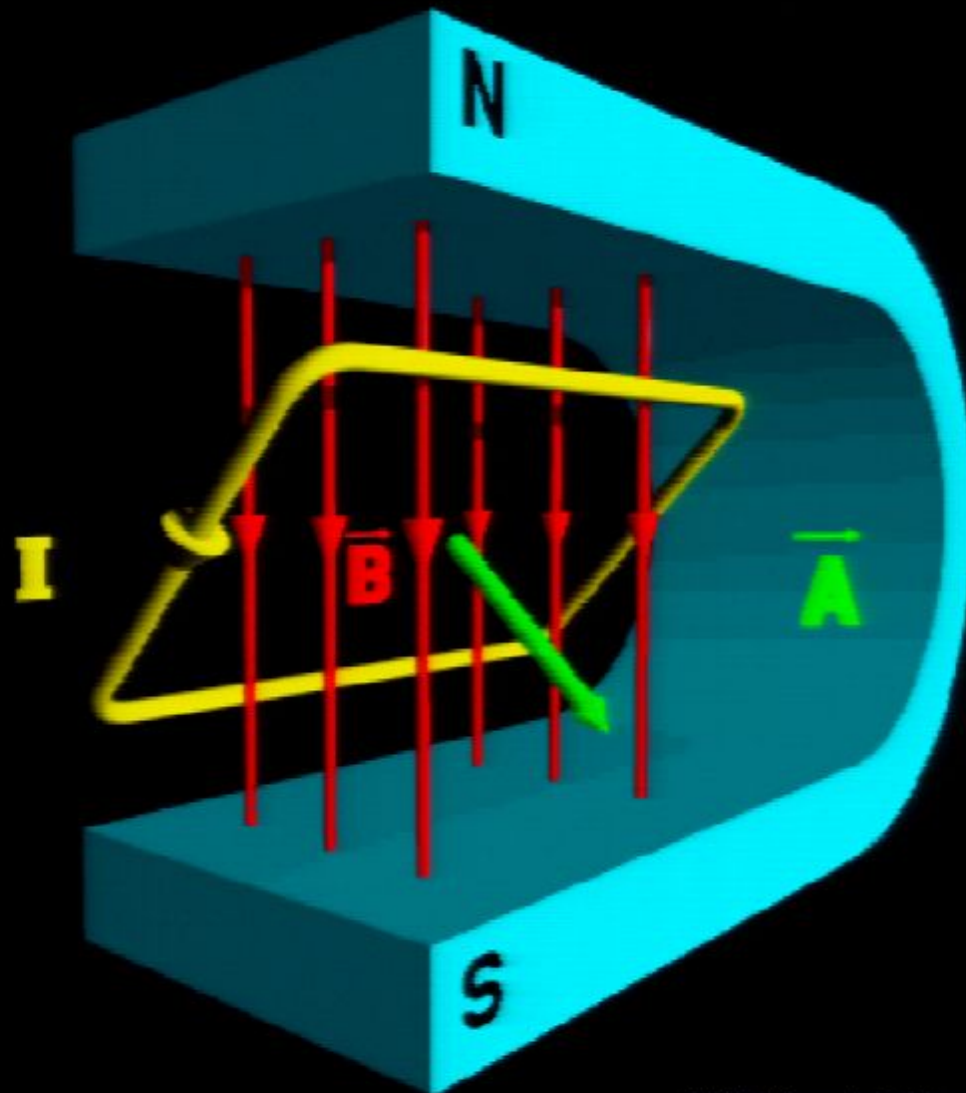


# build power generators



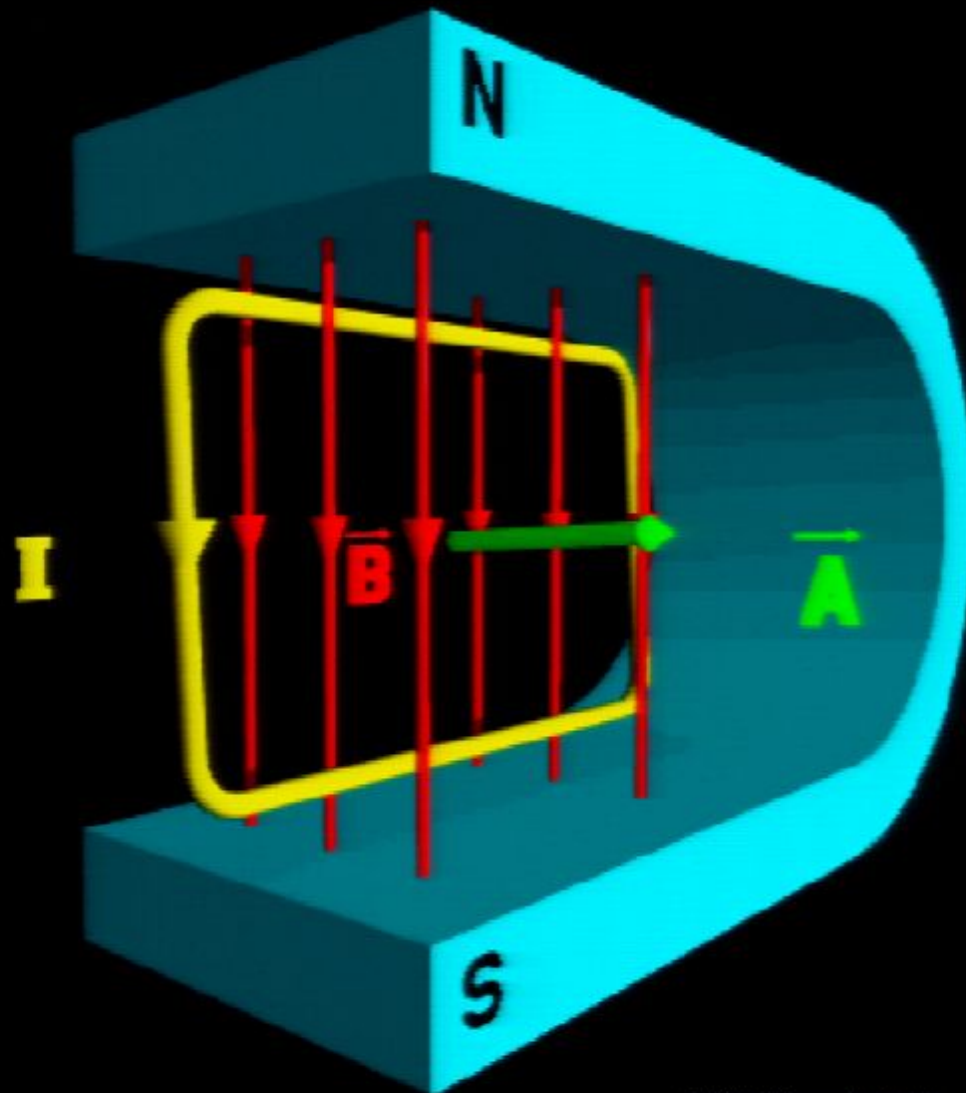


# build power generators



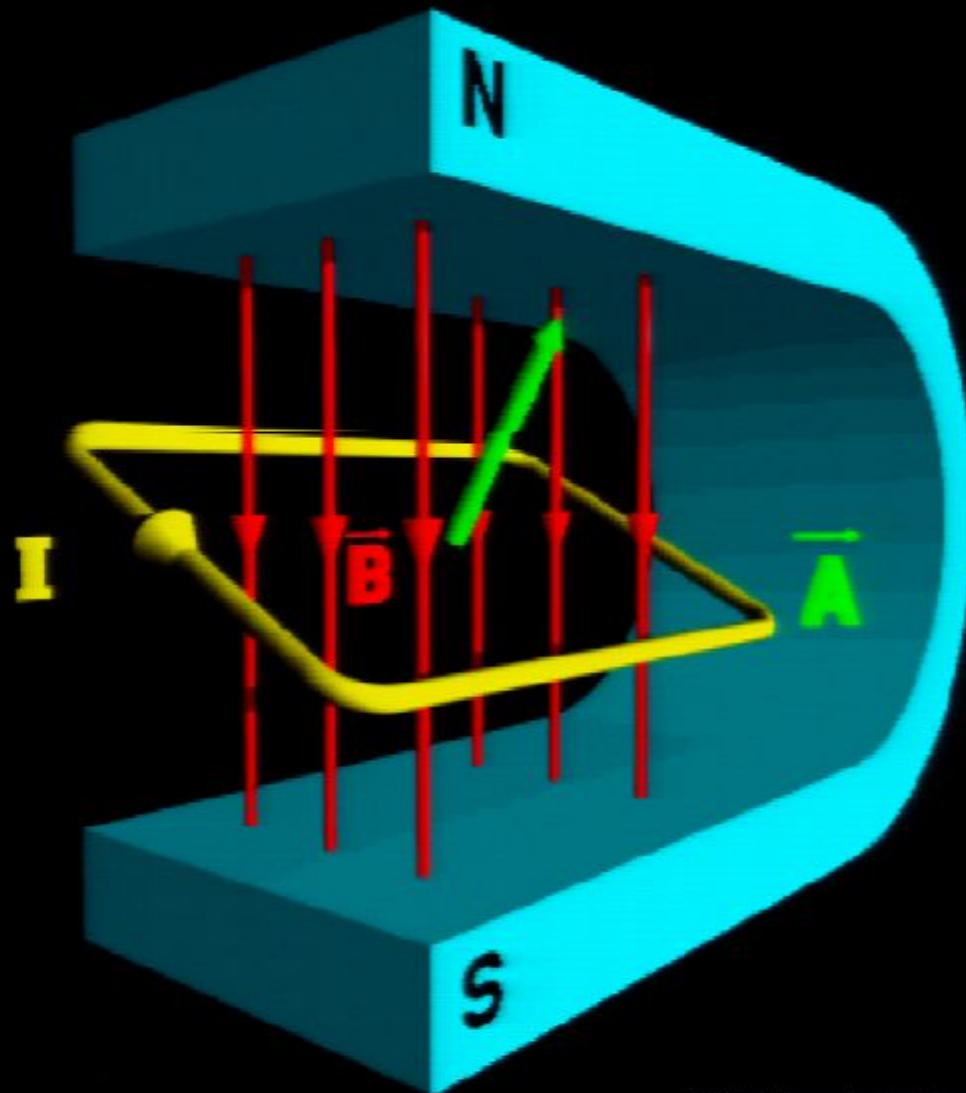


# build power generators



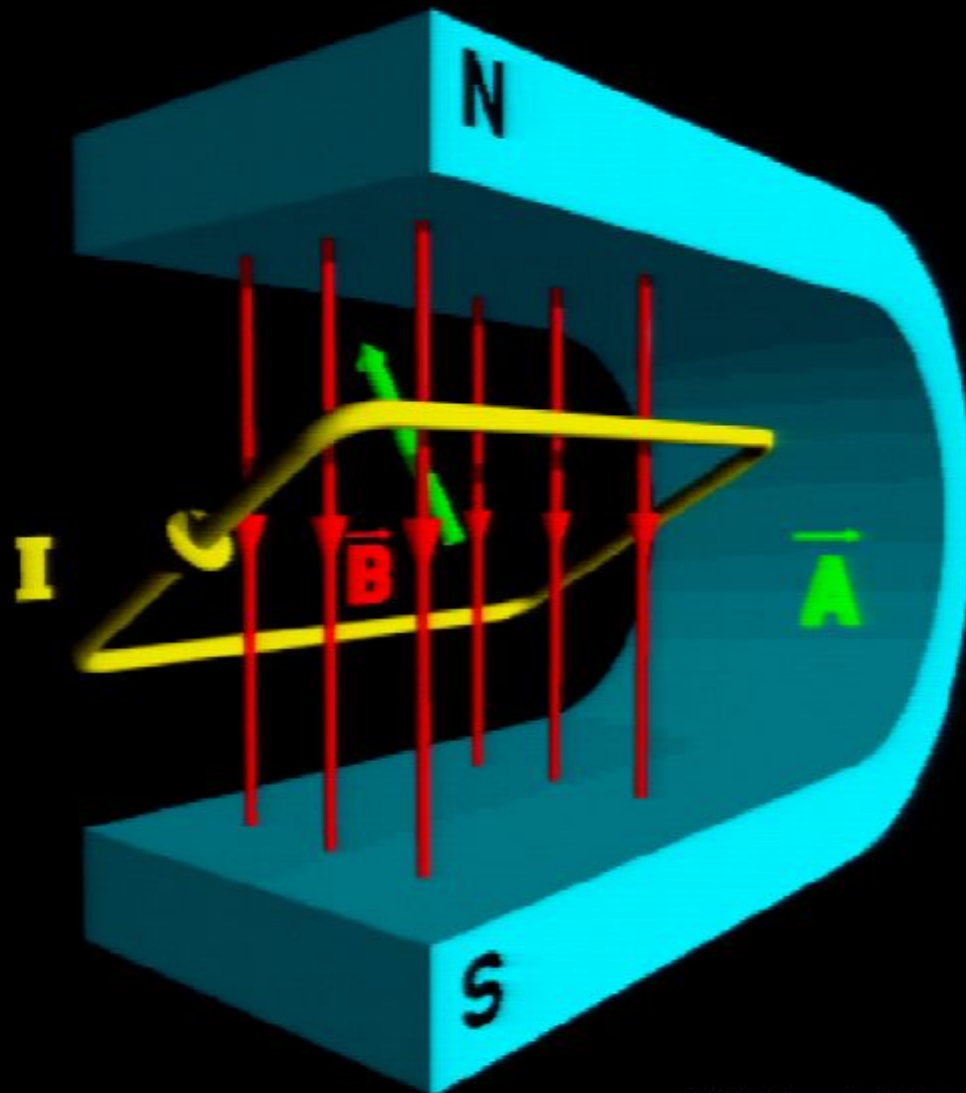


# build power generators





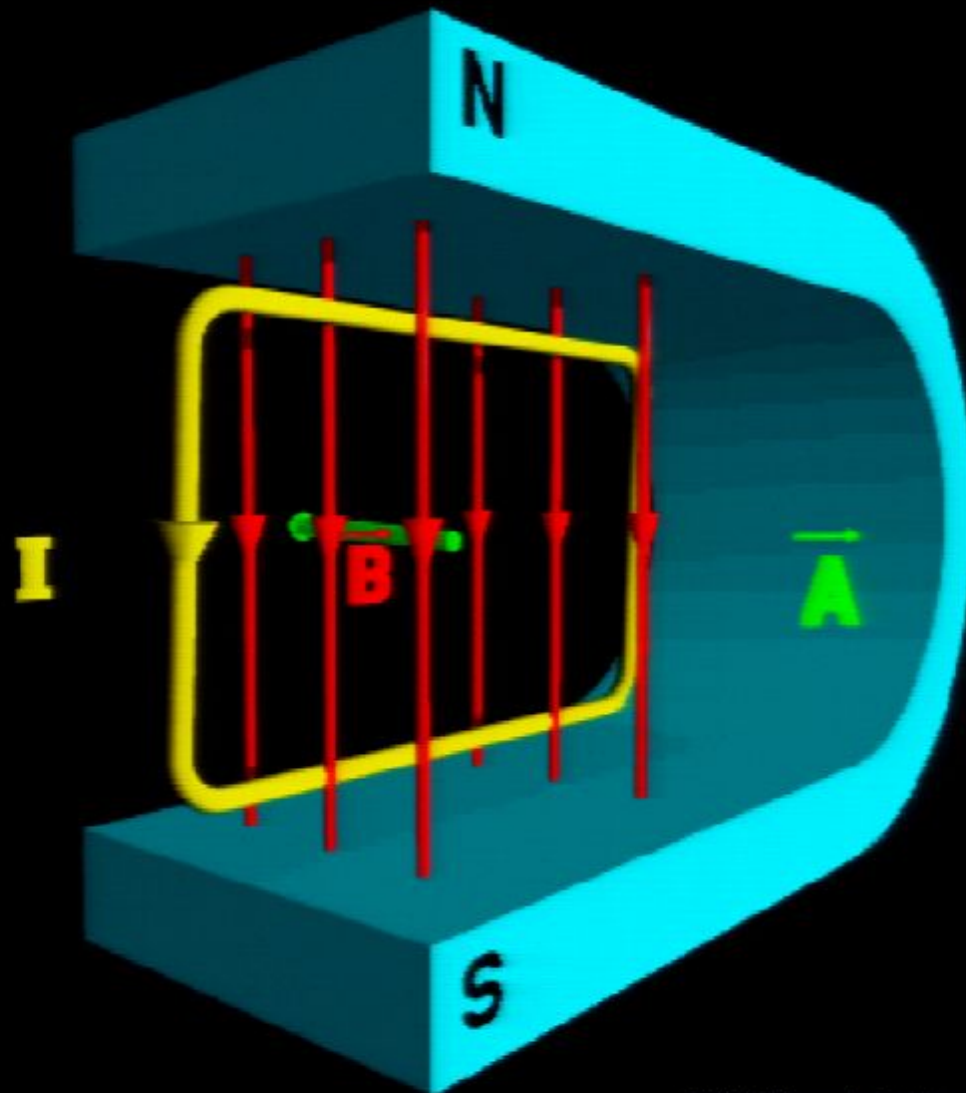
# build power generators





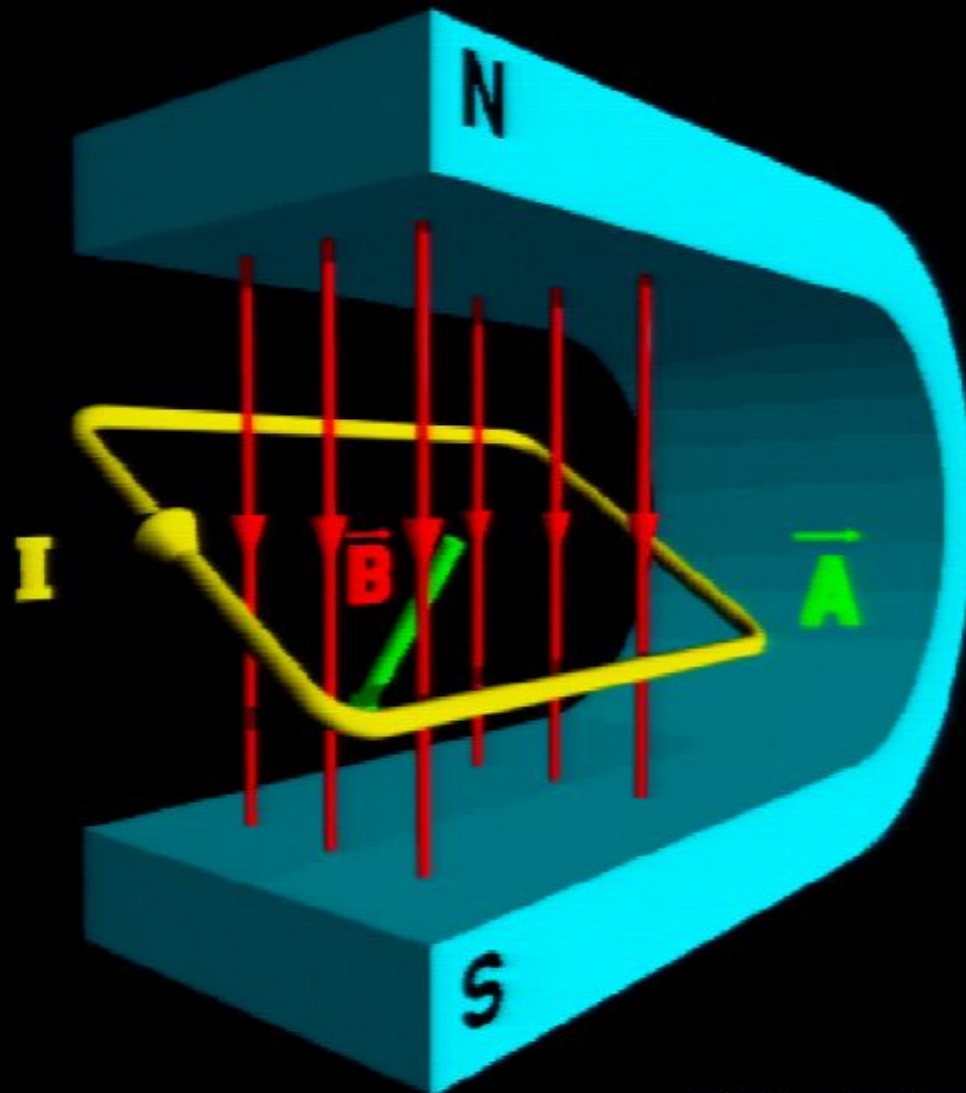


# build power generators



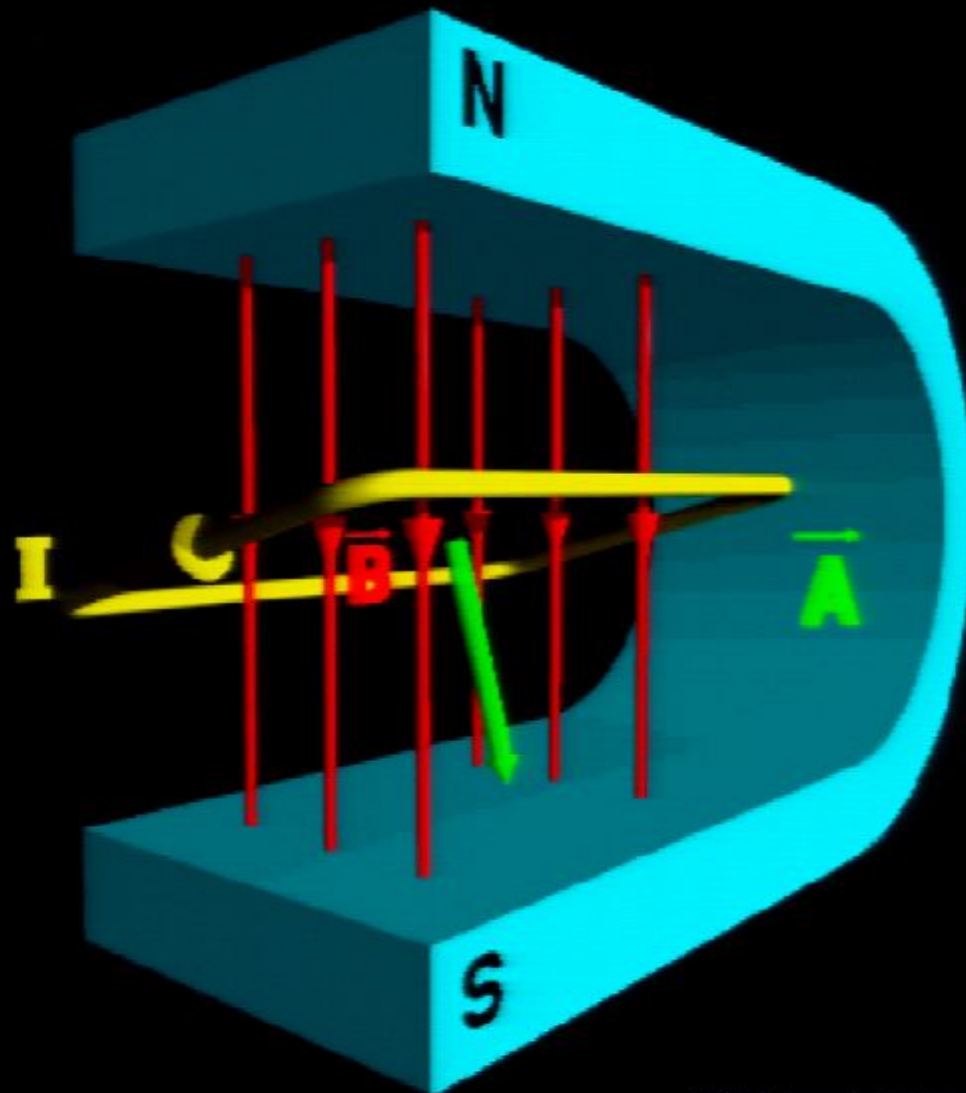


# build power generators



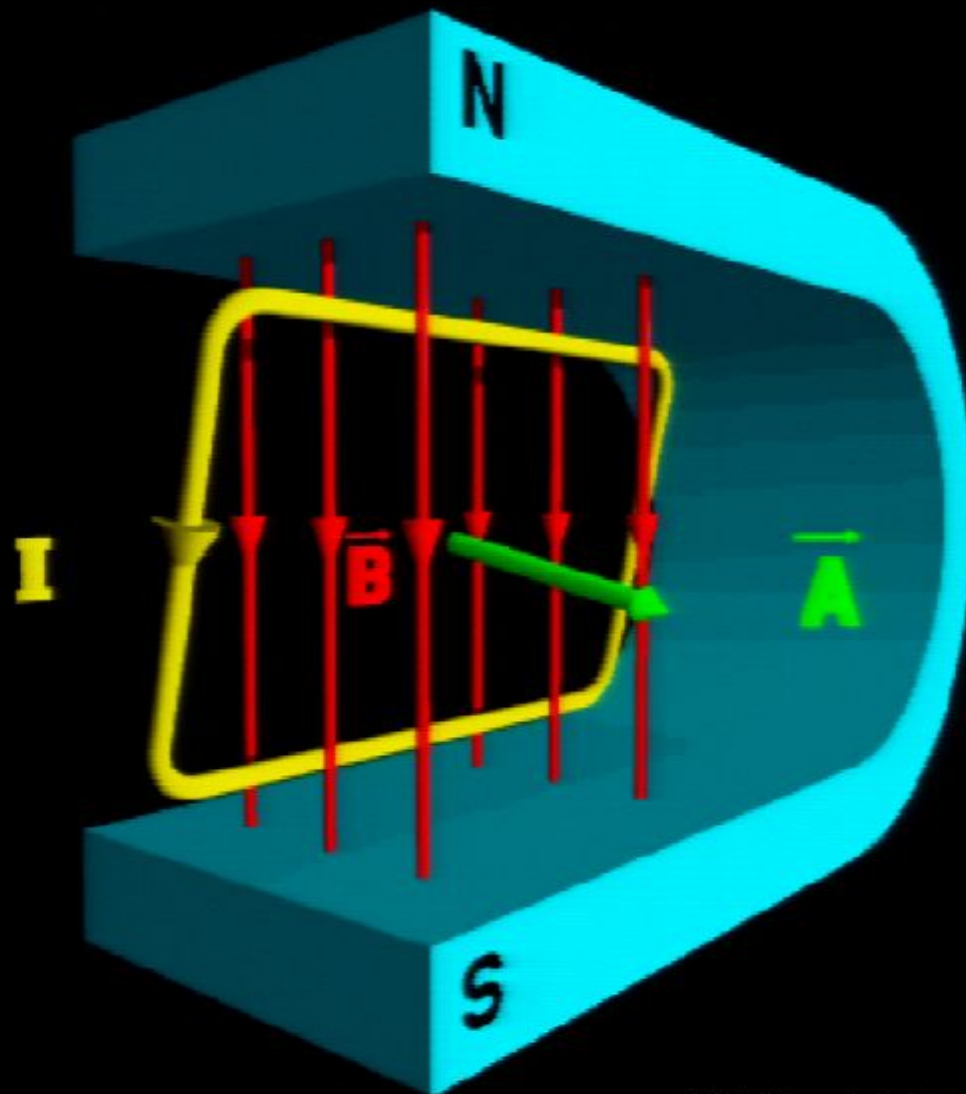


# build power generators



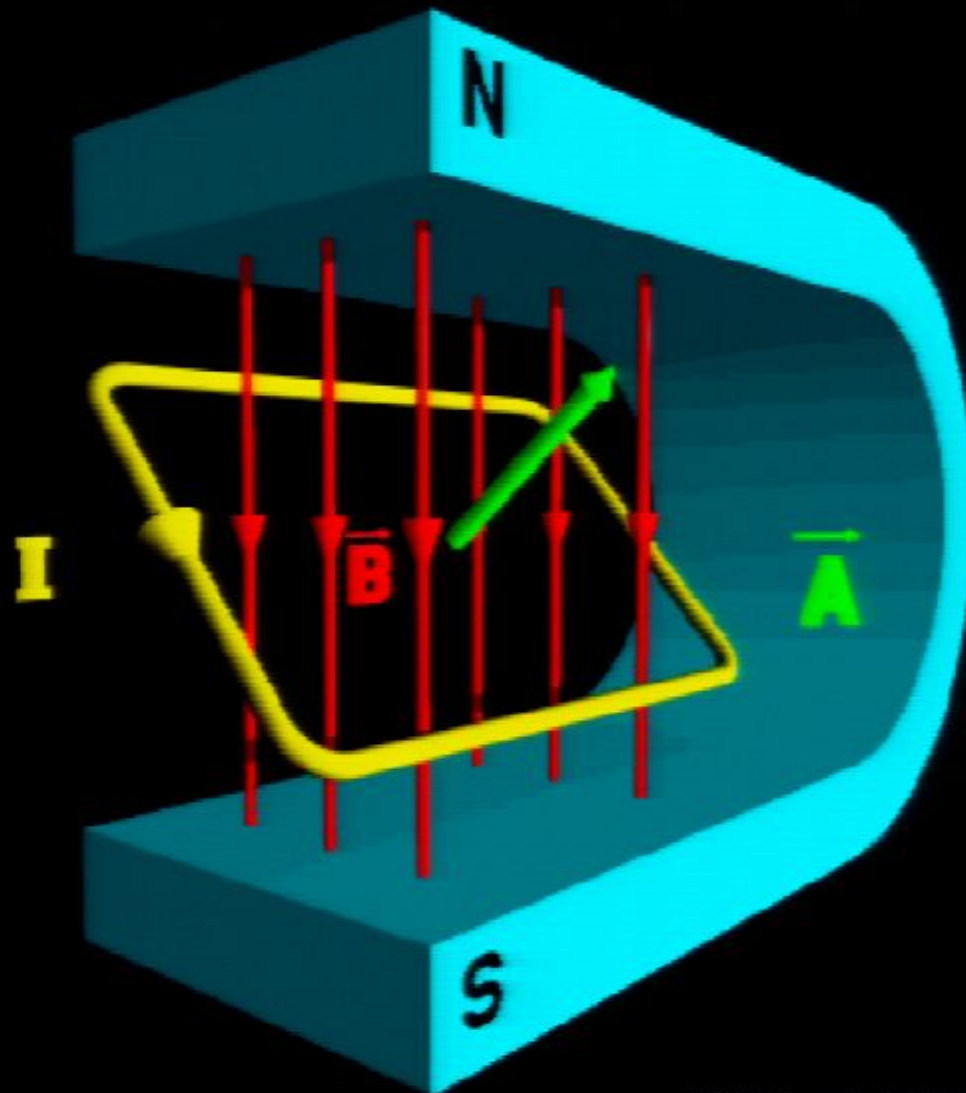


# build power generators



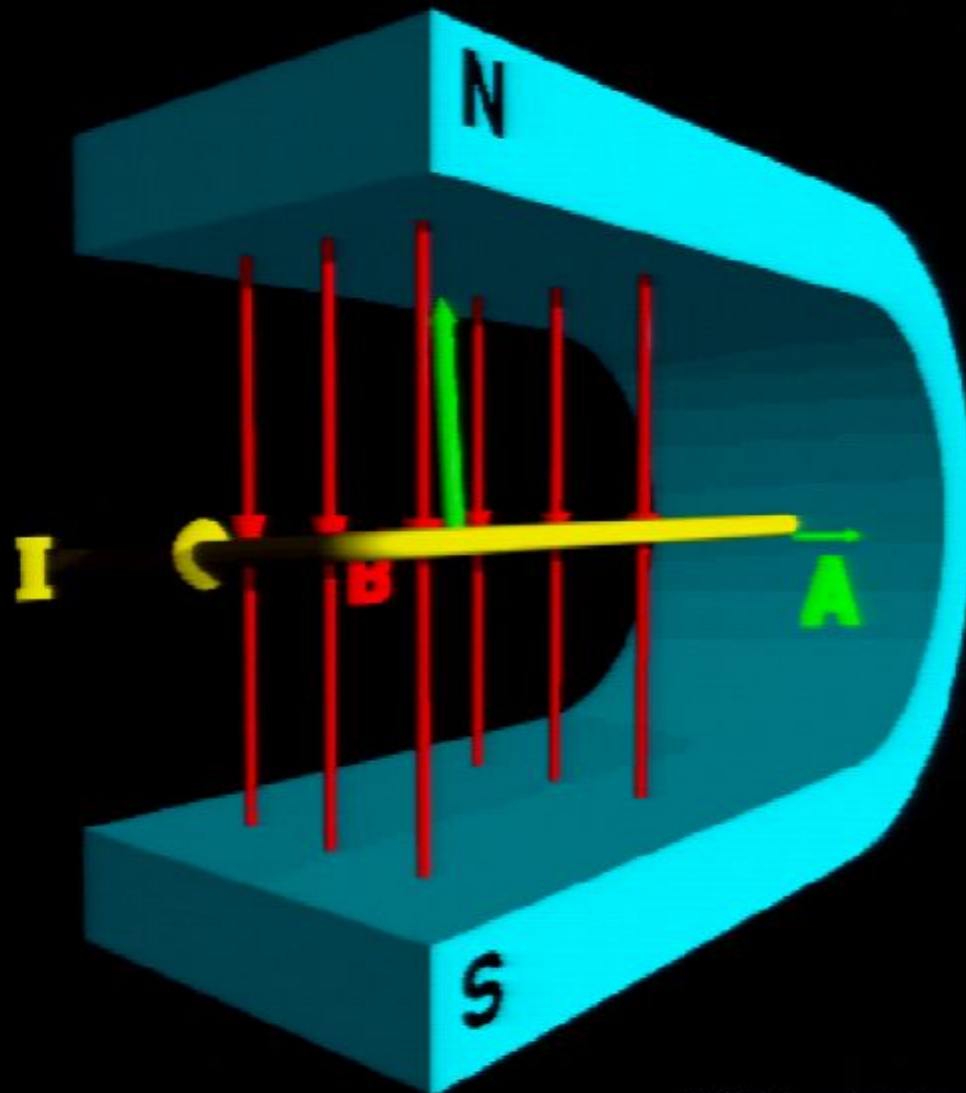


# build power generators



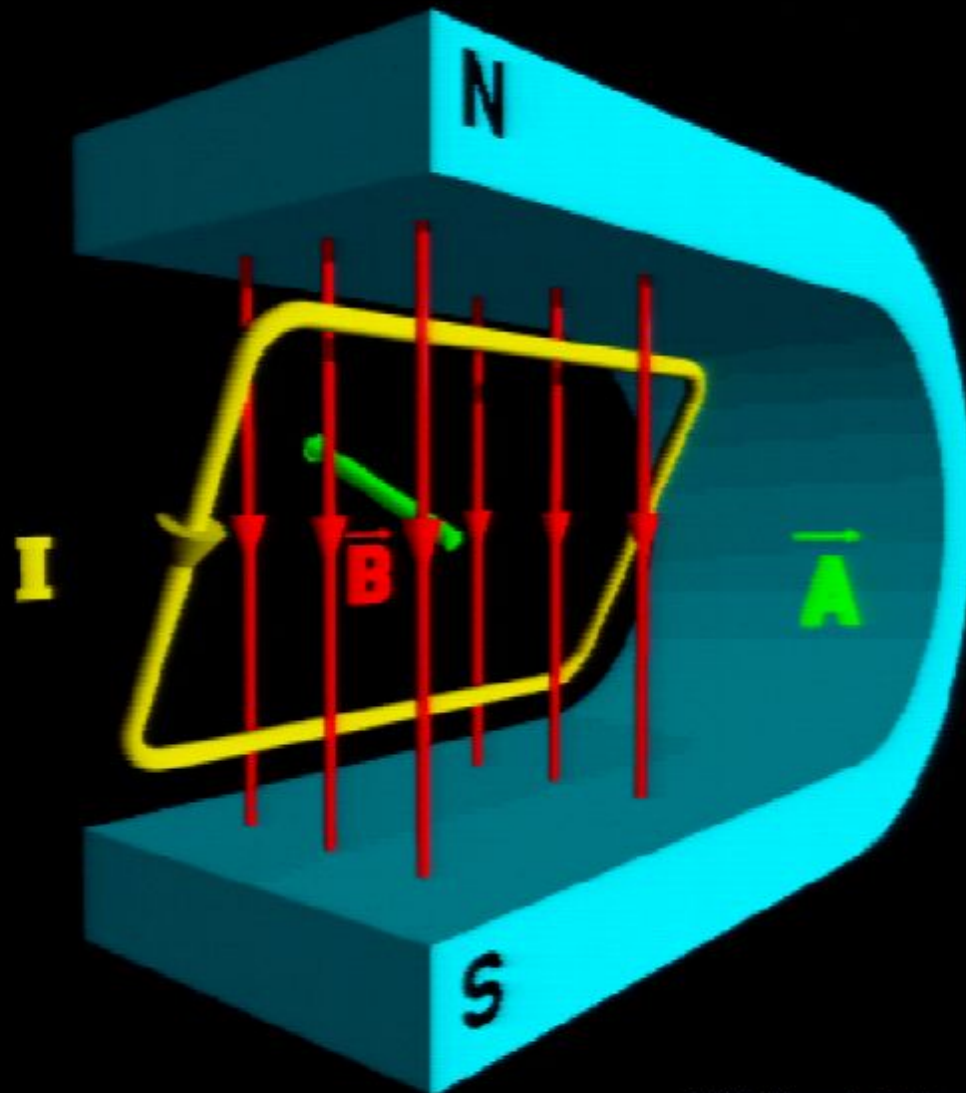


# build power generators



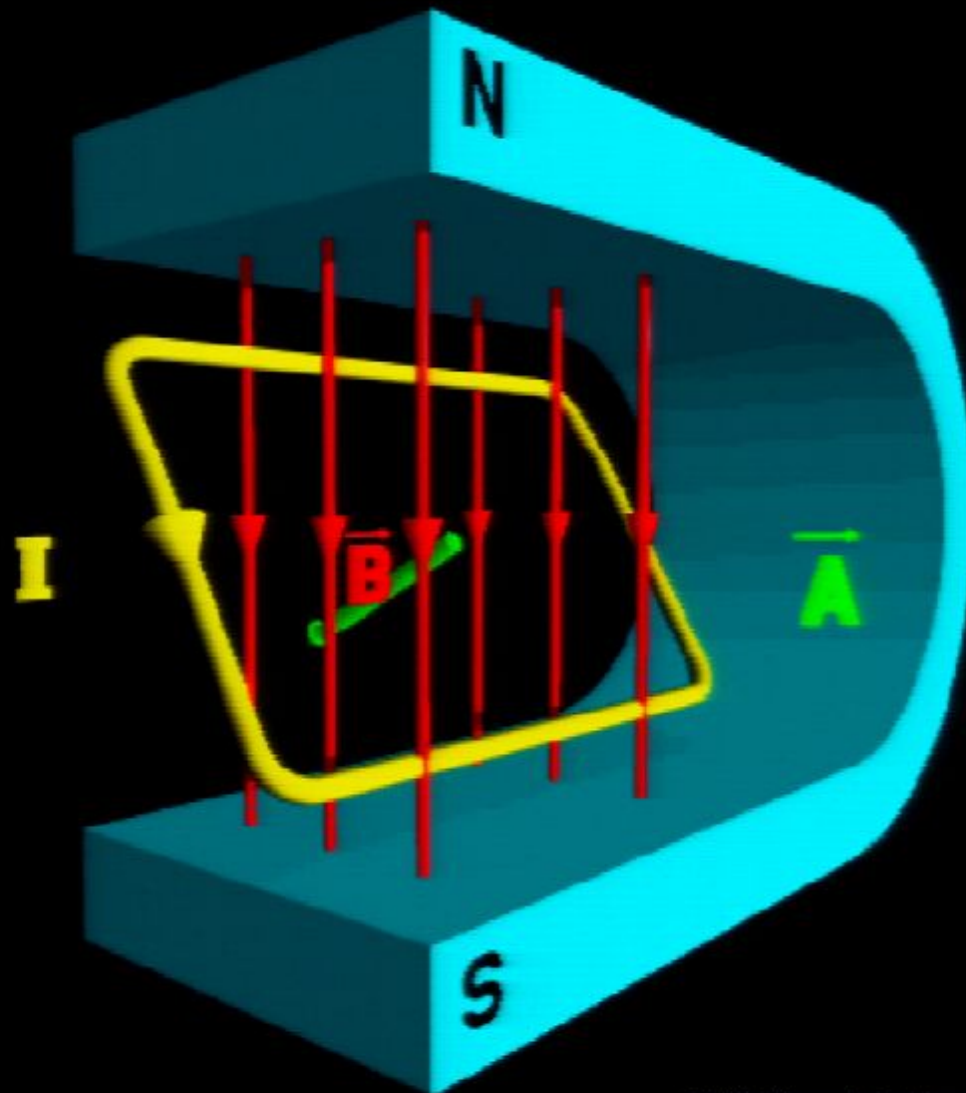


# build power generators





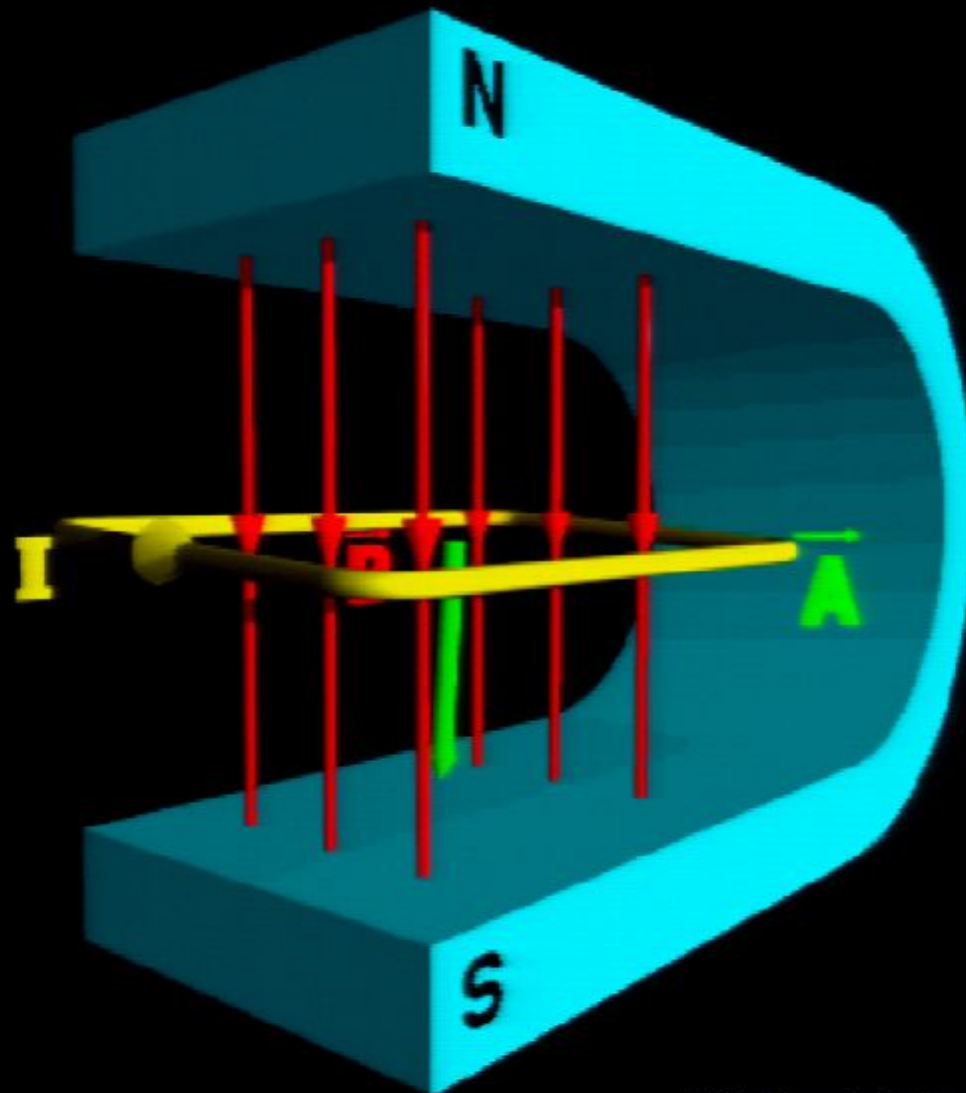
# build power generators





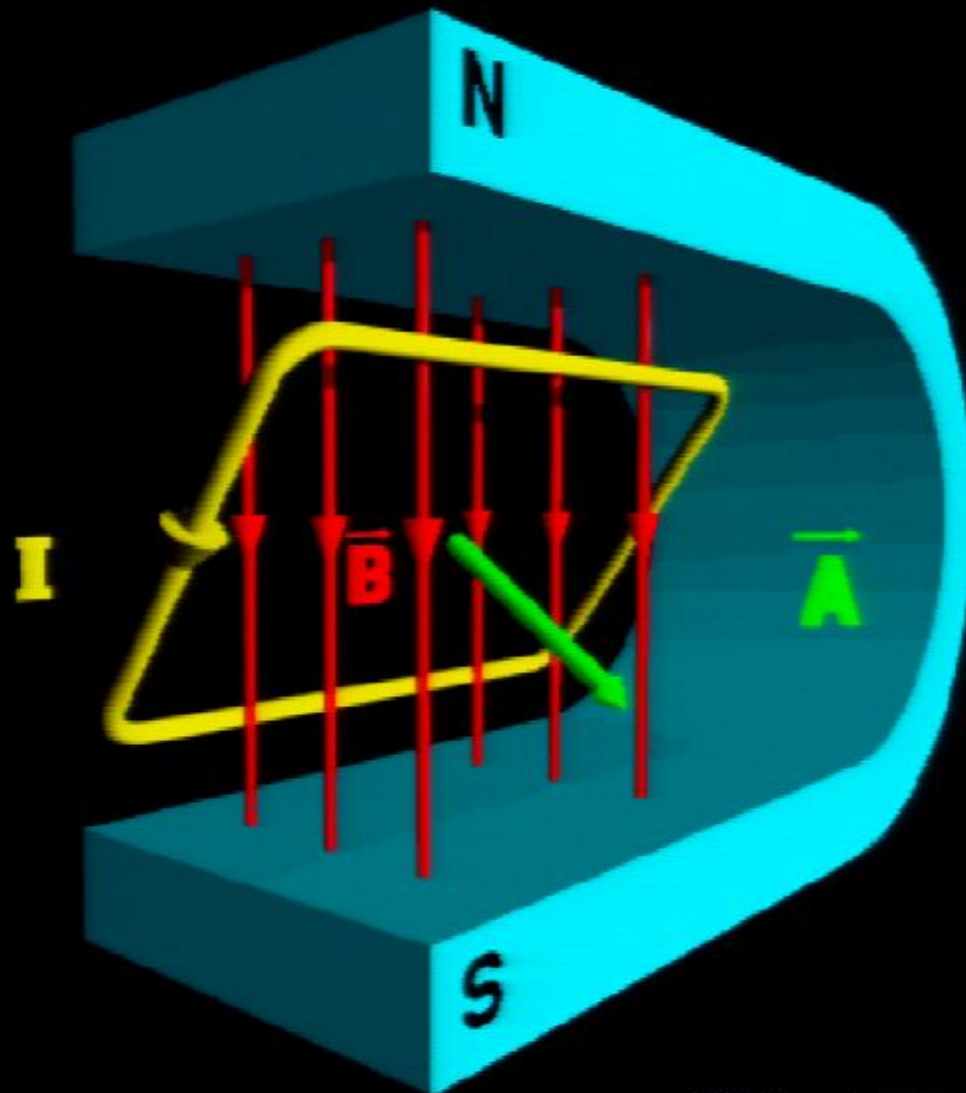


# build power generators



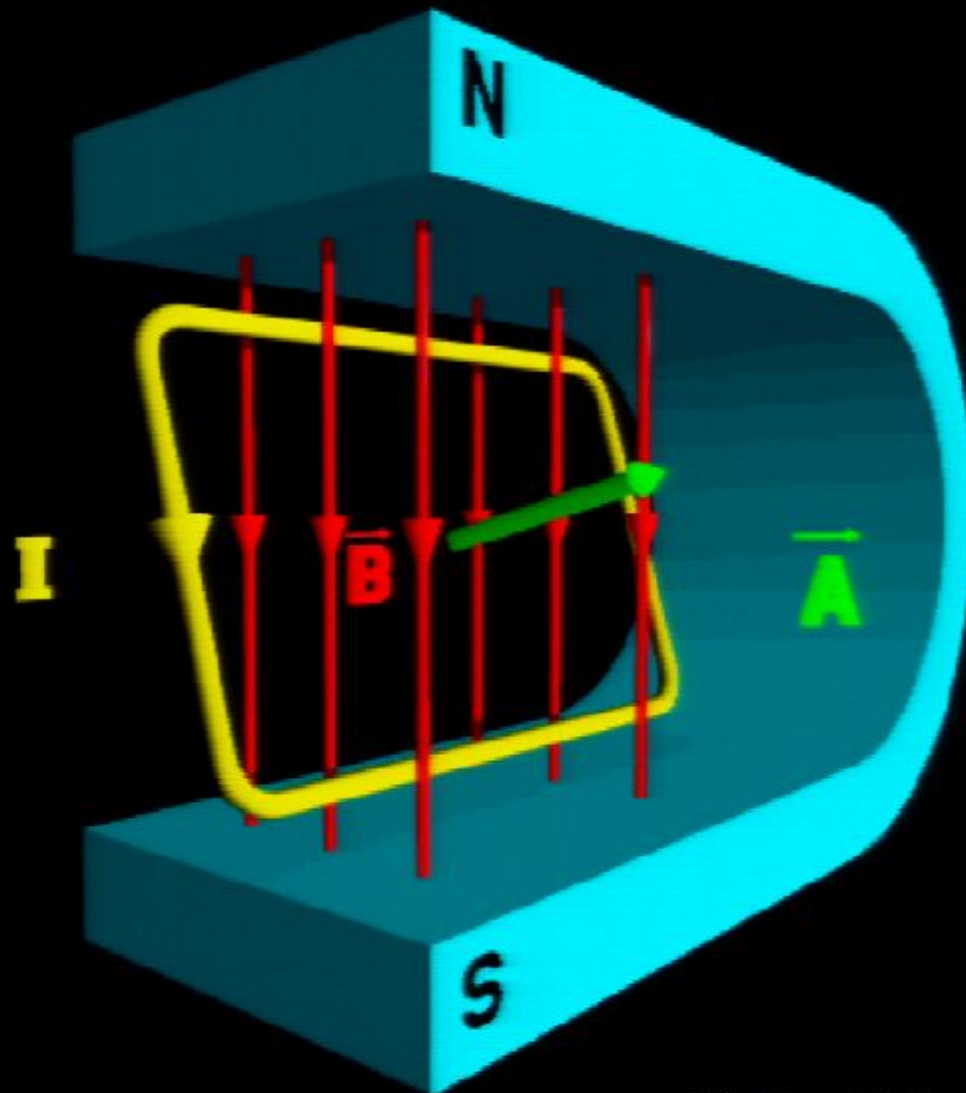


# build power generators



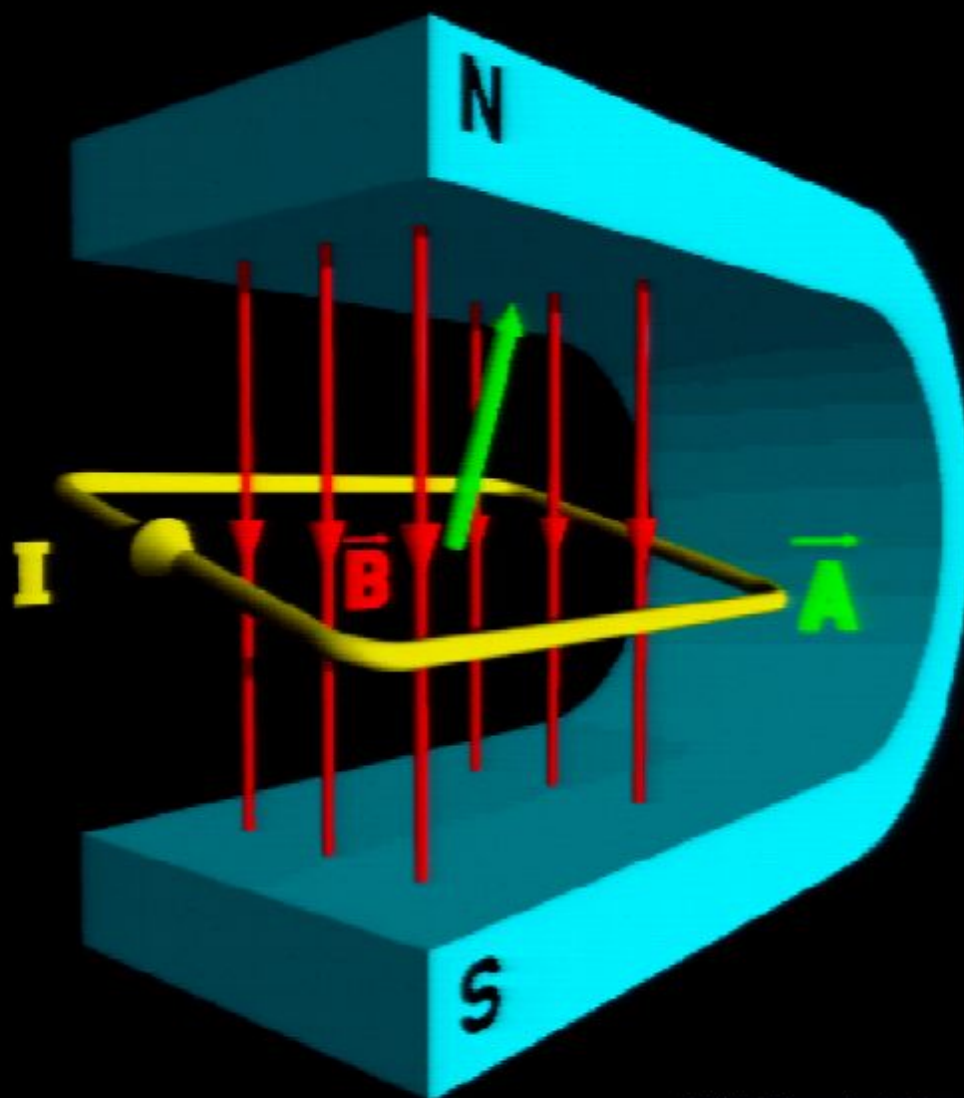


# build power generators





# build power generators





# build power generators





build power generators



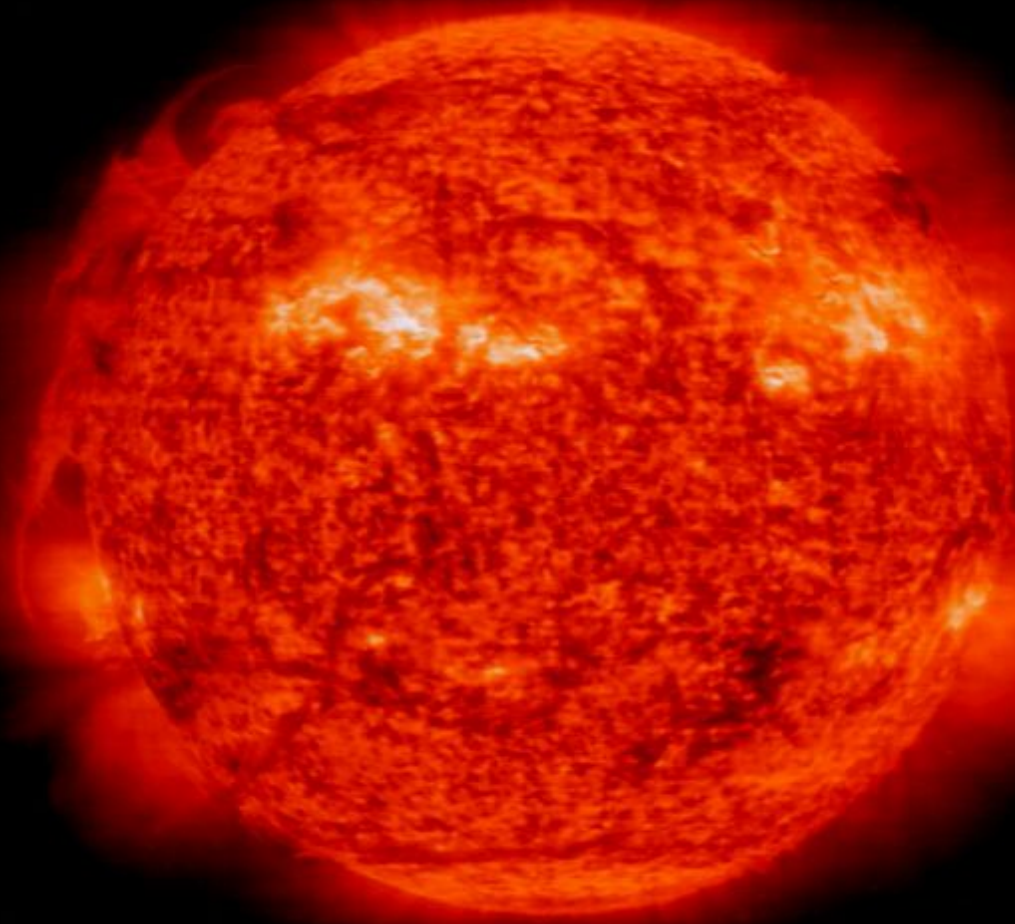


build power generators





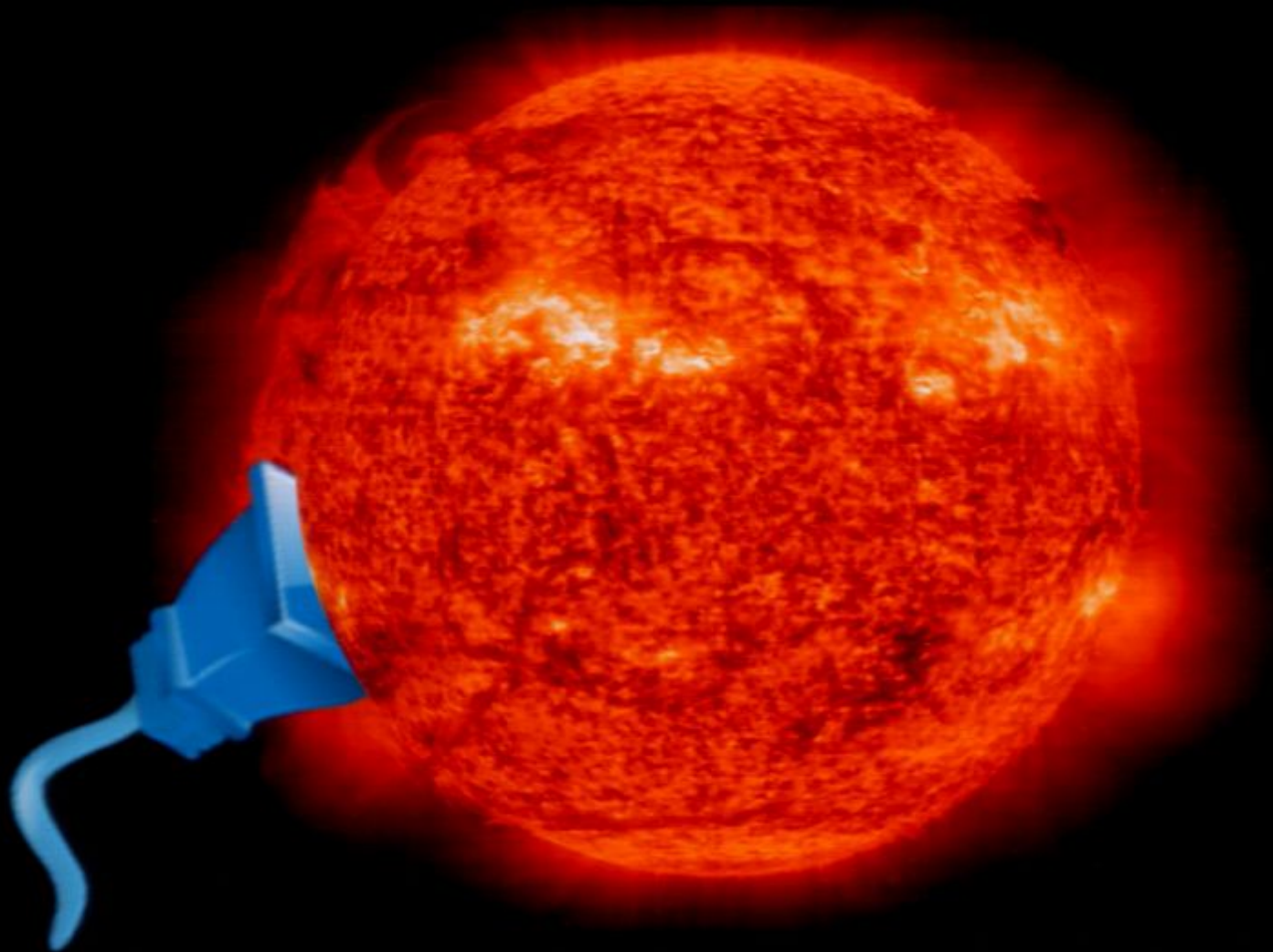
build power generators







build power generators





build power generators

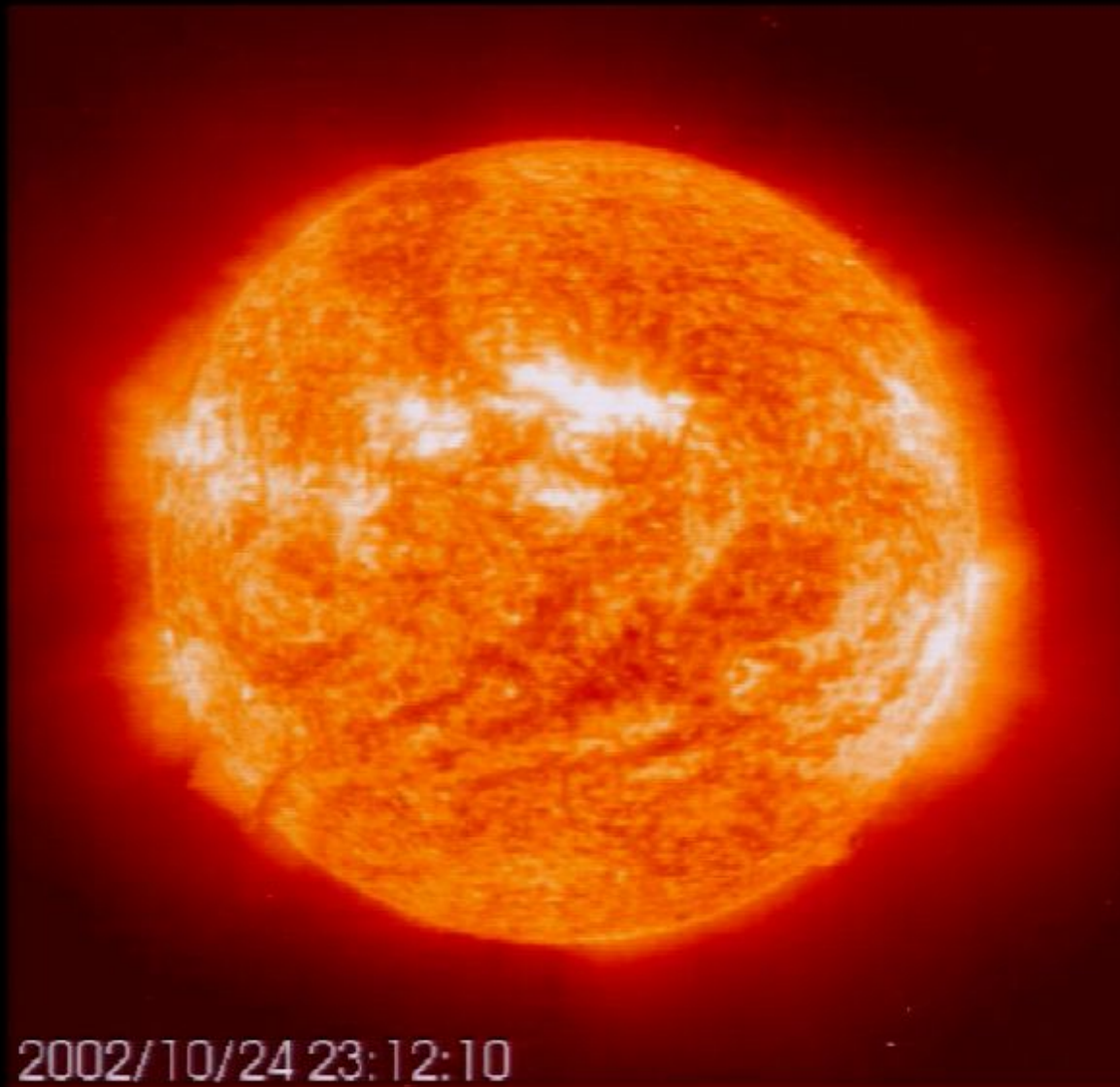
build an artificial sun



build power generators

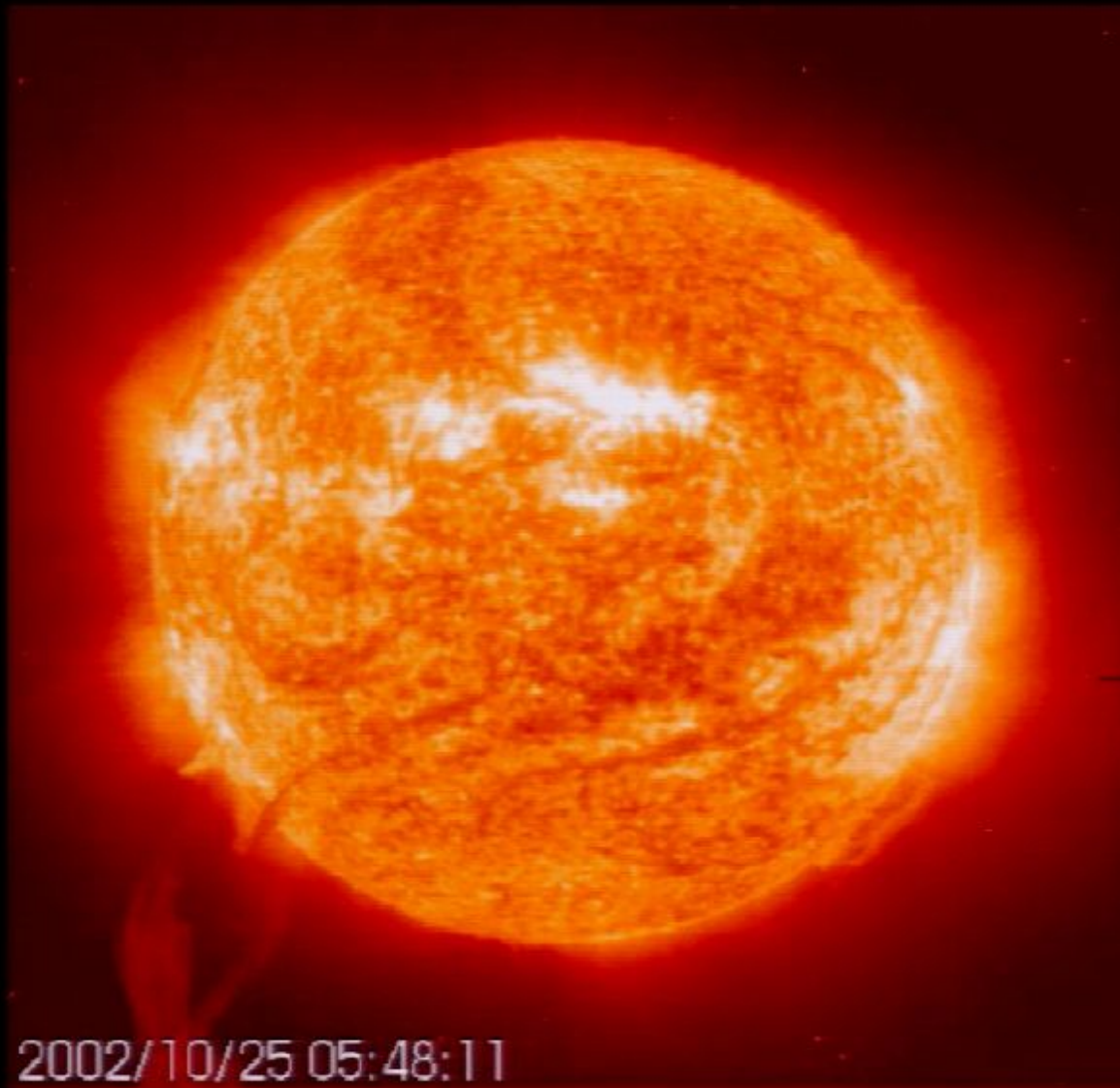


build an artificial sun?



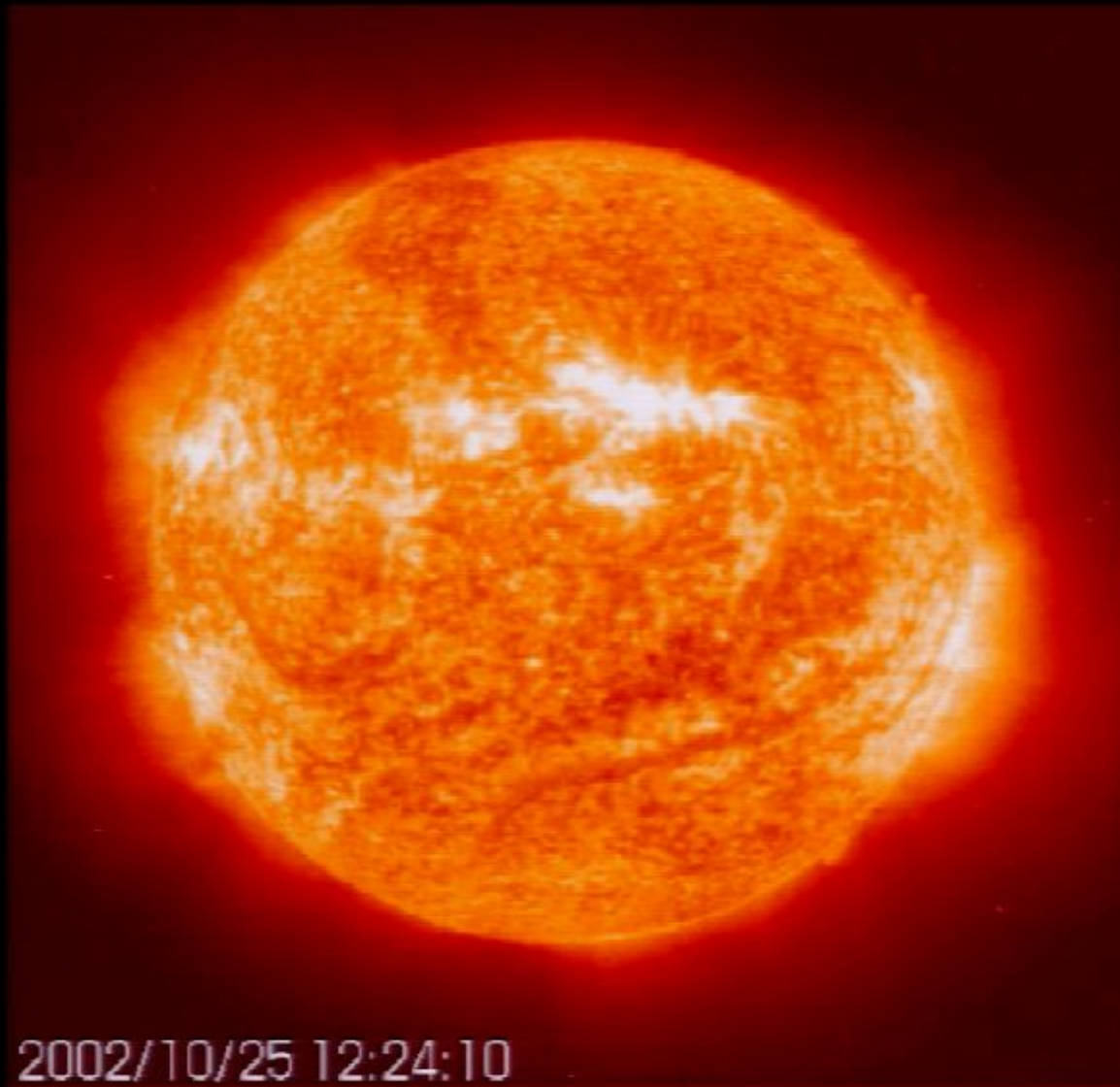
how does this  
thing **work**?

2002/10/24 23:12:10

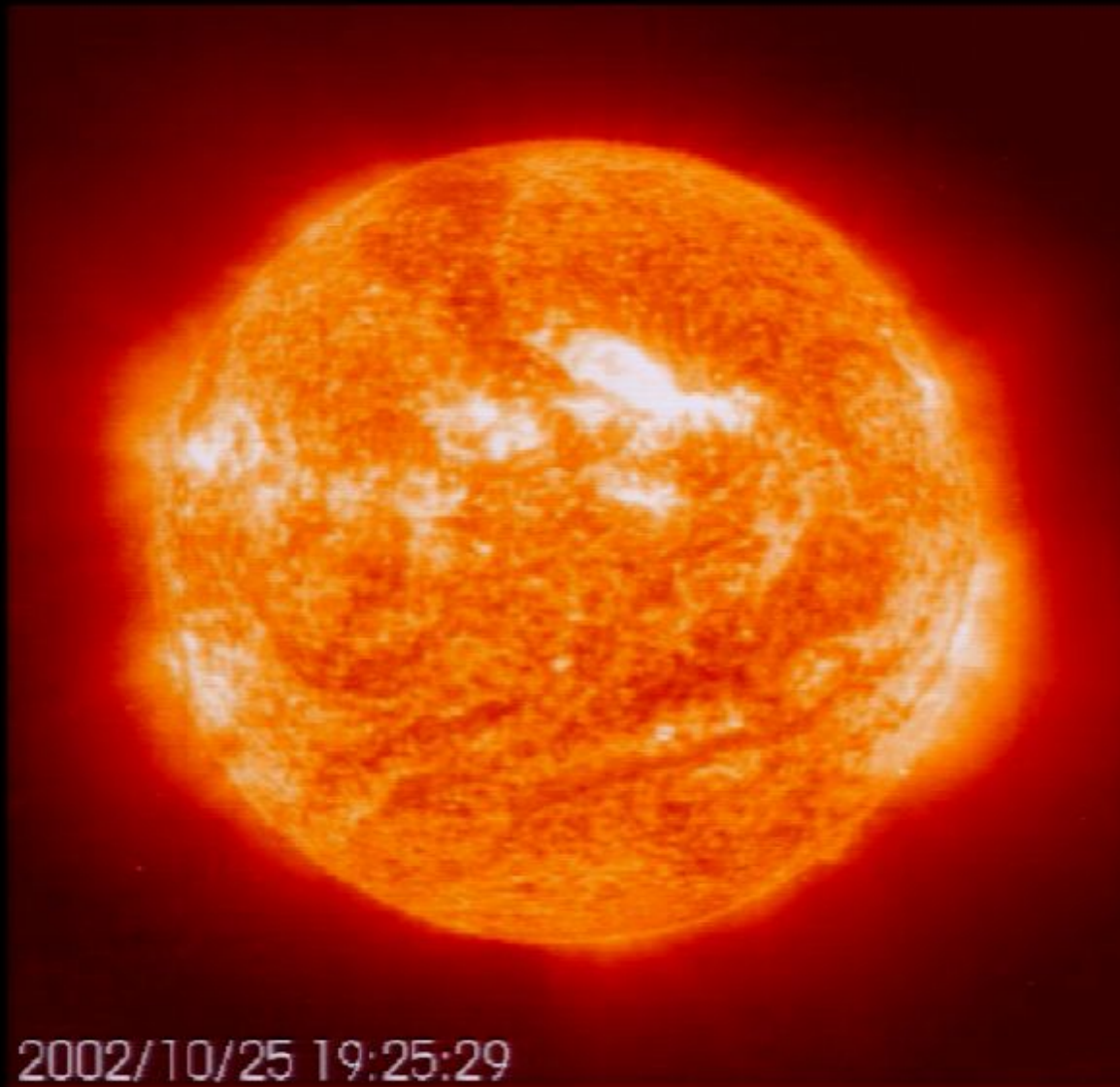


how does this  
thing **work**?

2002/10/25 05:48:11

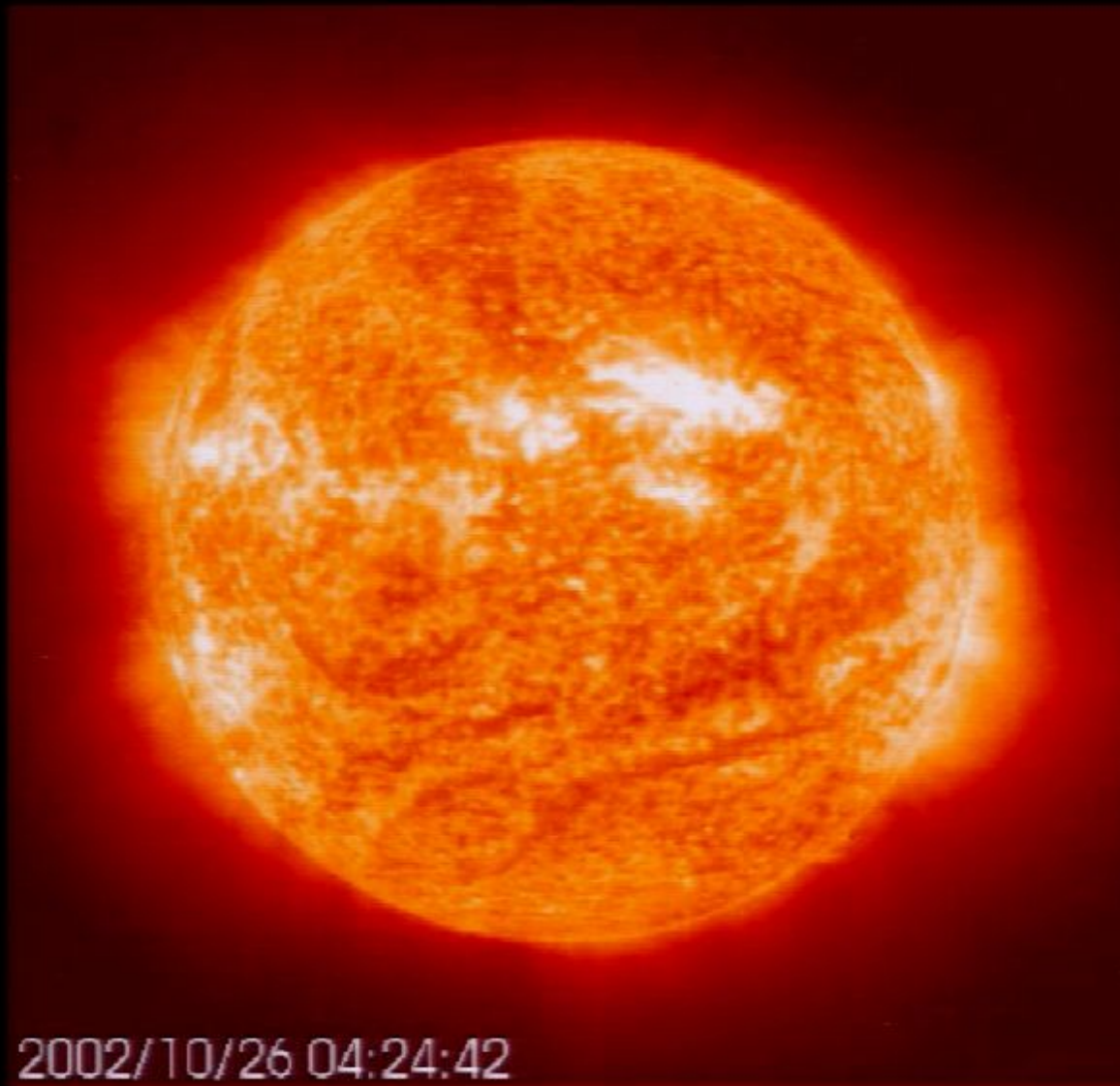


how does this  
thing **work**?



how does this  
thing **work**?

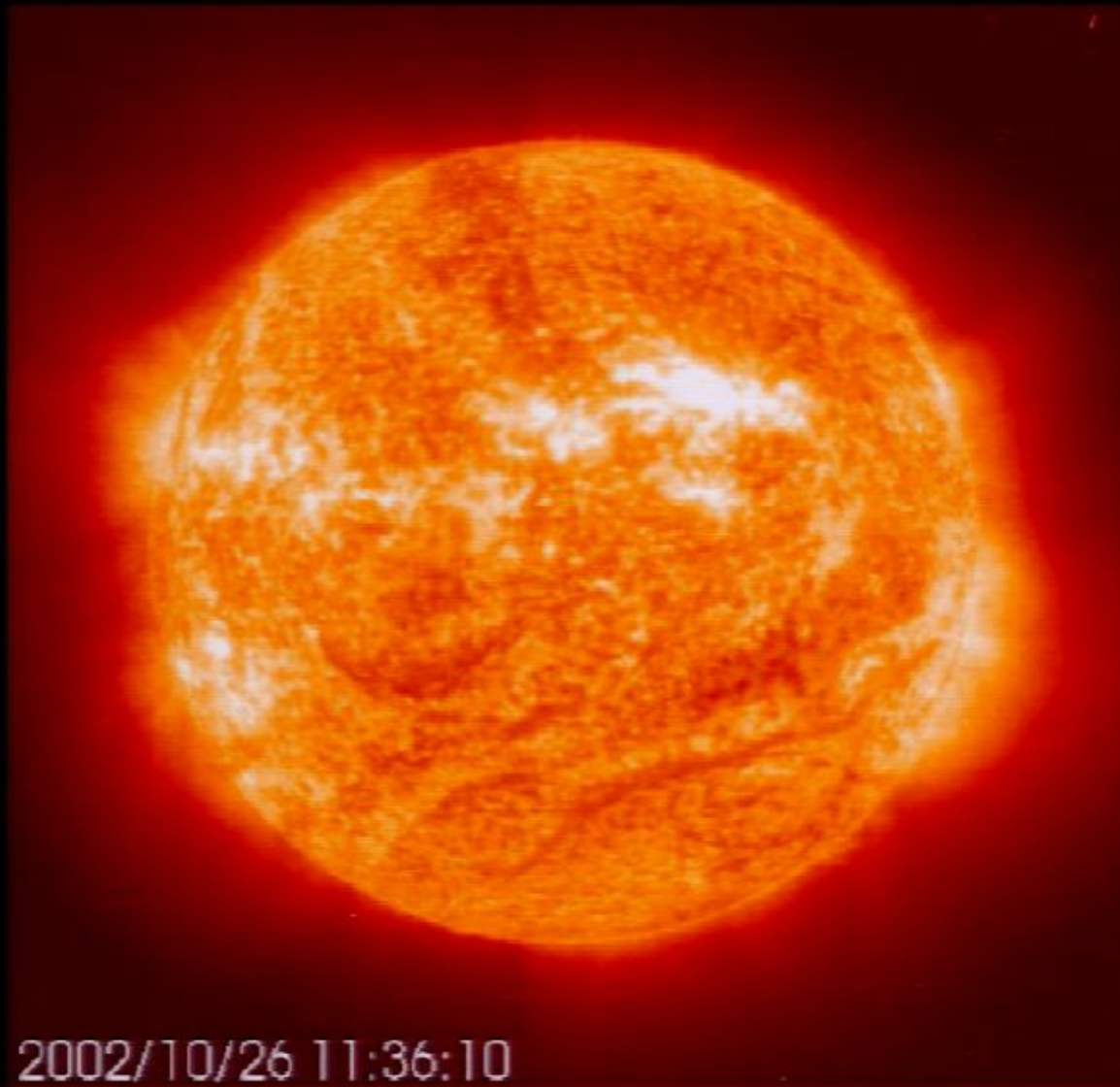
2002/10/25 19:25:29



how does this  
thing **work**?

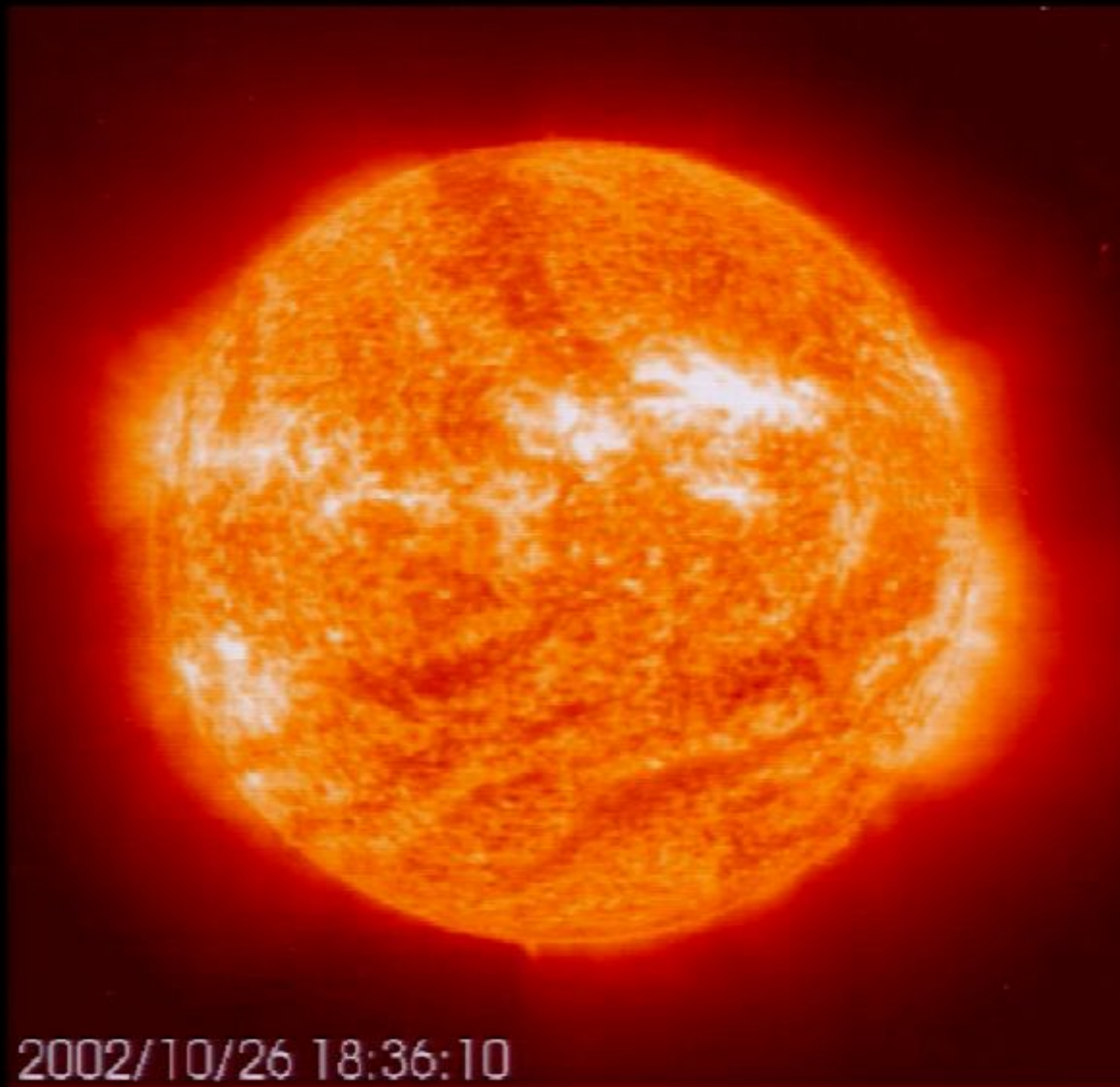
2002/10/26 04:24:42





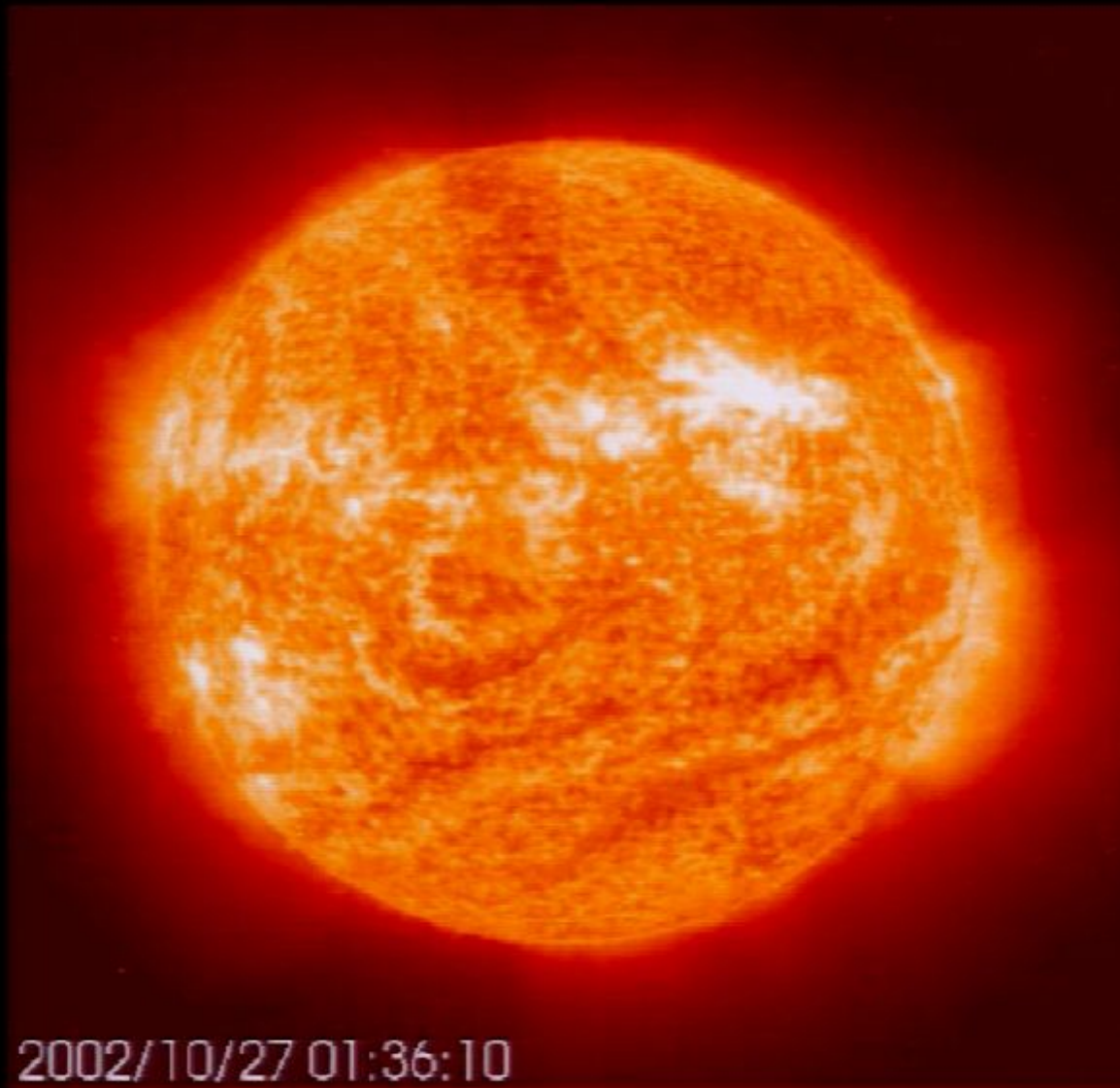
how does this  
thing **work**?

2002/10/26 11:36:10



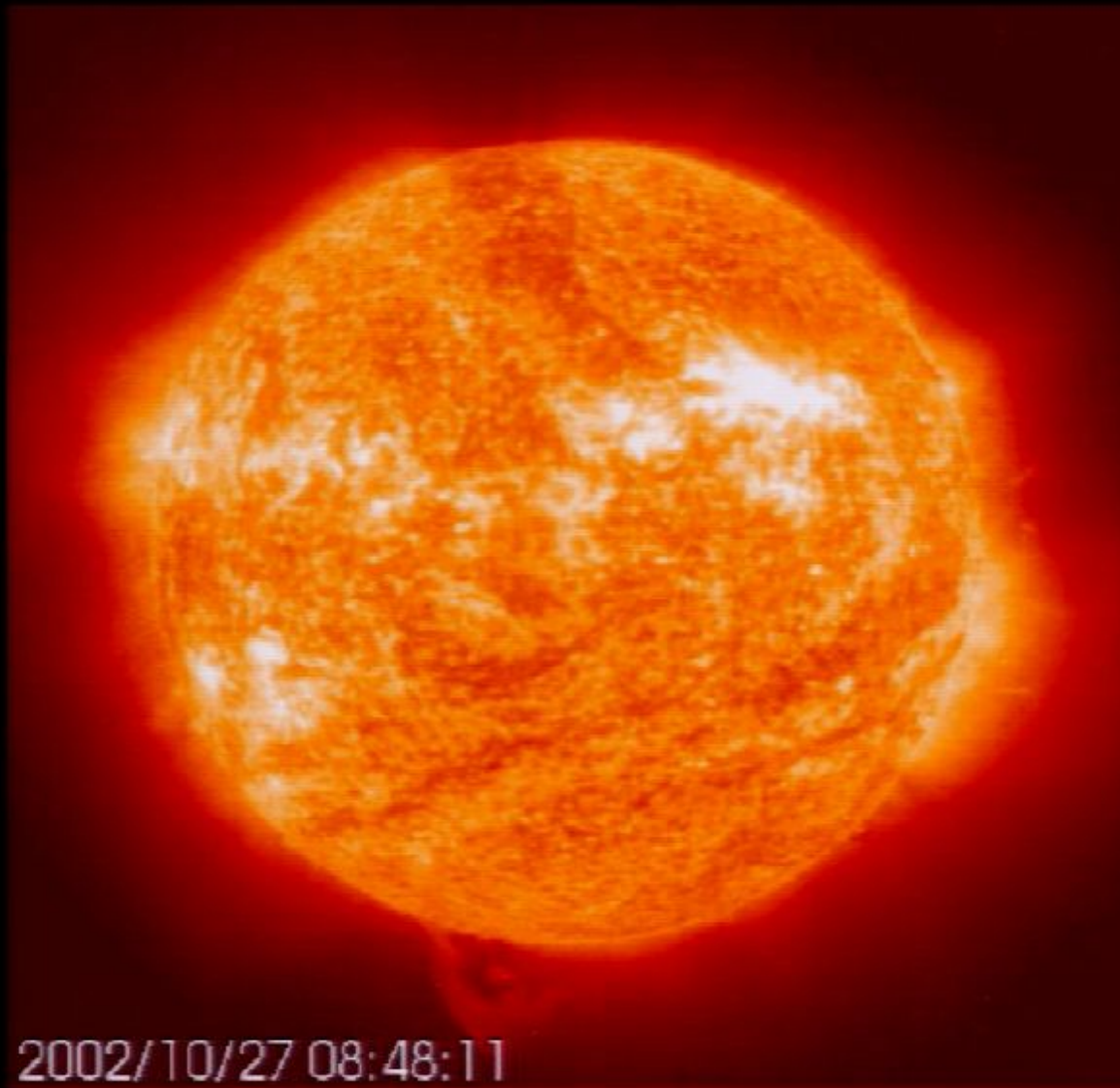
how does this  
thing **work**?

2002/10/26 18:36:10



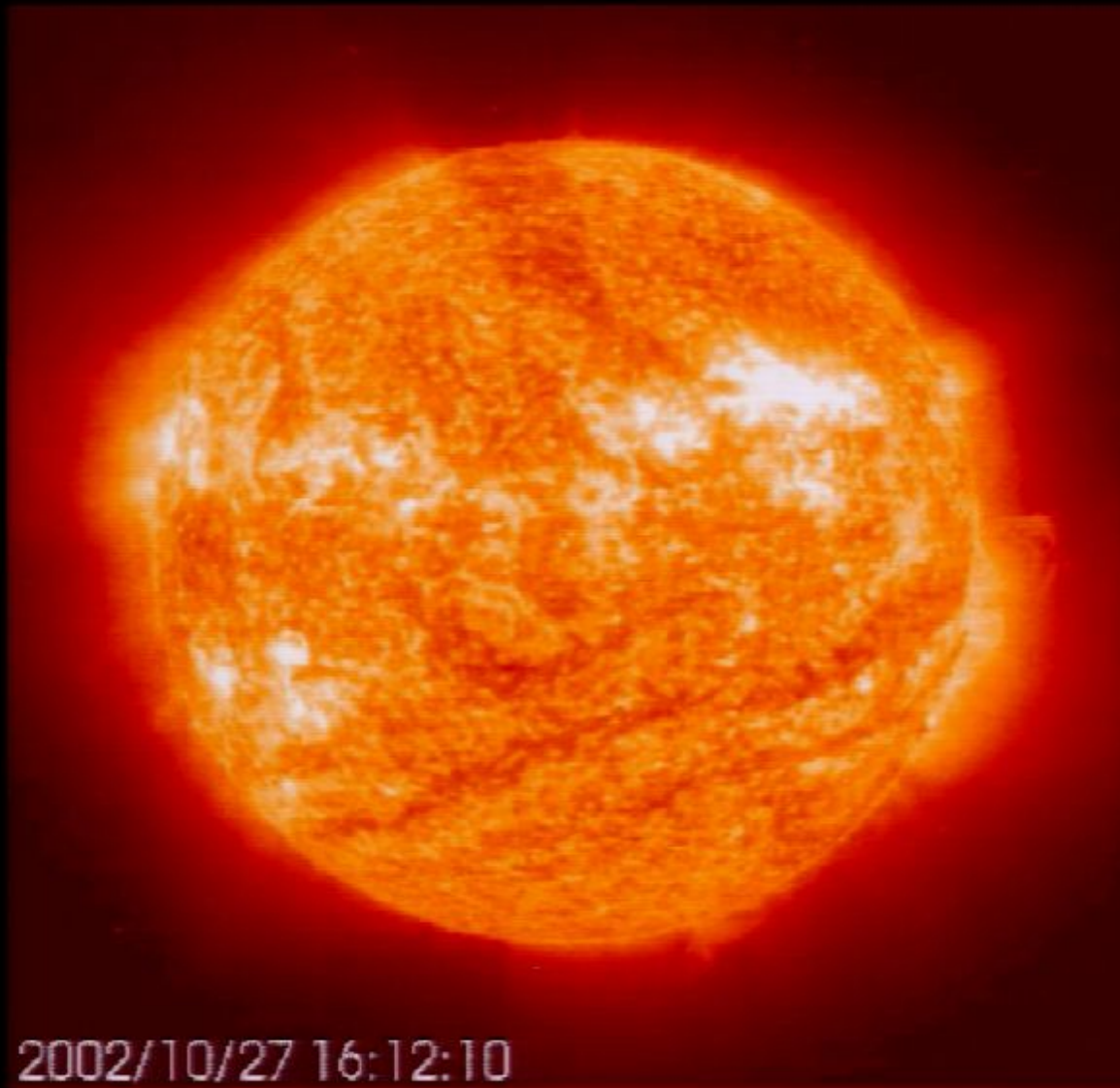
how does this  
thing **work**?

2002/10/27 01:36:10



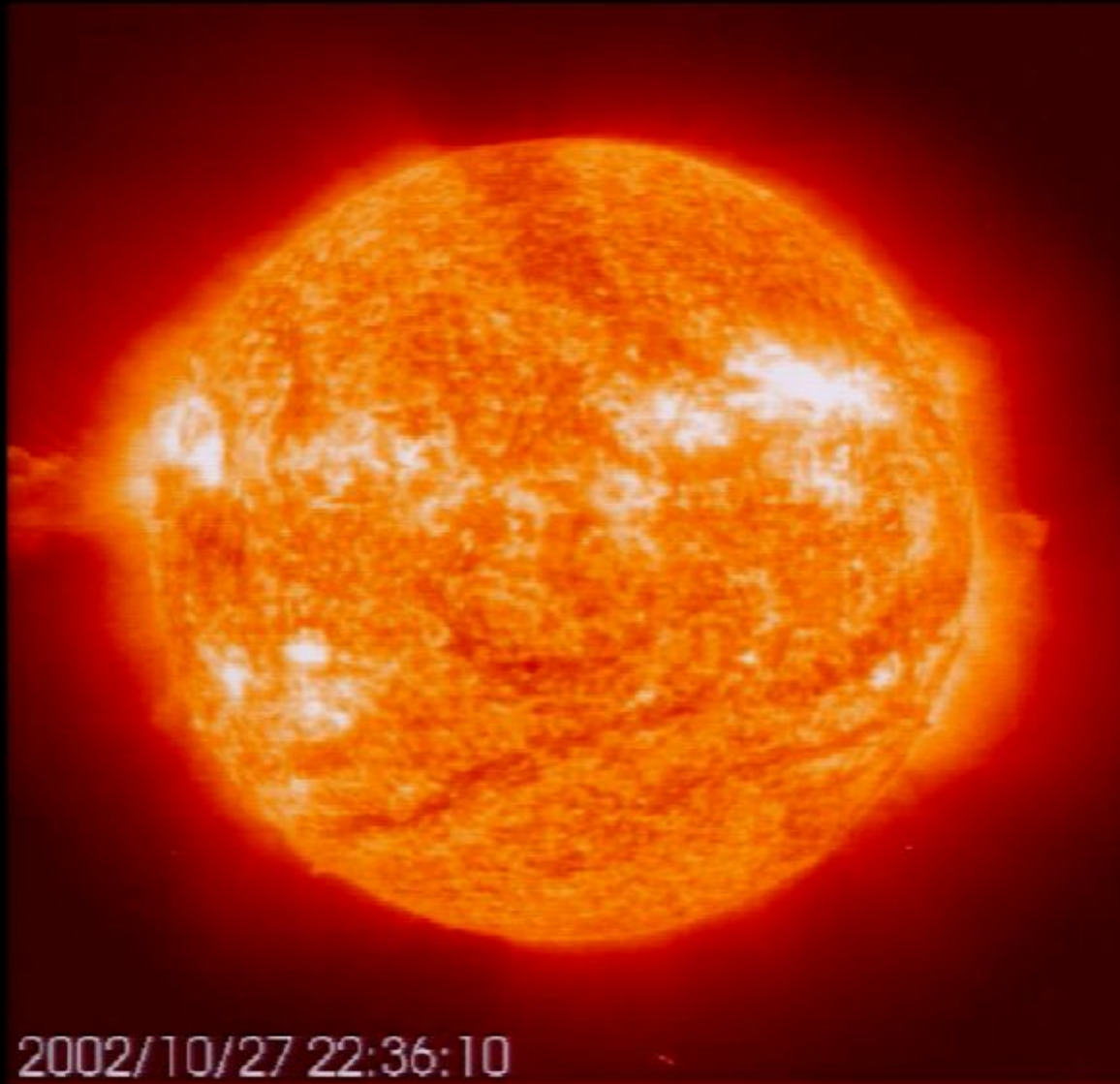
how does this  
thing **work**?

2002/10/27 08:48:11

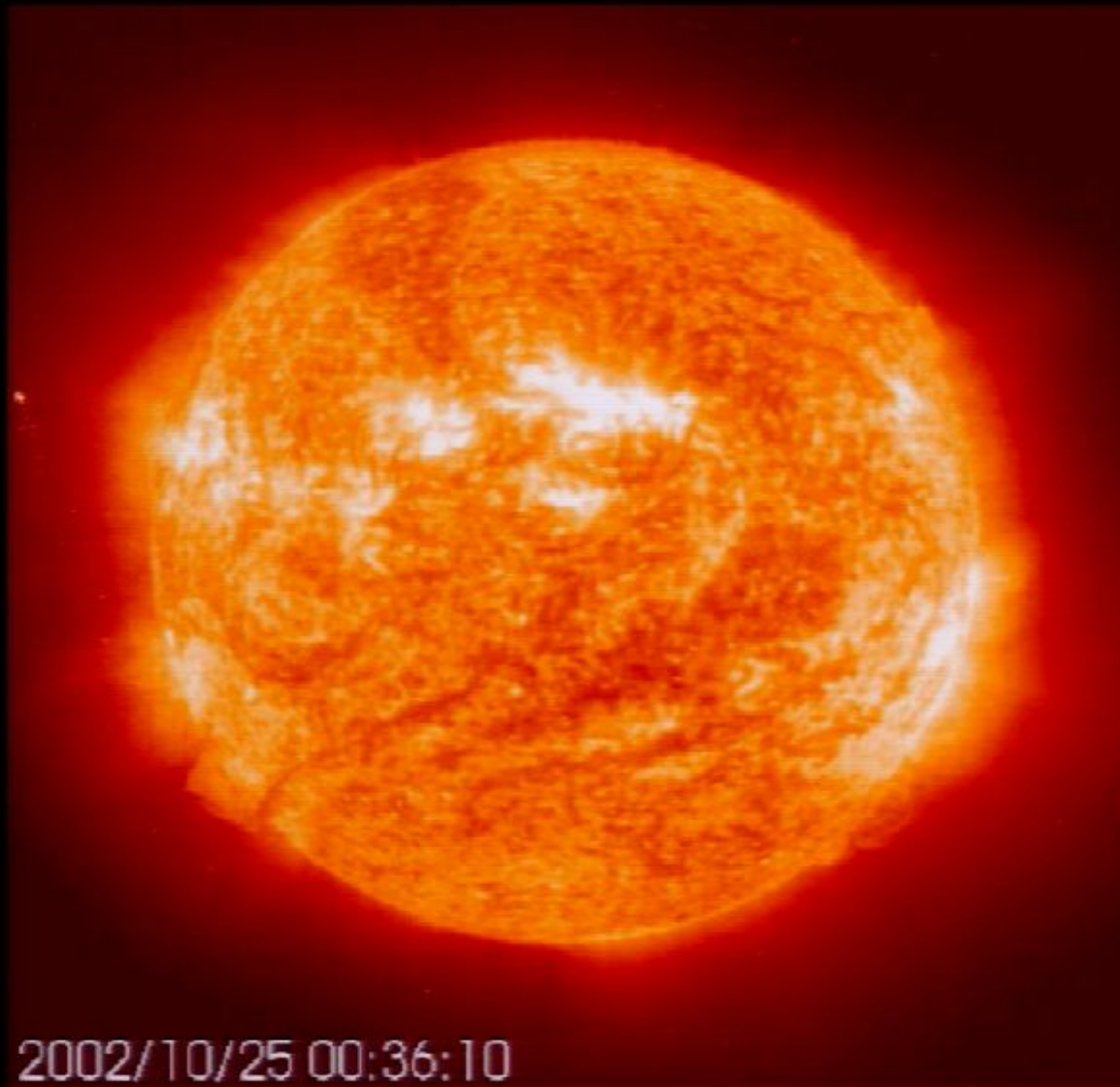


how does this  
thing **work**?

2002/10/27 16:12:10

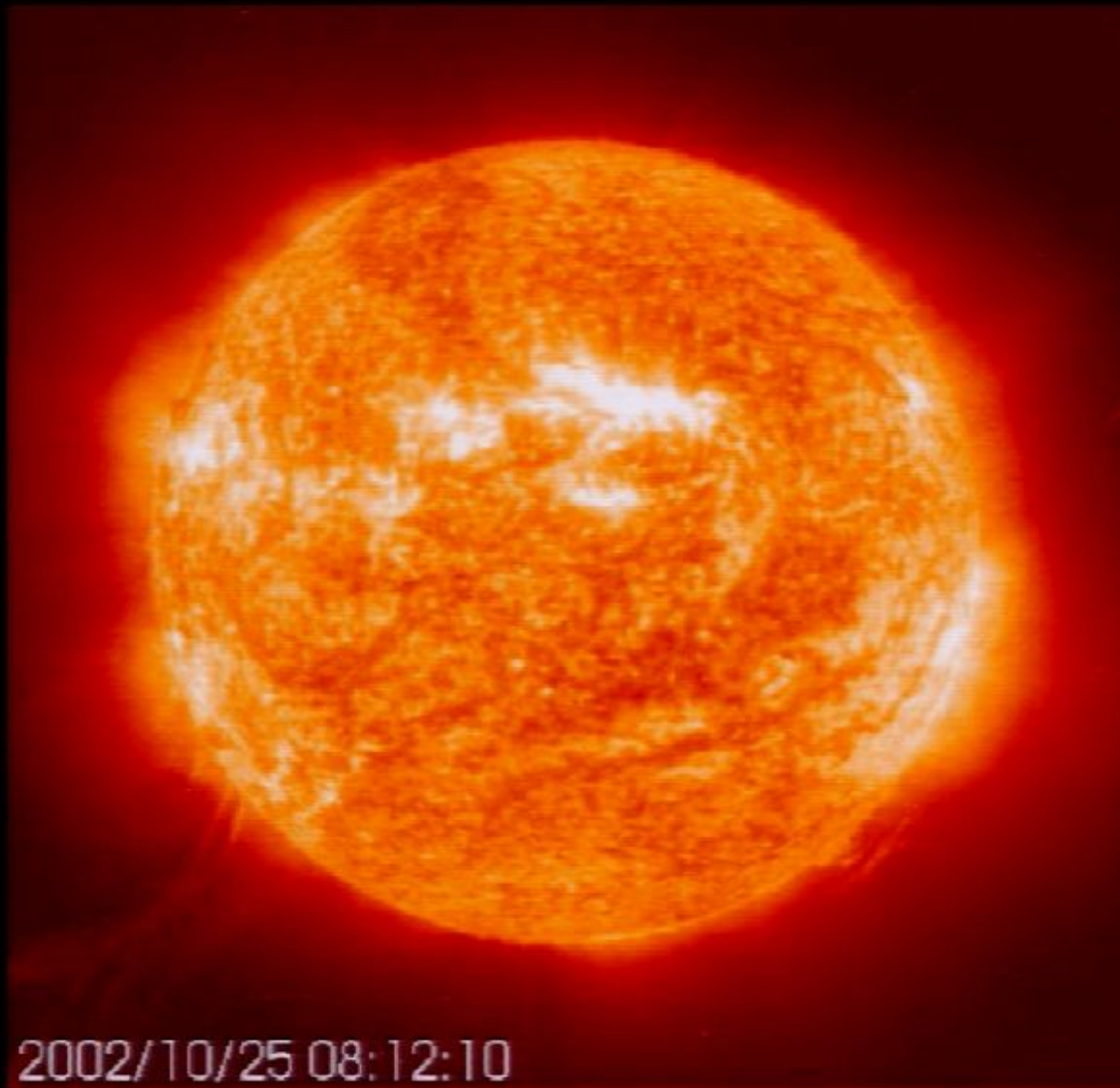


how does this  
thing **work**?



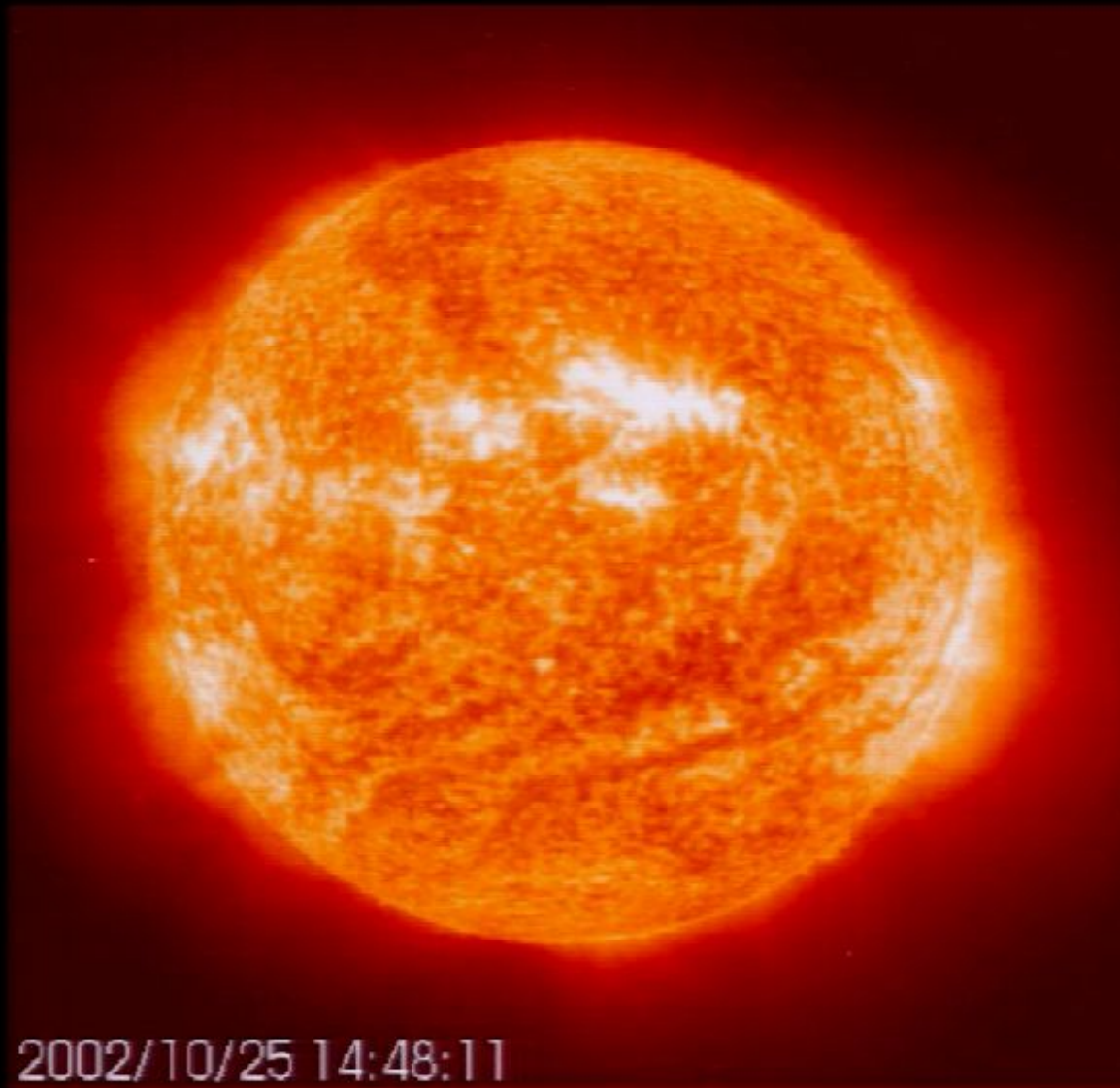
how does this  
thing **work**?

2002/10/25 00:36:10



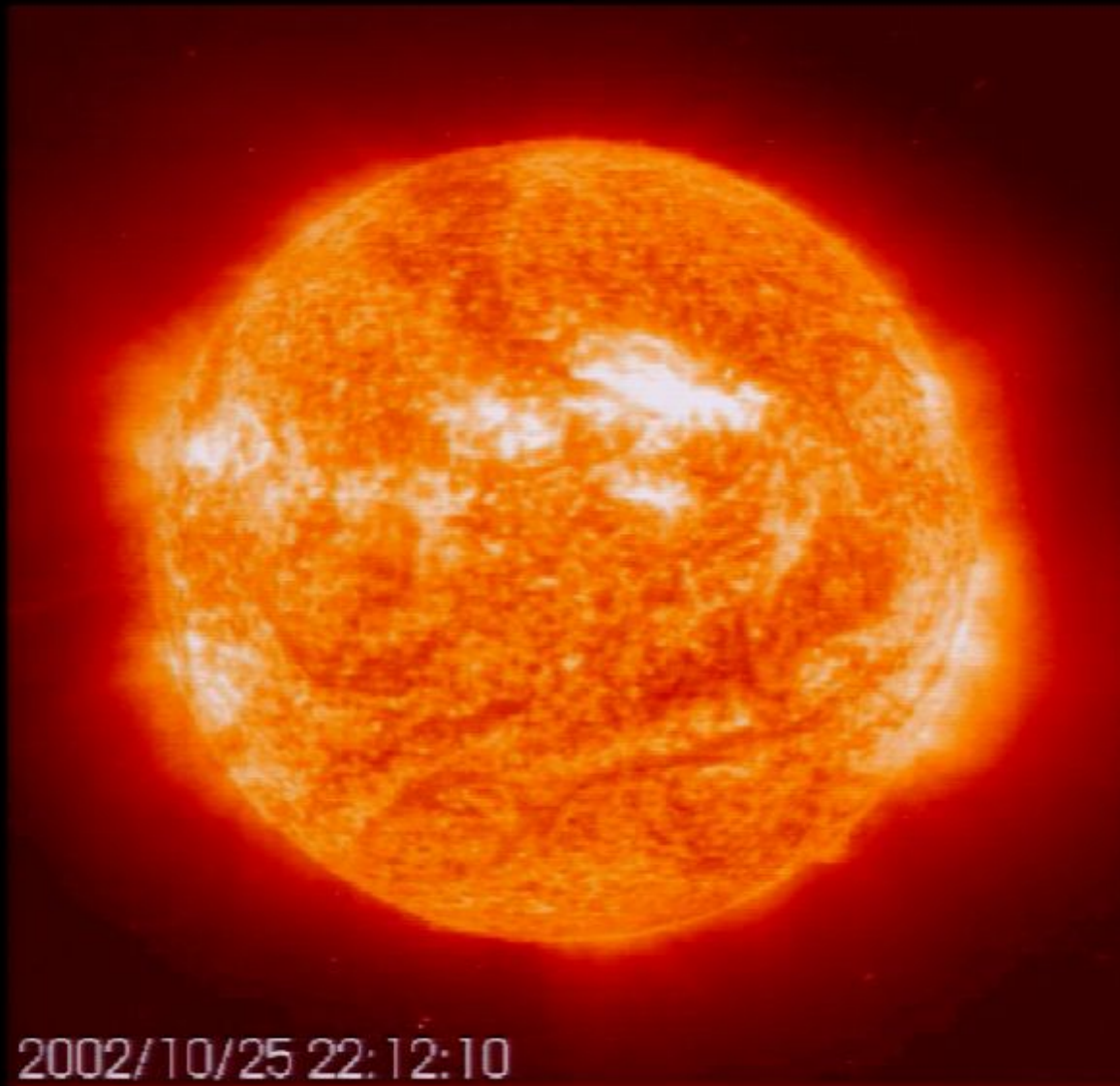
how does this  
thing **work**?





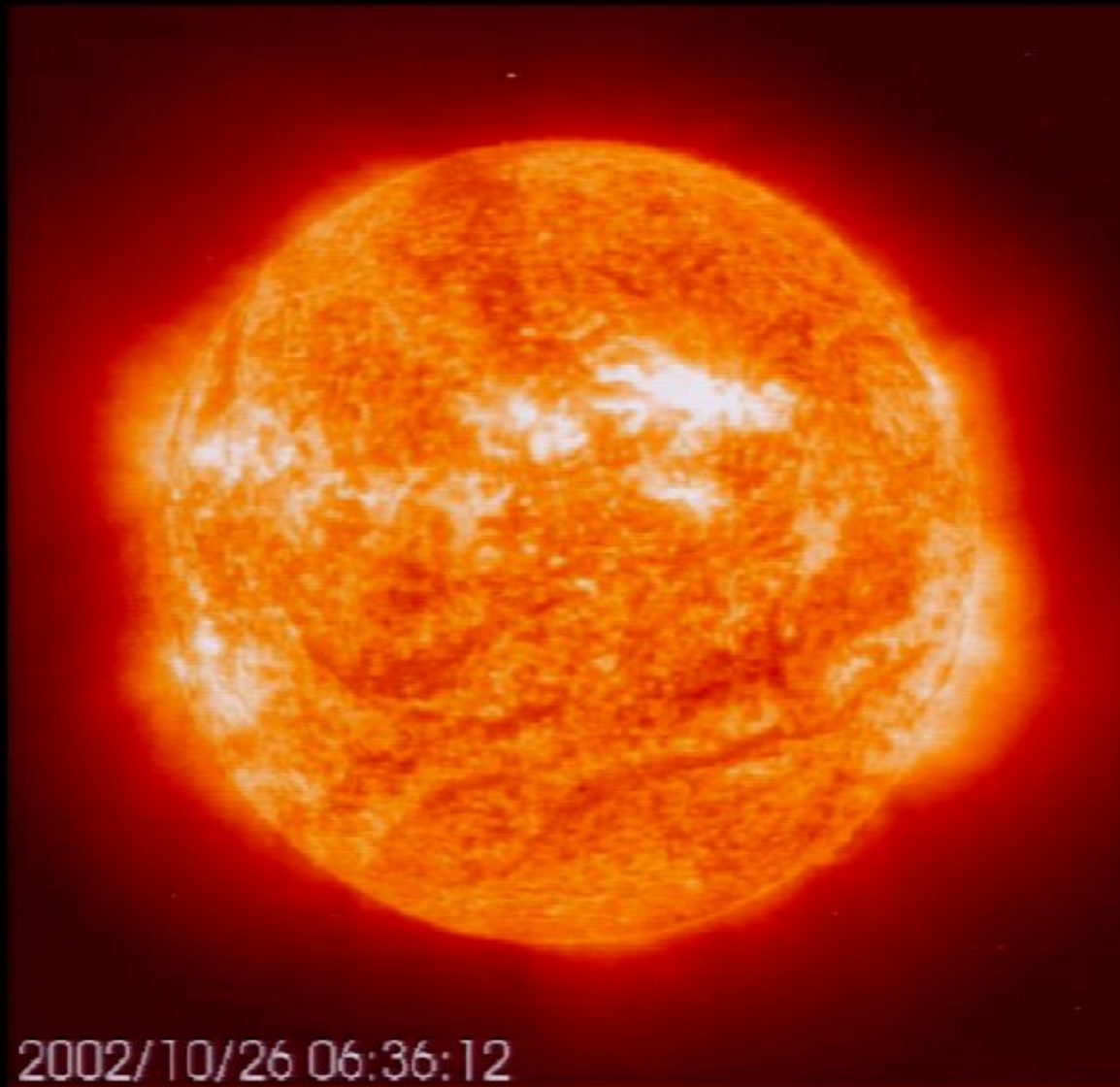
how does this  
thing **work**?

2002/10/25 14:48:11

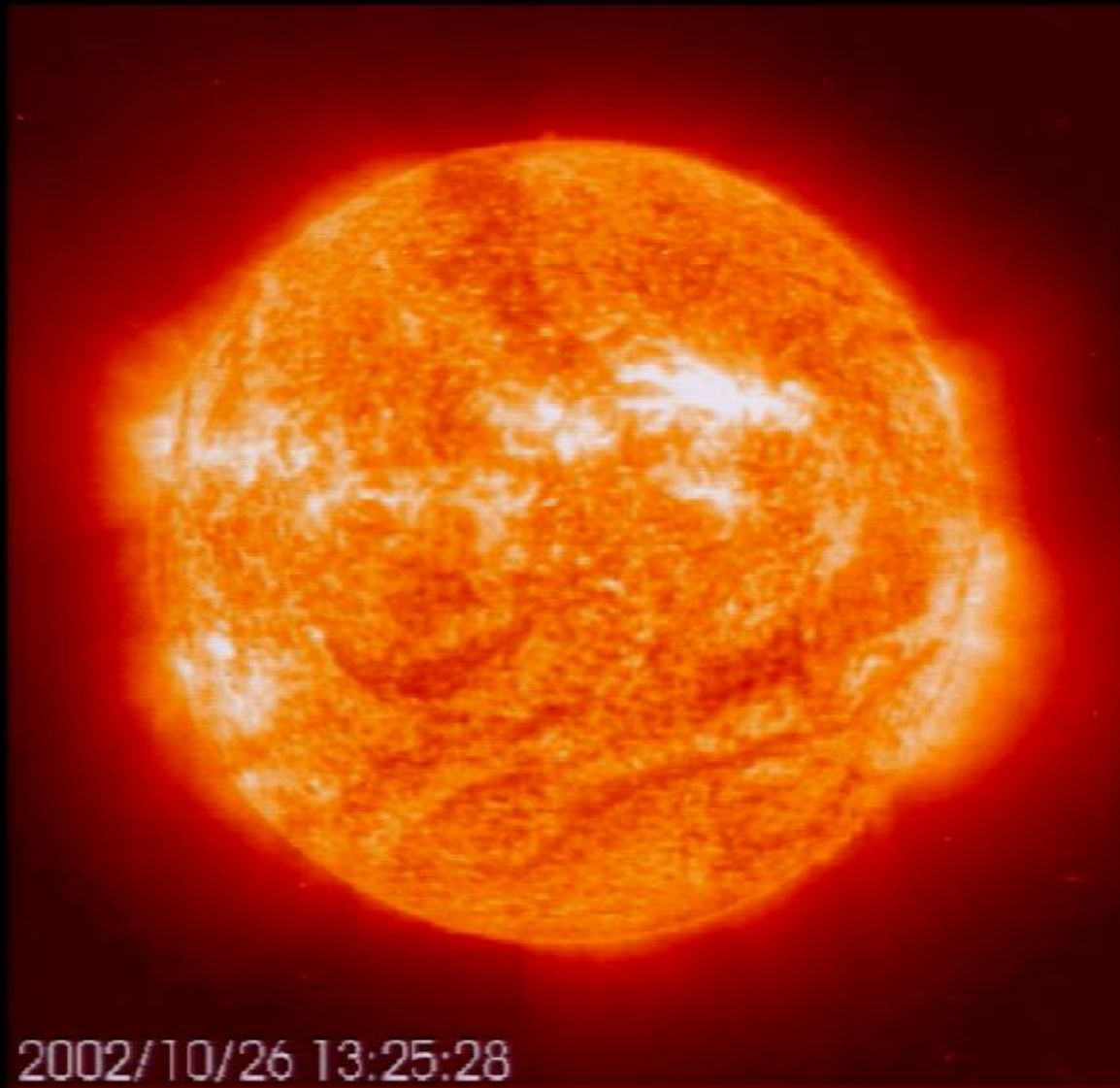


how does this  
thing **work**?

2002/10/25 22:12:10



how does this  
thing **work**?



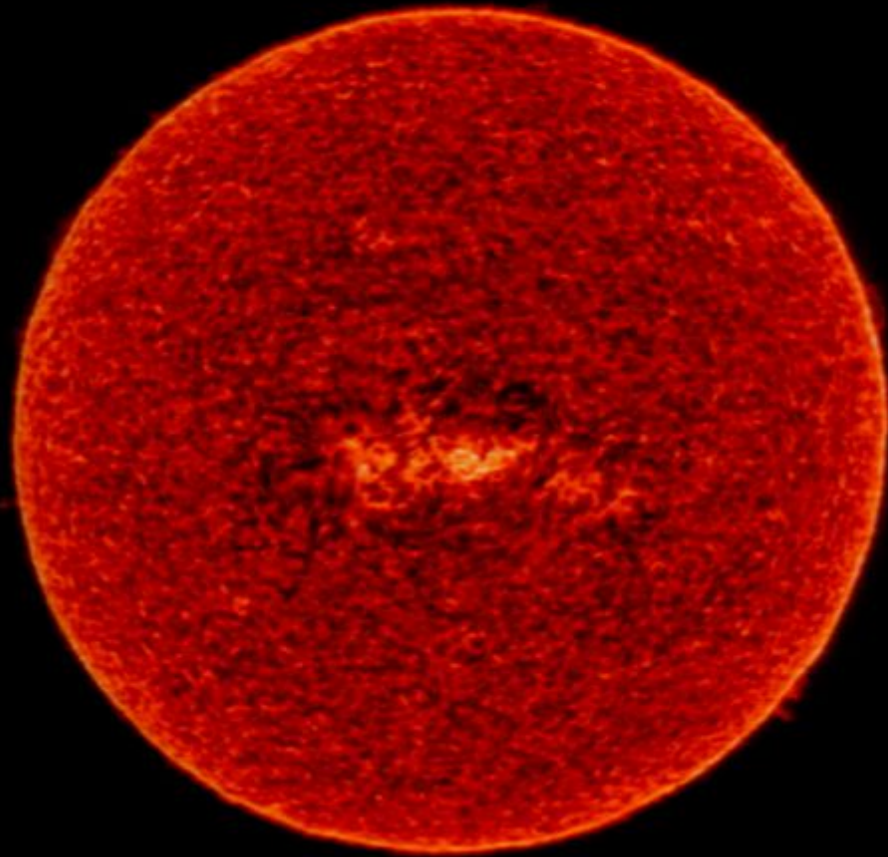
how does this  
thing **work**?

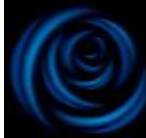
2002/10/26 13:25:28

The image features a dark blue background with a grid of glowing blue squares. In the foreground, a wireframe human head is shown in profile, facing left. To the left of the head, there are several molecular models consisting of grey spheres connected by lines. A central grey sphere is surrounded by radiating lines, resembling a star or a data point. The overall aesthetic is high-tech and scientific.

THE PHYSICS OF INNOVATION **SPECIAL RELATIVITY**

 understand special relativity

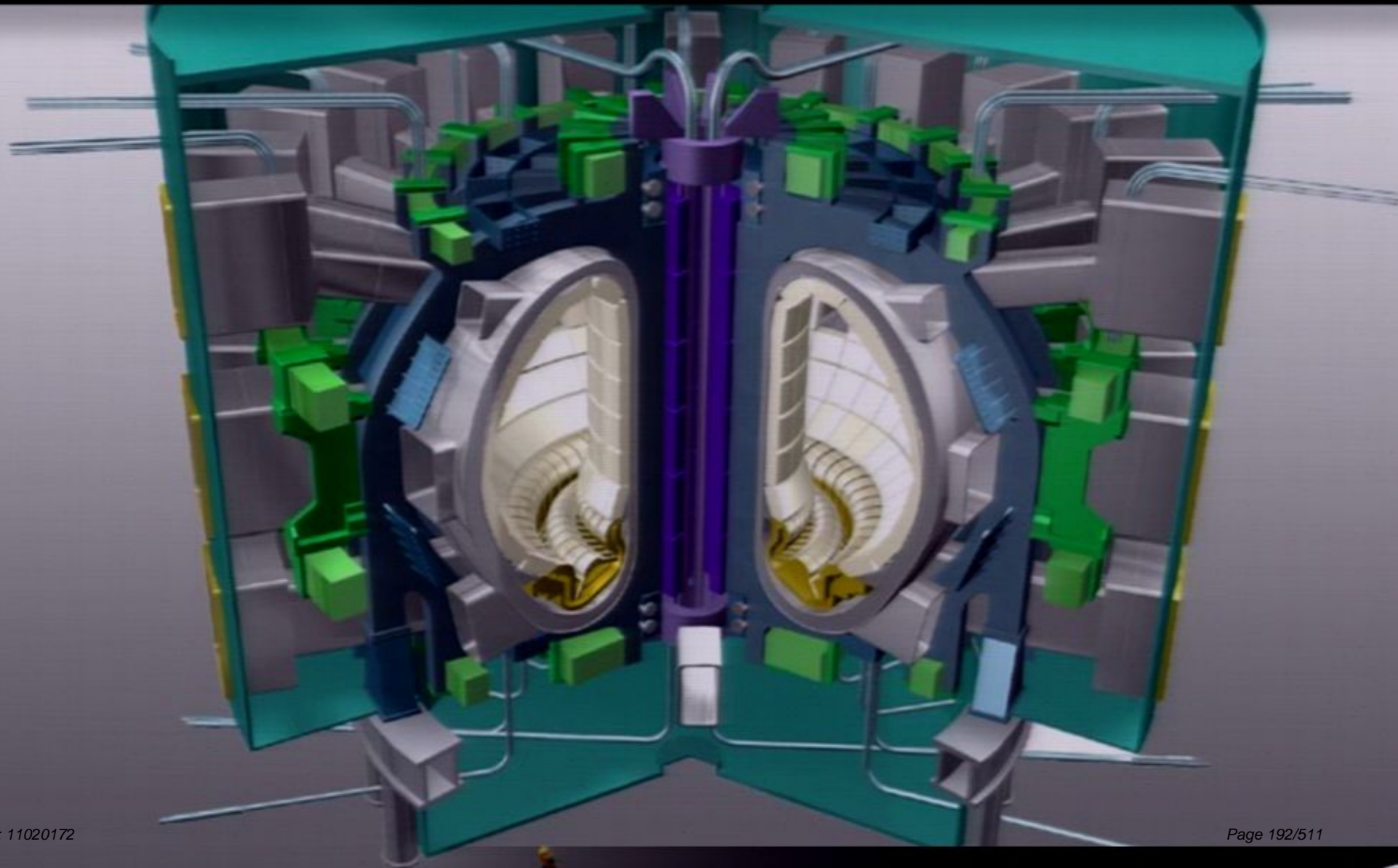


 understand special relativity


$$E = mc^2$$



# build artificial sun (ITER)





The image features a futuristic, digital-themed background. On the right side, a human head is rendered as a glowing blue wireframe mesh. The background is filled with various scientific and technological motifs: a cluster of grey spheres on the left, a central sphere with radiating lines, and a grid of blue squares. The overall color palette is dominated by dark blues and greys, with bright blue highlights.

THE PHYSICS OF INNOVATION **GENERAL RELATIVITY**



where does  
this come  
from?



The image features a dark blue, futuristic digital environment. In the foreground on the right, a human head is rendered as a white wireframe mesh, facing left. The background is filled with various digital and scientific motifs: a grid of glowing blue squares, several molecular models consisting of grey spheres connected by thin lines, and a central glowing sphere with radiating lines. The overall aesthetic is high-tech and scientific.

THE PHYSICS OF INNOVATION **QUANTUM**



where does this come from?

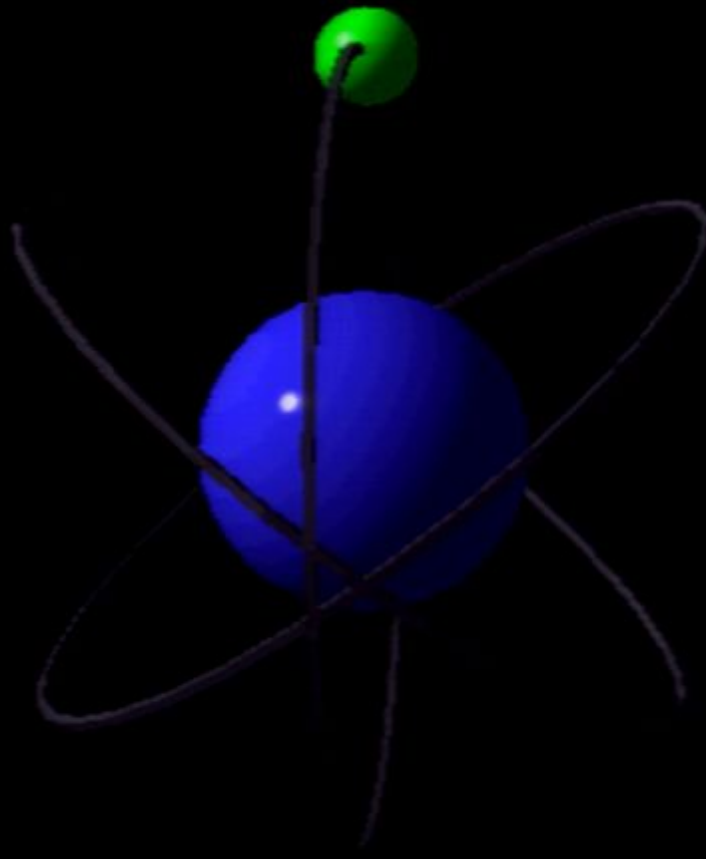




explore mystery

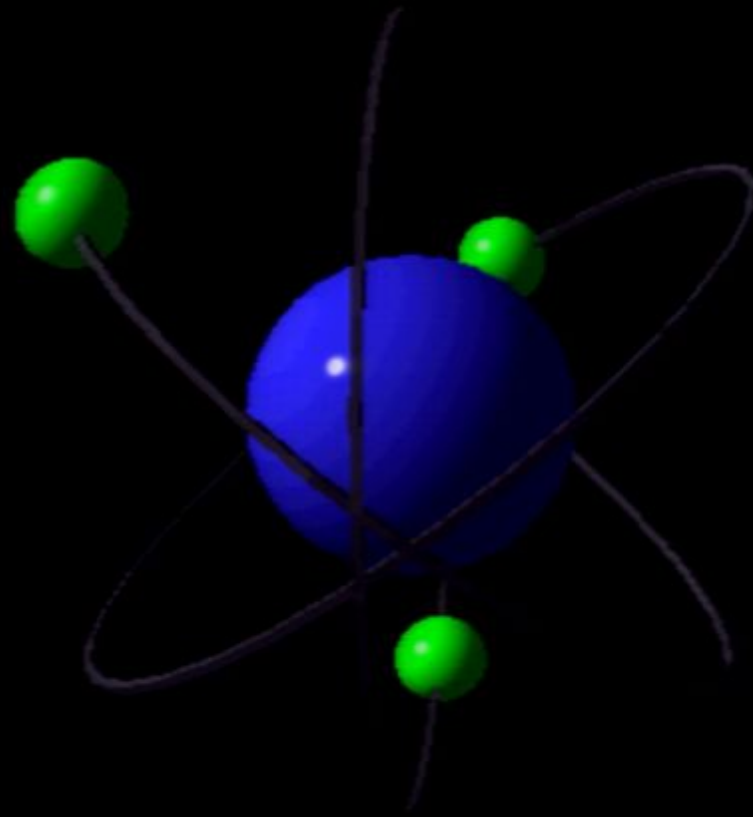
how can atoms exist?

△ explore how can atoms exist?

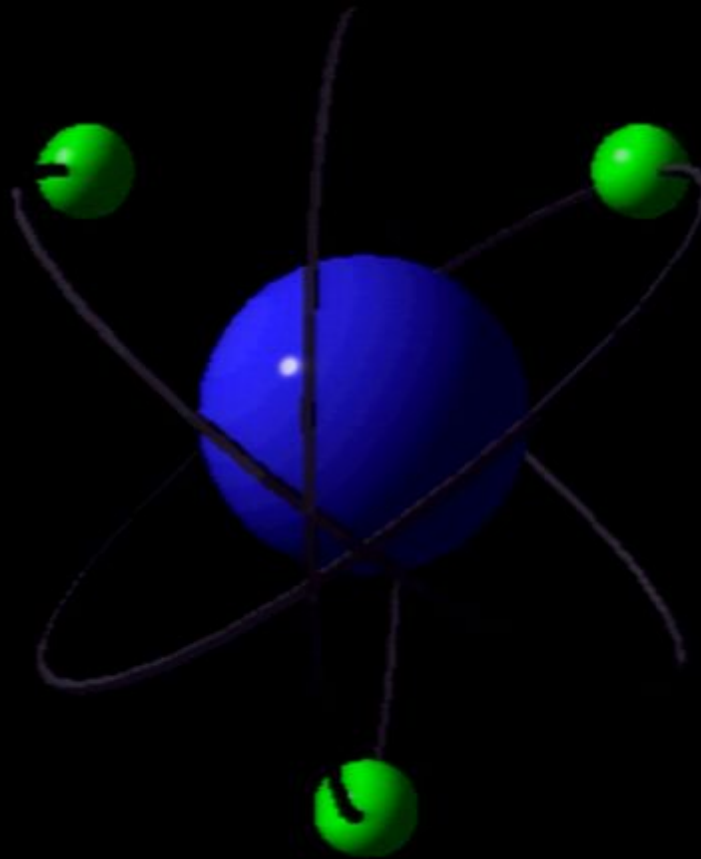




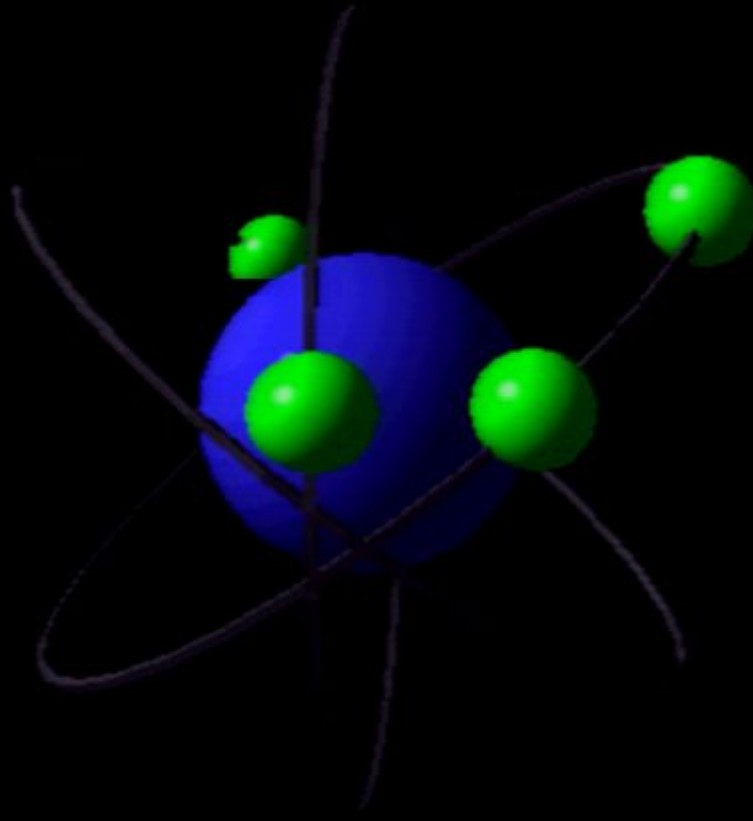
△ explore how can atoms exist?



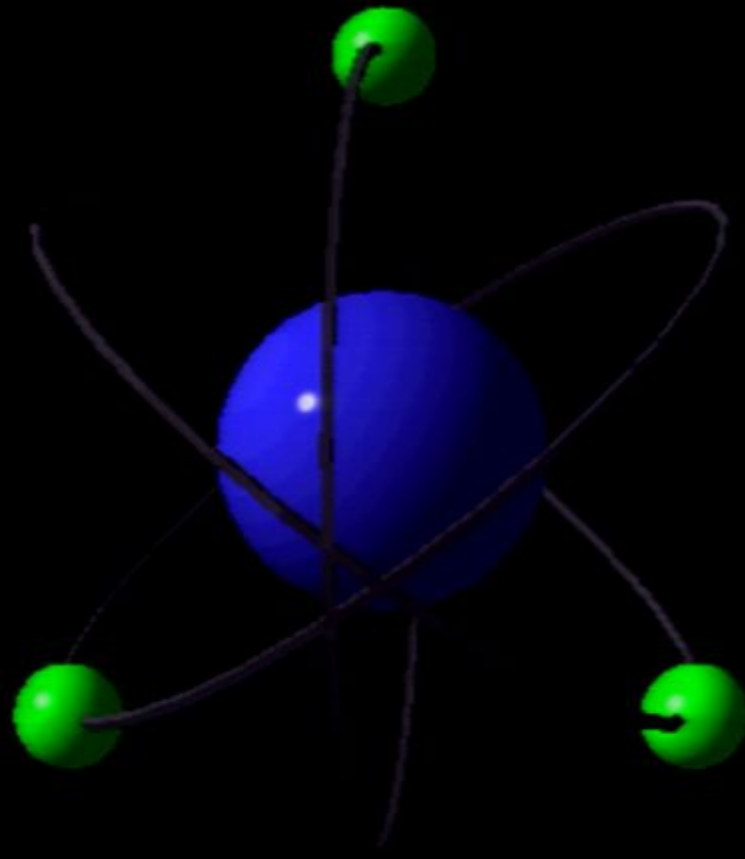
△ explore how can atoms exist?



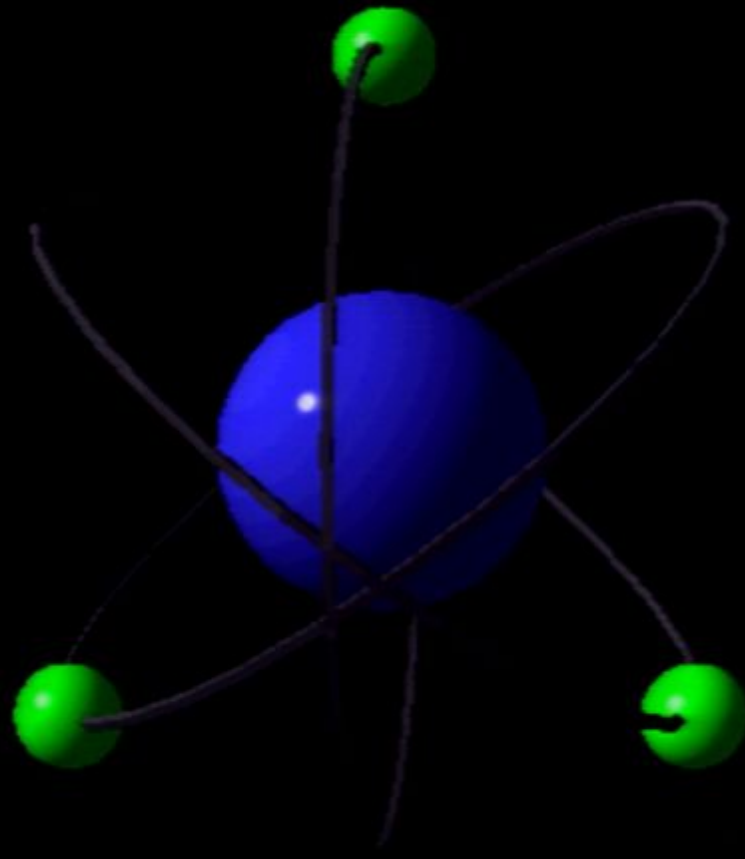
△ explore how can atoms exist?



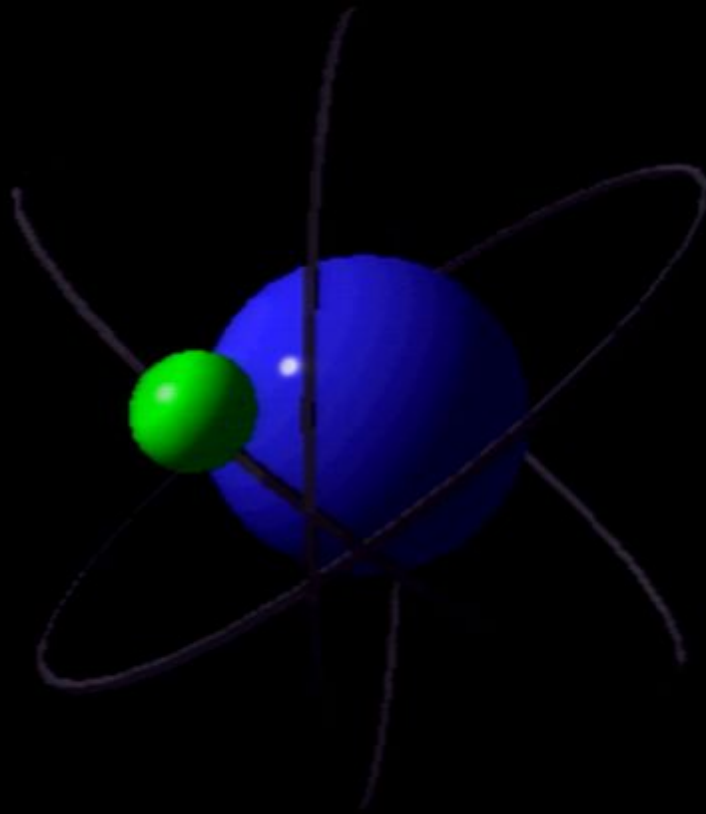
△ explore how can atoms exist?



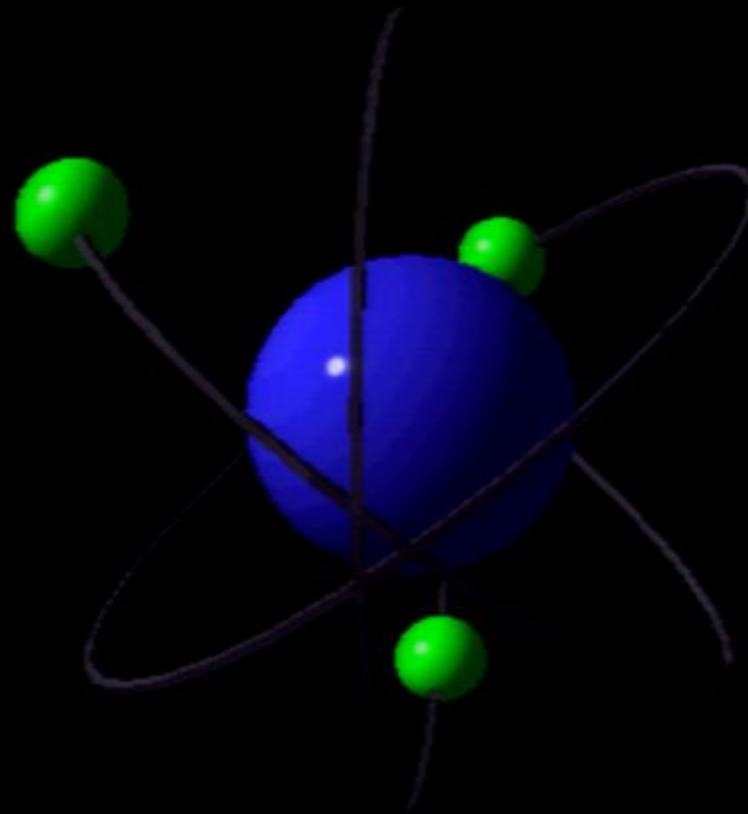
△ explore how can atoms exist?



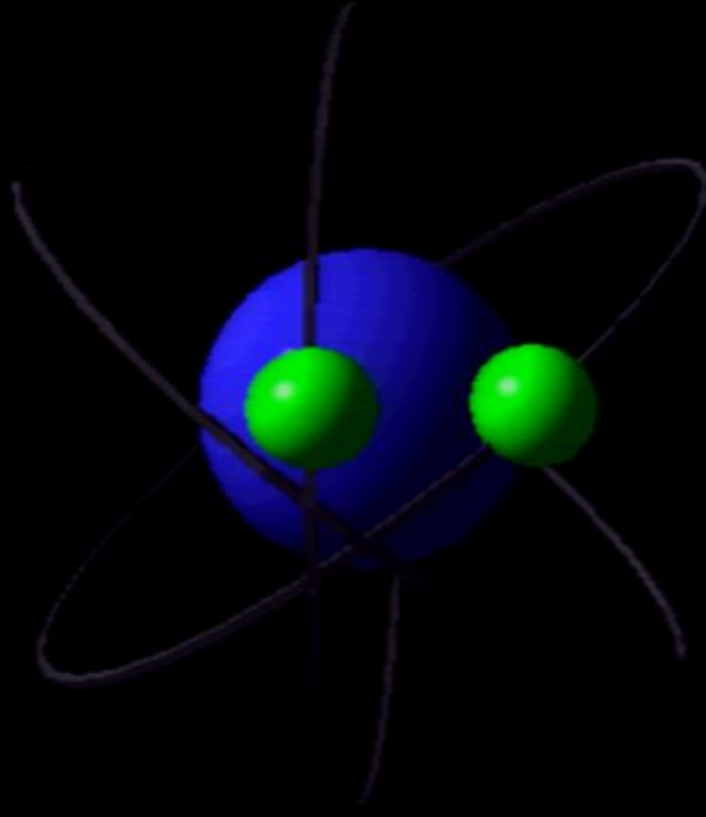
△ explore how can atoms exist?



△ explore how can atoms exist?

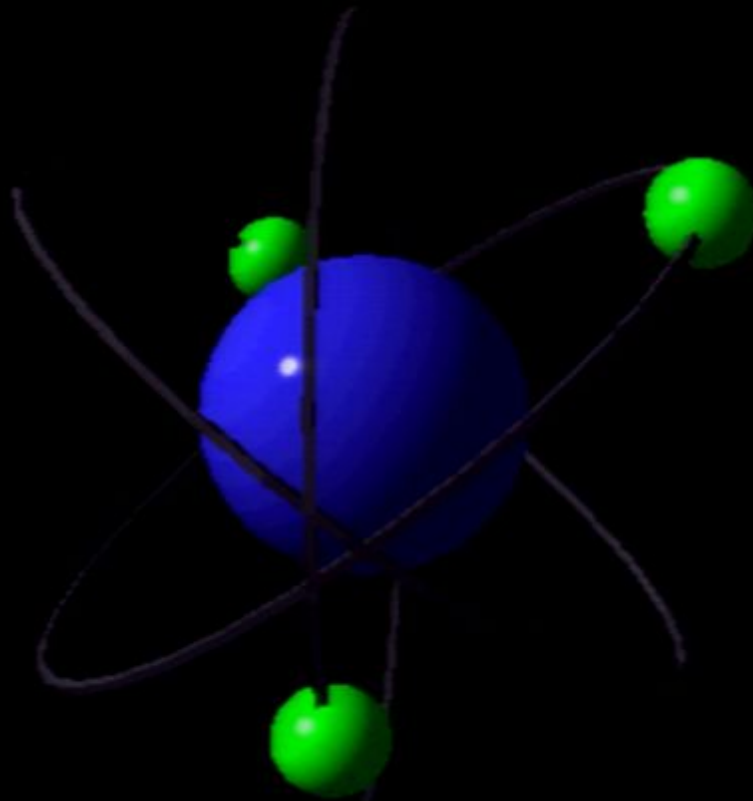


△ explore how can atoms exist?

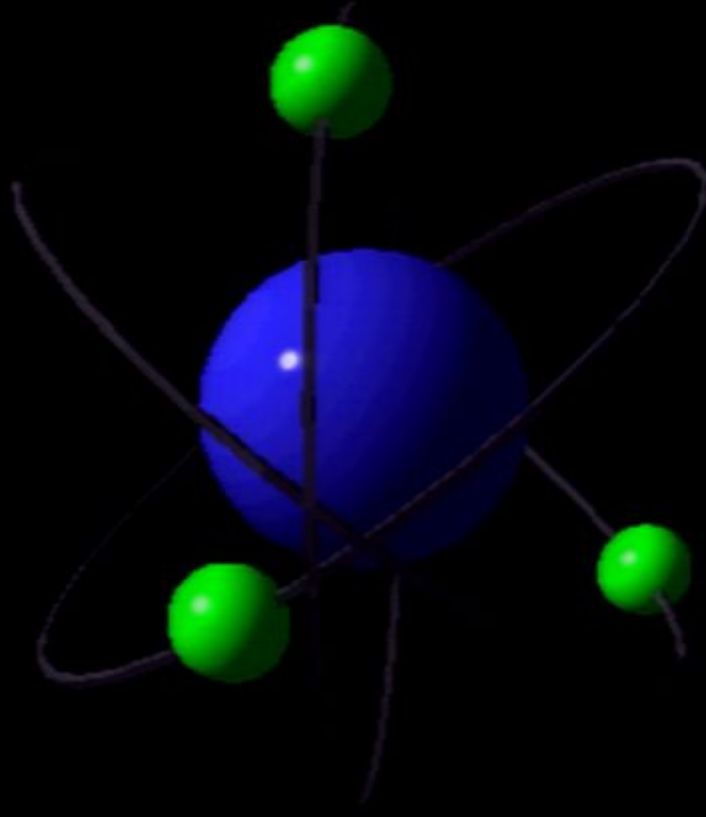




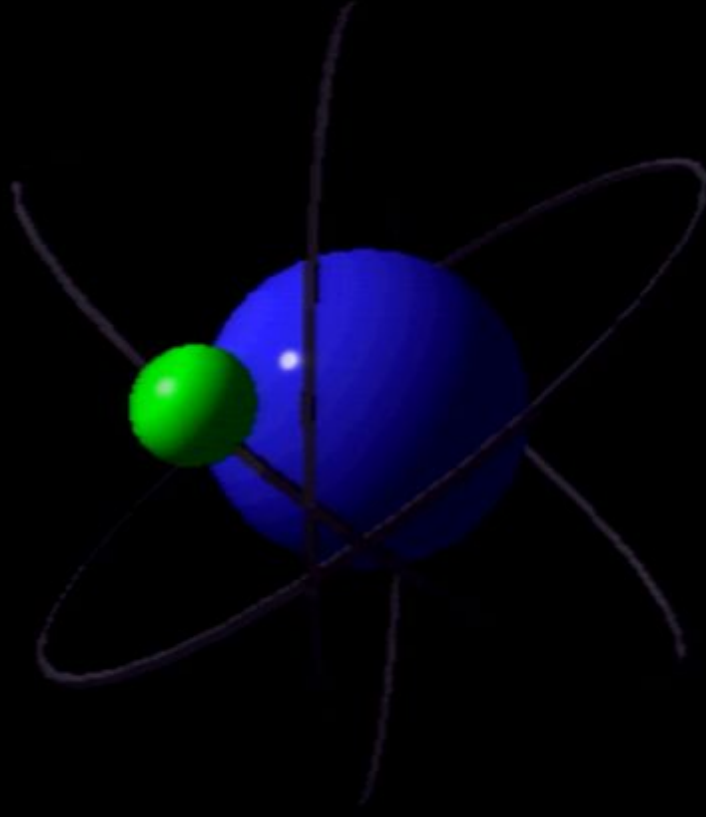
△ explore how can atoms exist?



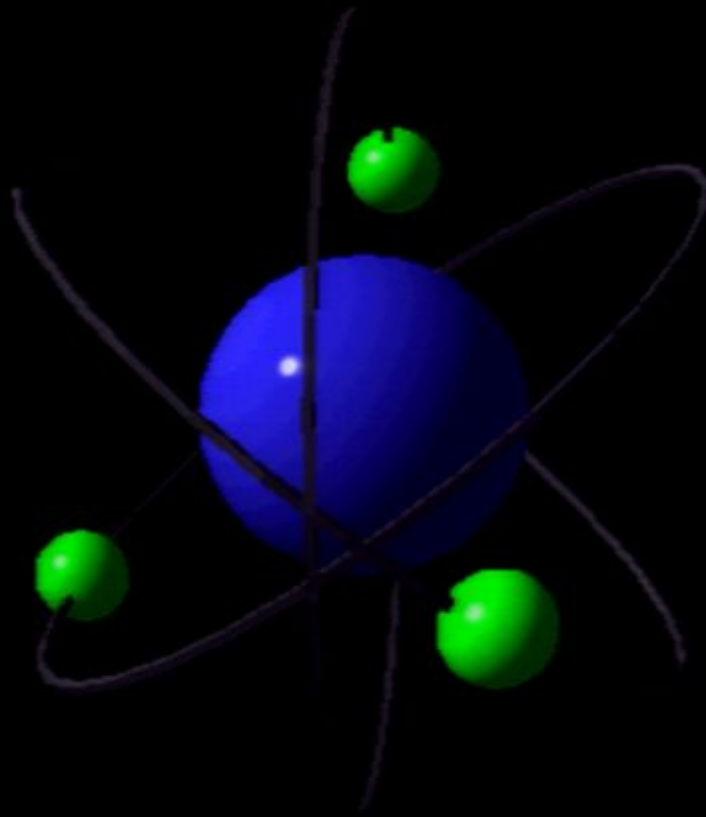
△ explore how can atoms exist?



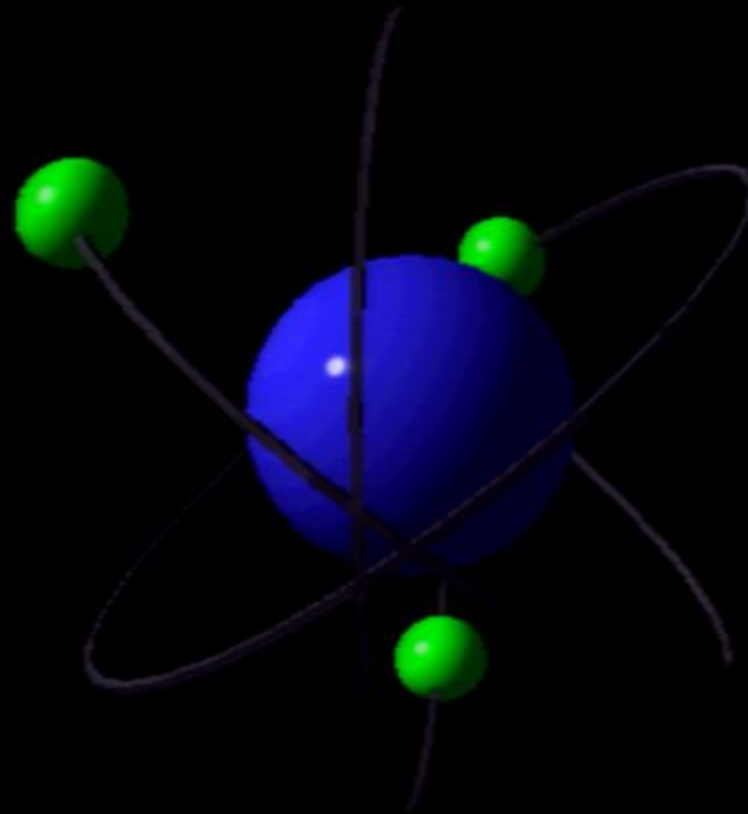
△ explore how can atoms exist?



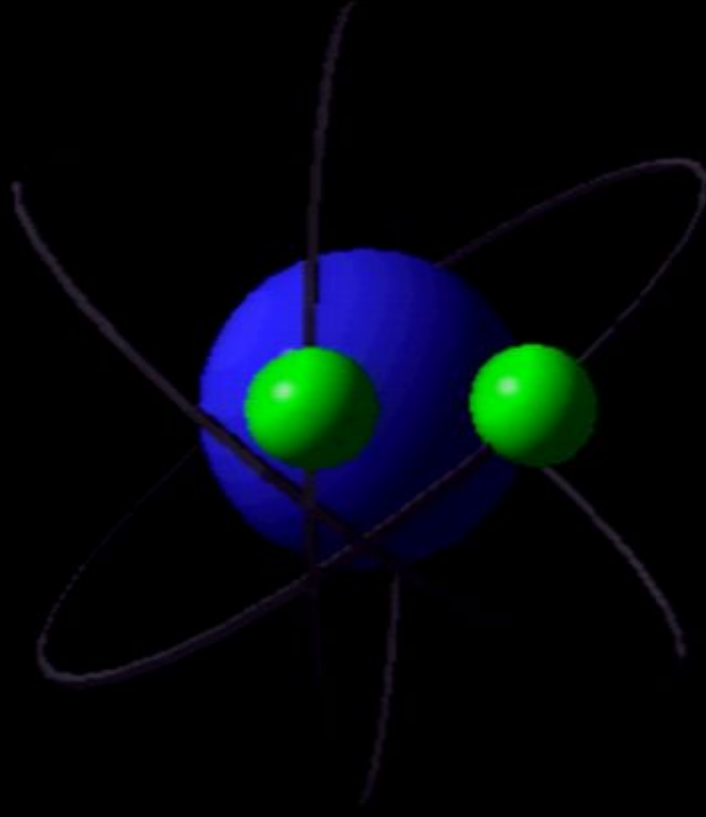
△ explore how can atoms exist?



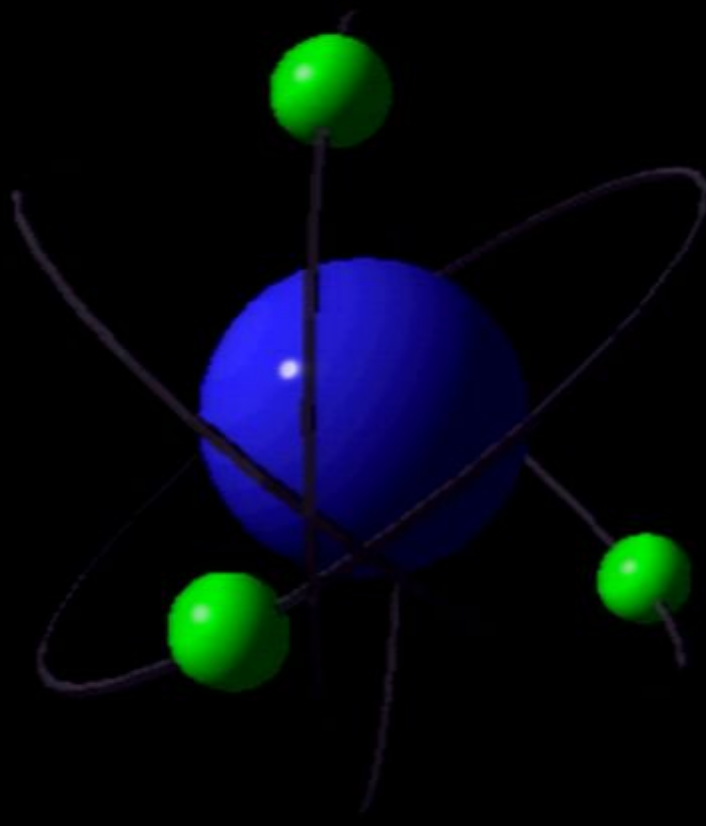
△ explore how can atoms exist?



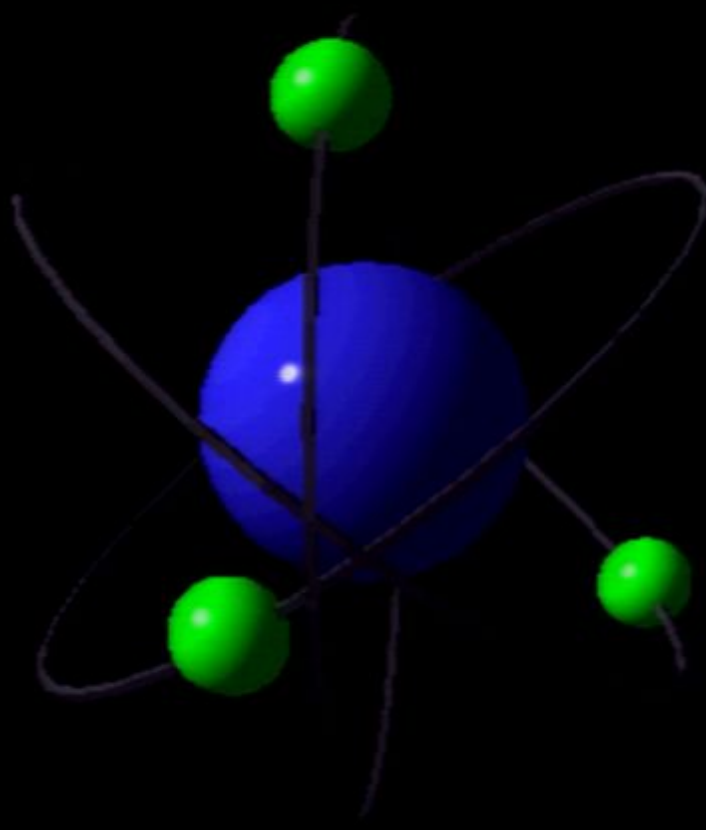
△ explore how can atoms exist?



△ explore how can atoms exist?

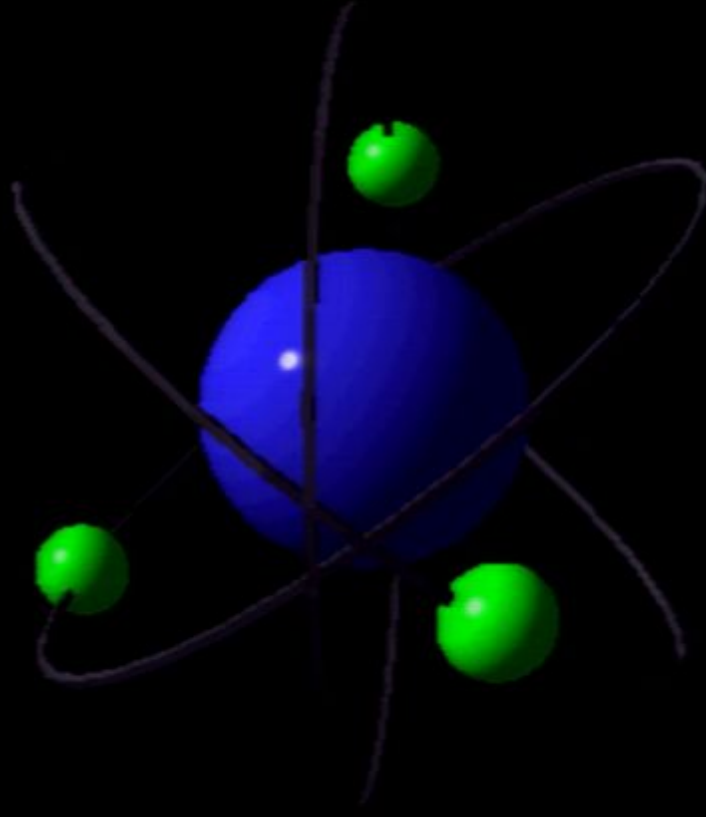


△ explore how can atoms exist?

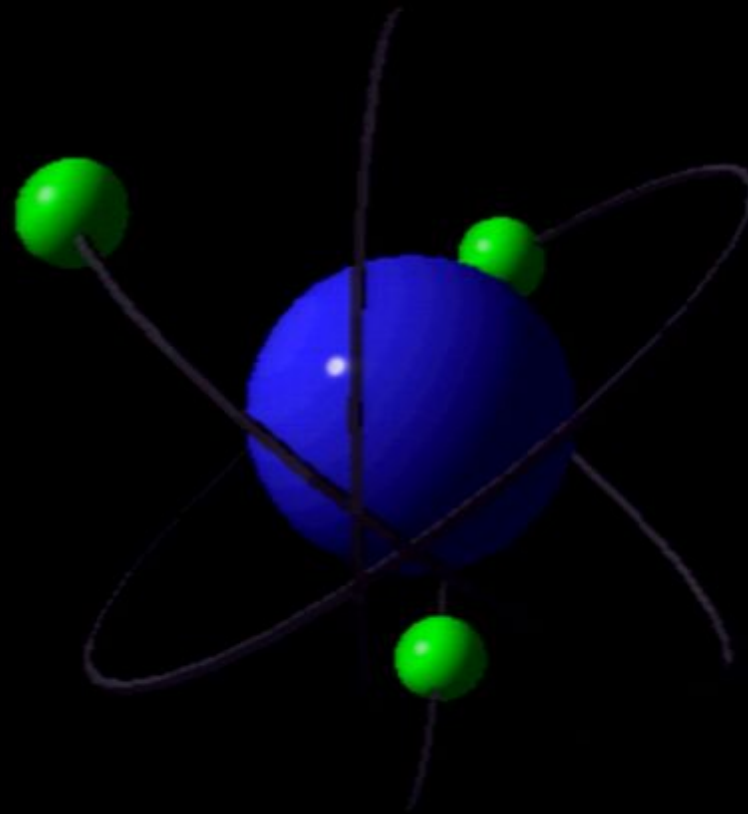




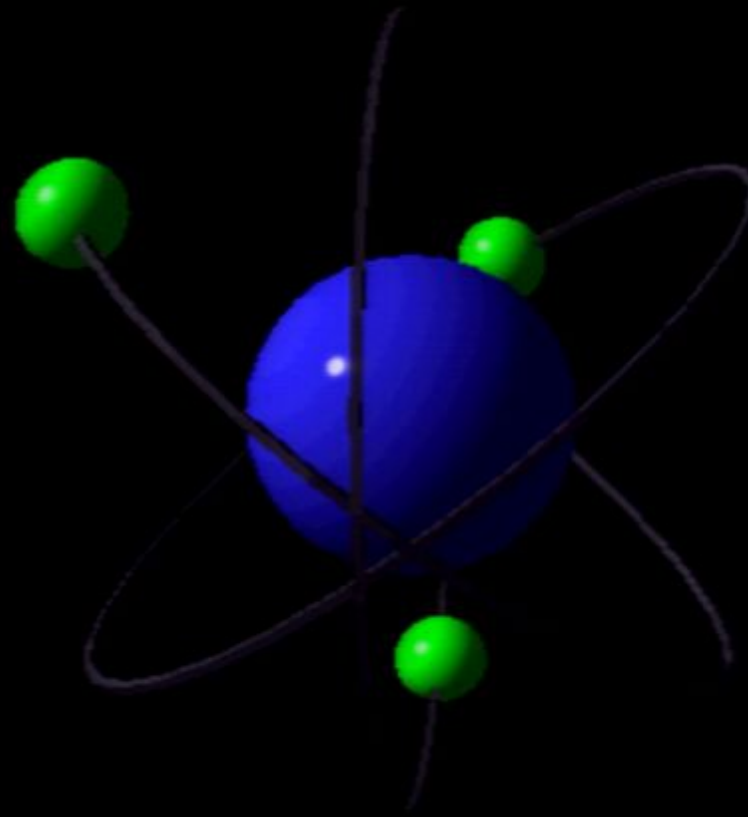
△ explore how can atoms exist?



△ explore how can atoms exist?



△ explore how can atoms exist?





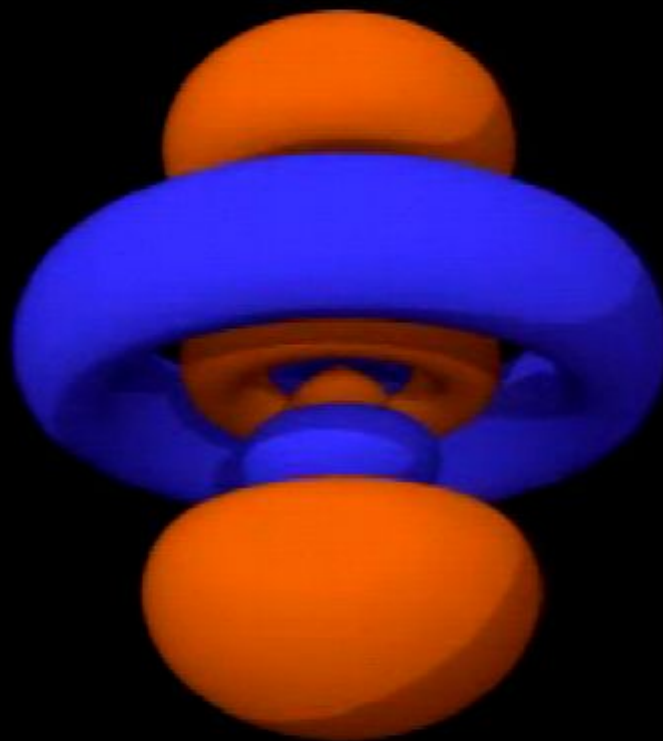
understand reality

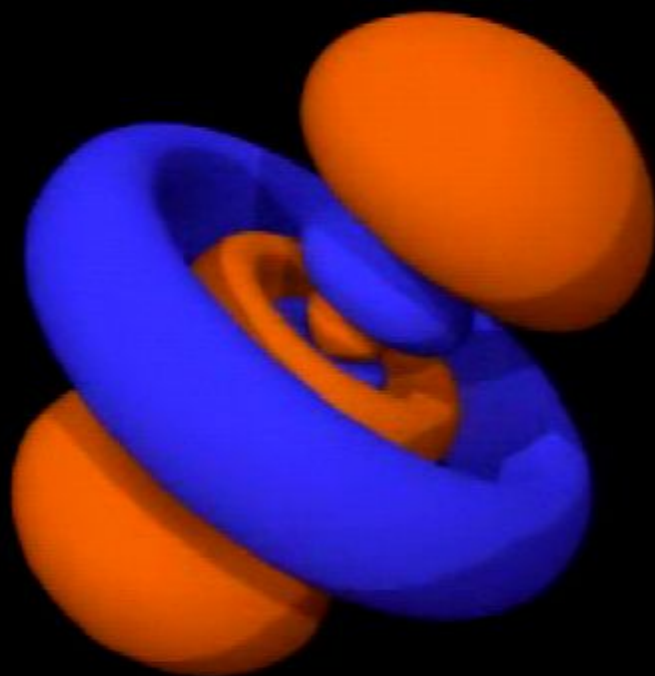
quantum



understand reality  
quantum

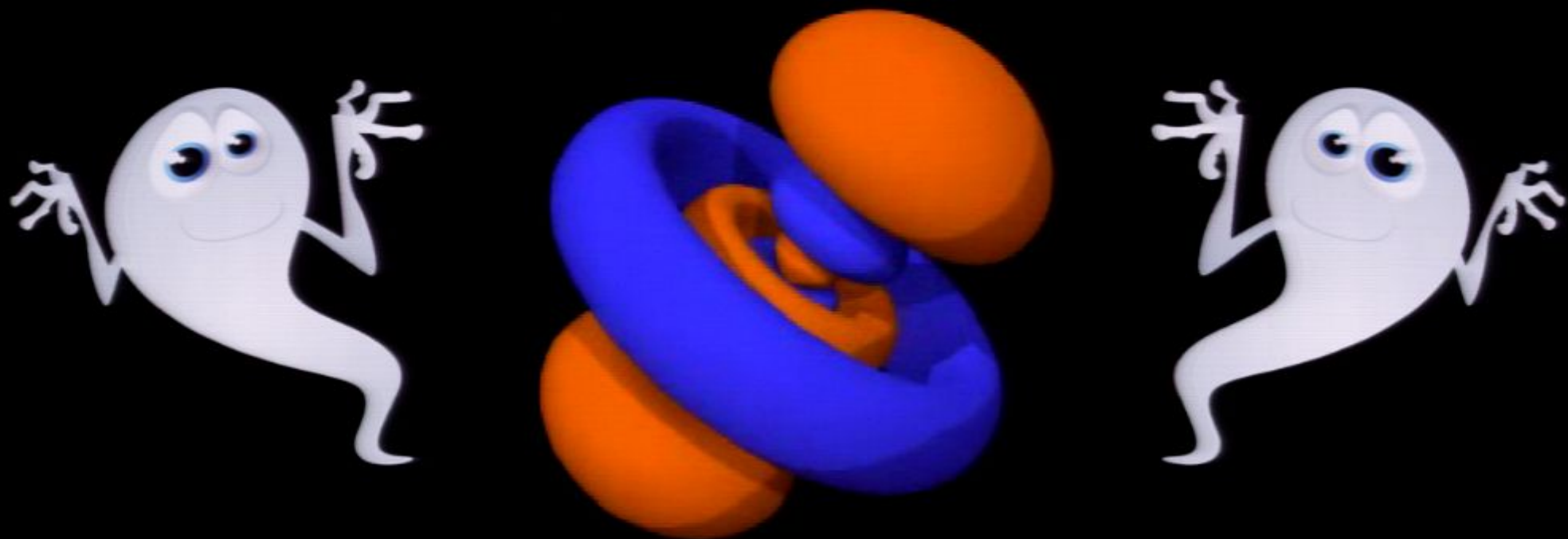
 understand quantum



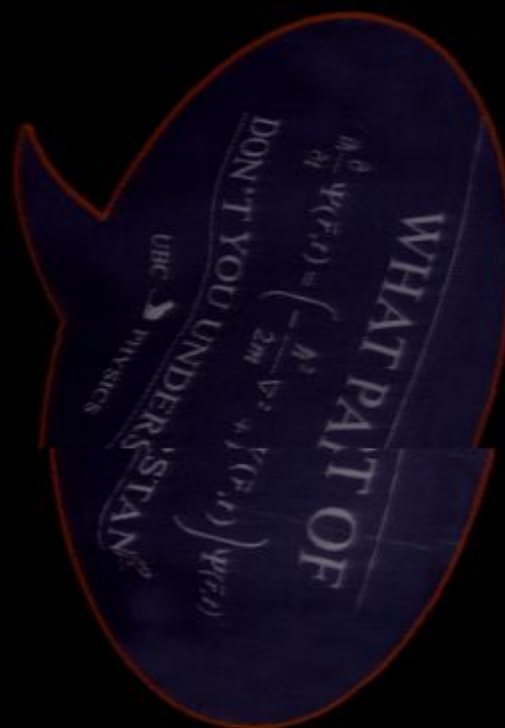


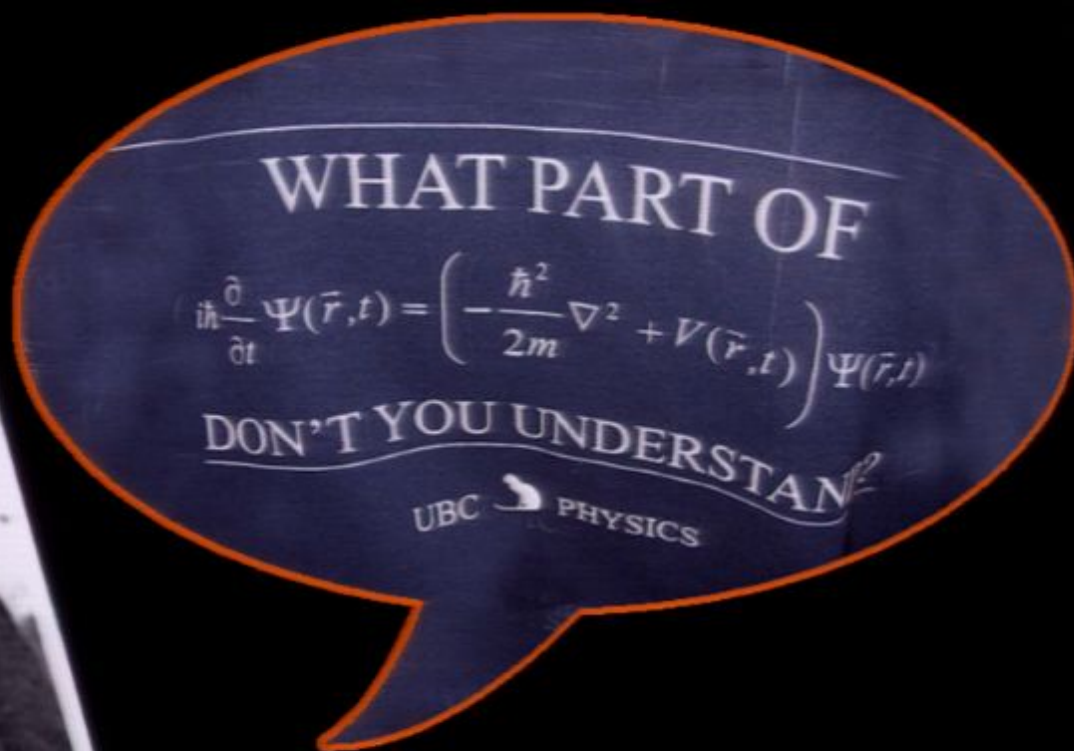
small is different





small is different







build cool stuff



build cool stuff  
every electronic  
device on the planet



build electronic devices





build computers





build supercomputers

# Simulated Reality





build supercomputers

# Simulated Reality

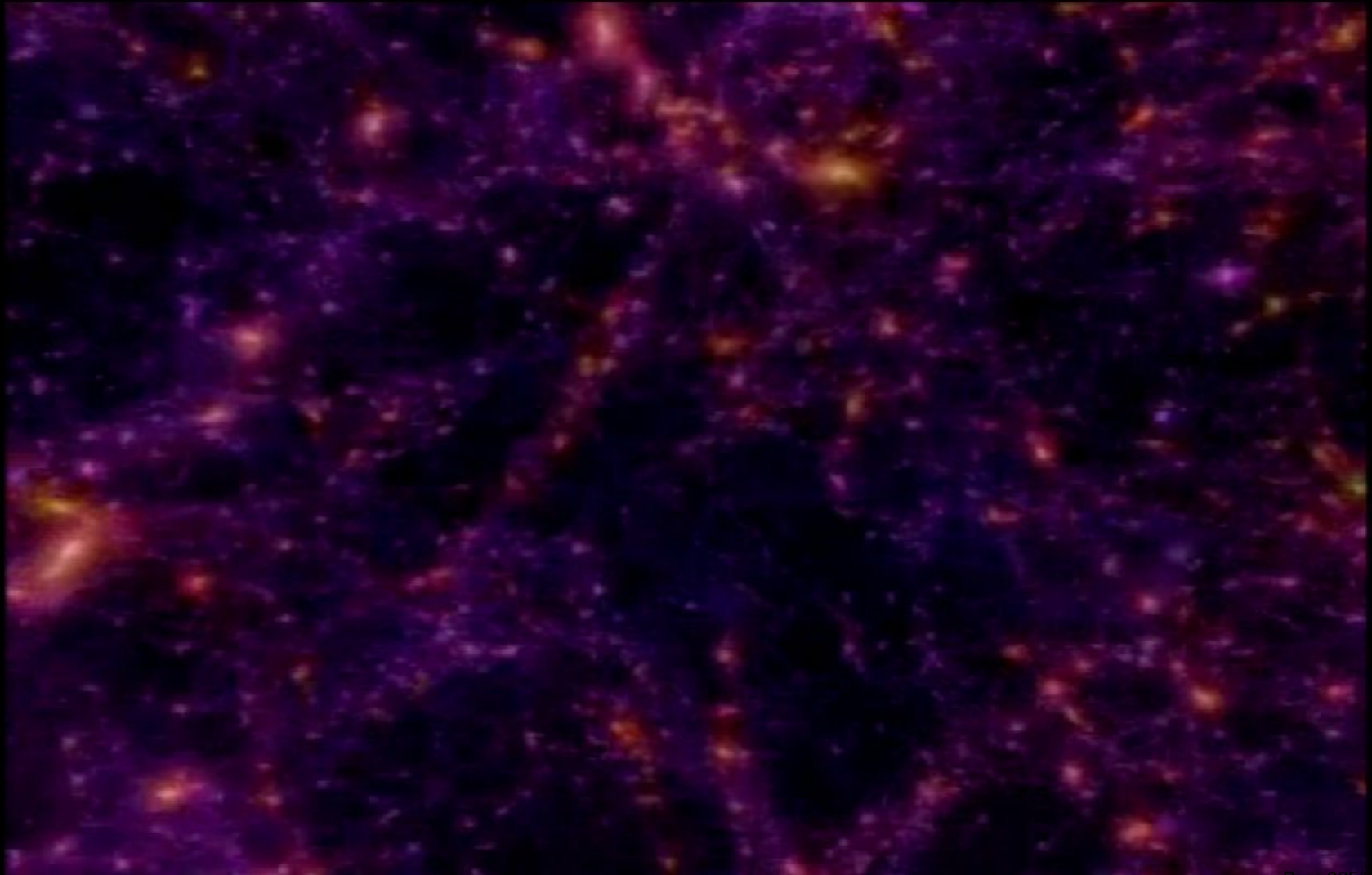


build supercomputers



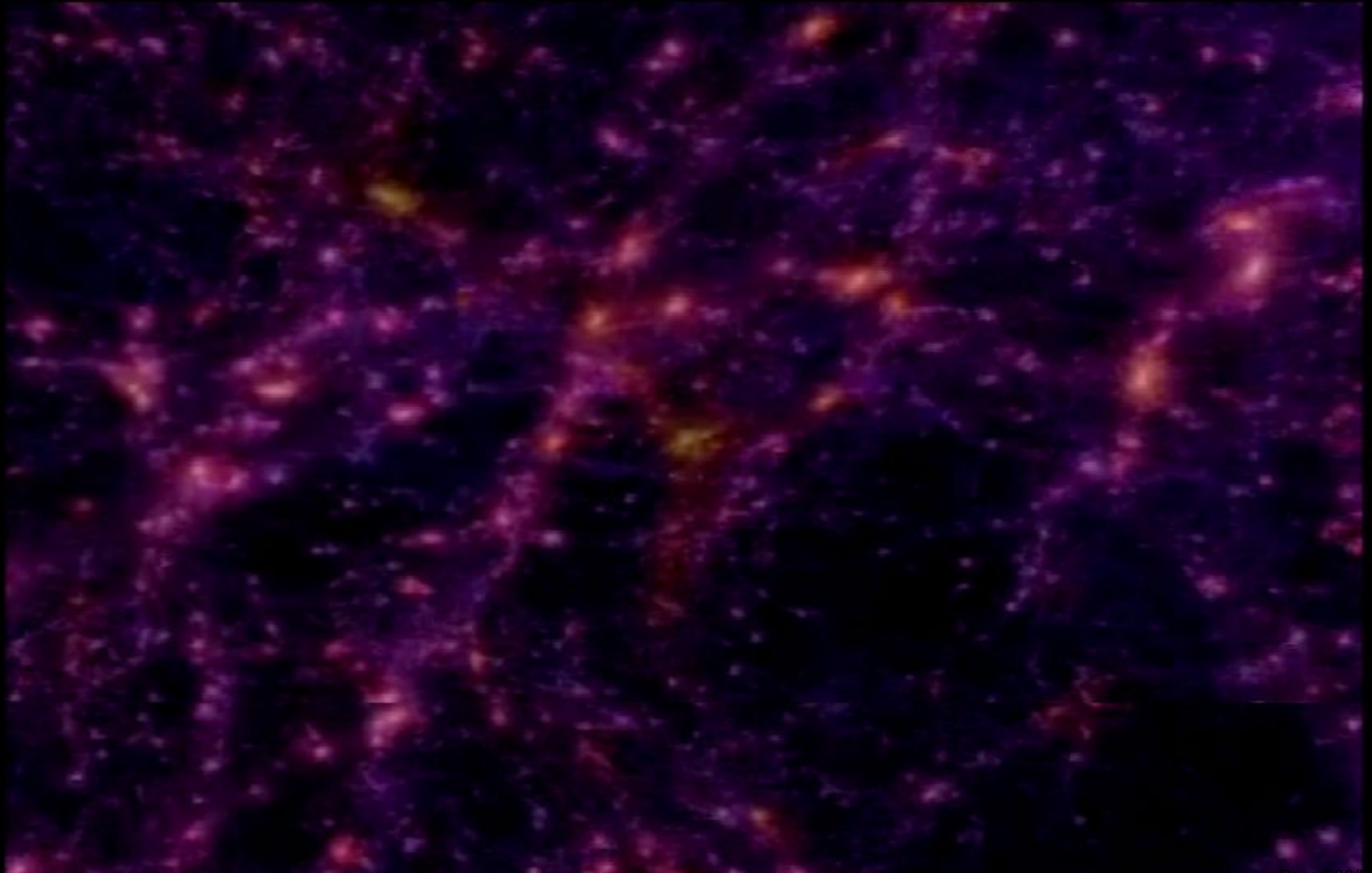


build supercomputers





build supercomputers



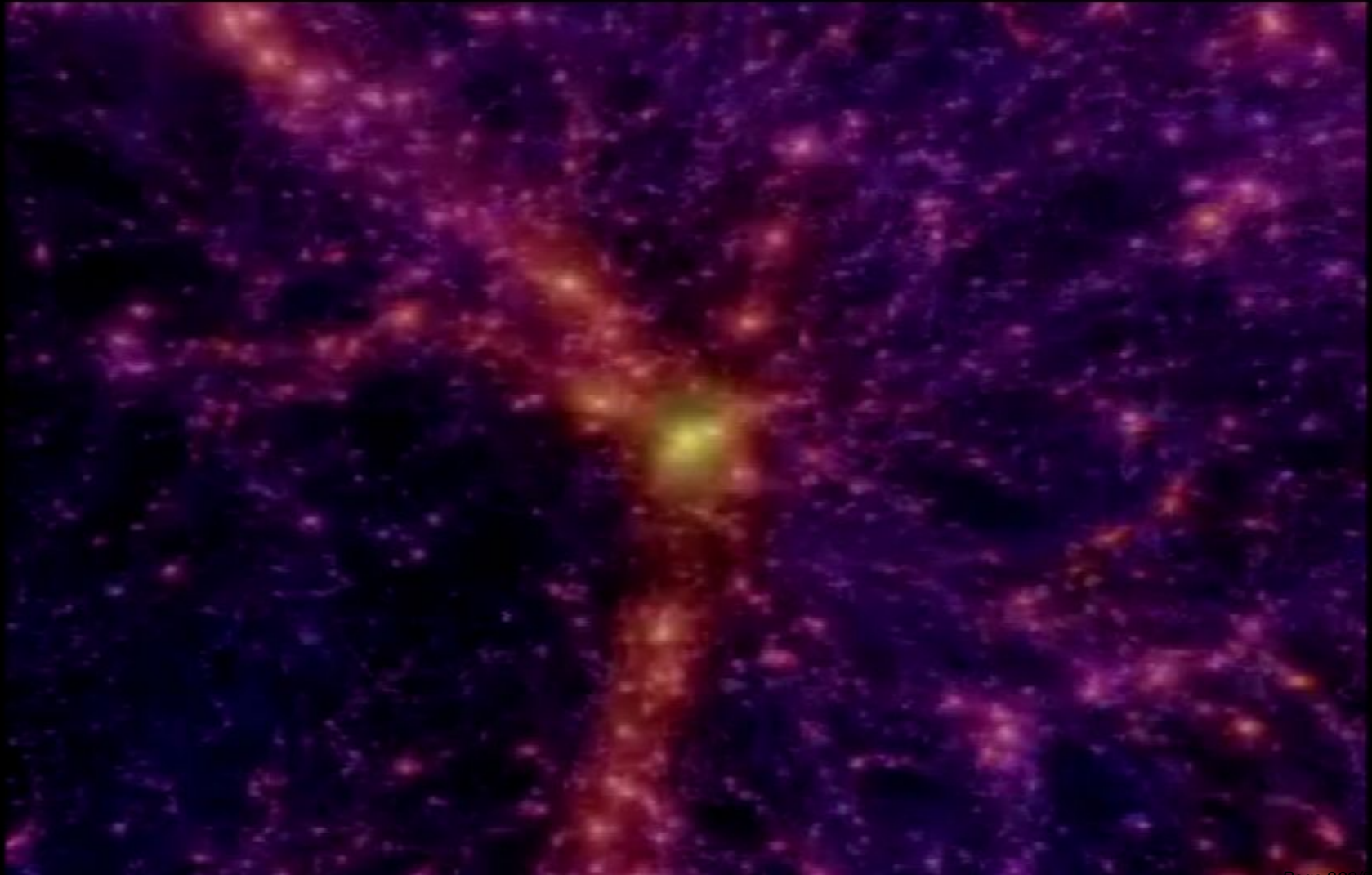


build supercomputers





build supercomputers





build supercomputers



© 2000



build supercomputers







build supercomputers





build supercomputers





build supercomputers





build supercomputers





build supercomputers





build cell phones





build electronics everywhere





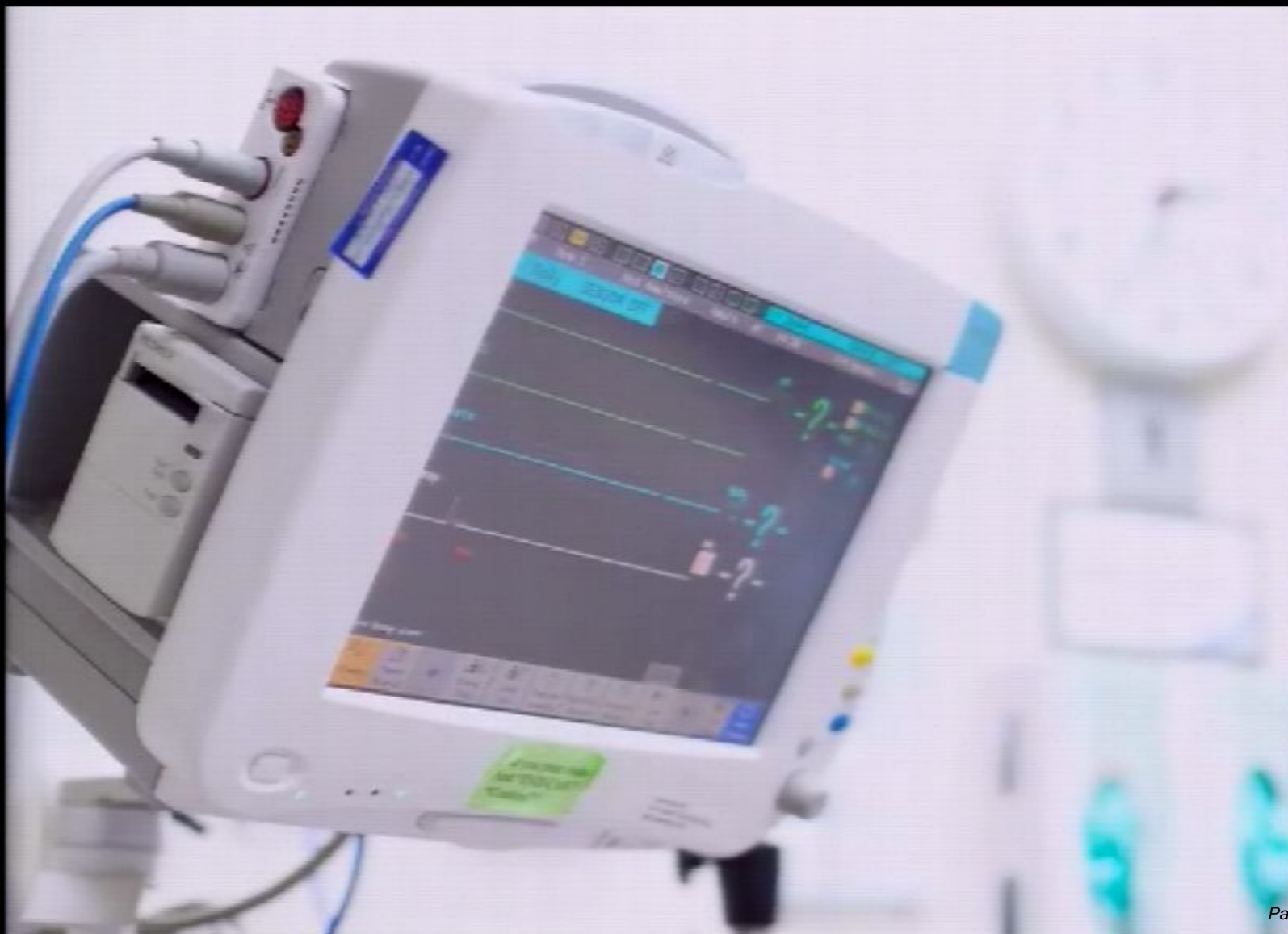
build electronics everywhere







build electronics everywhere





**build** electronics everywhere





build electronics everywhere





**build** electronics everywhere





build electronics everywhere





build electronics everywhere



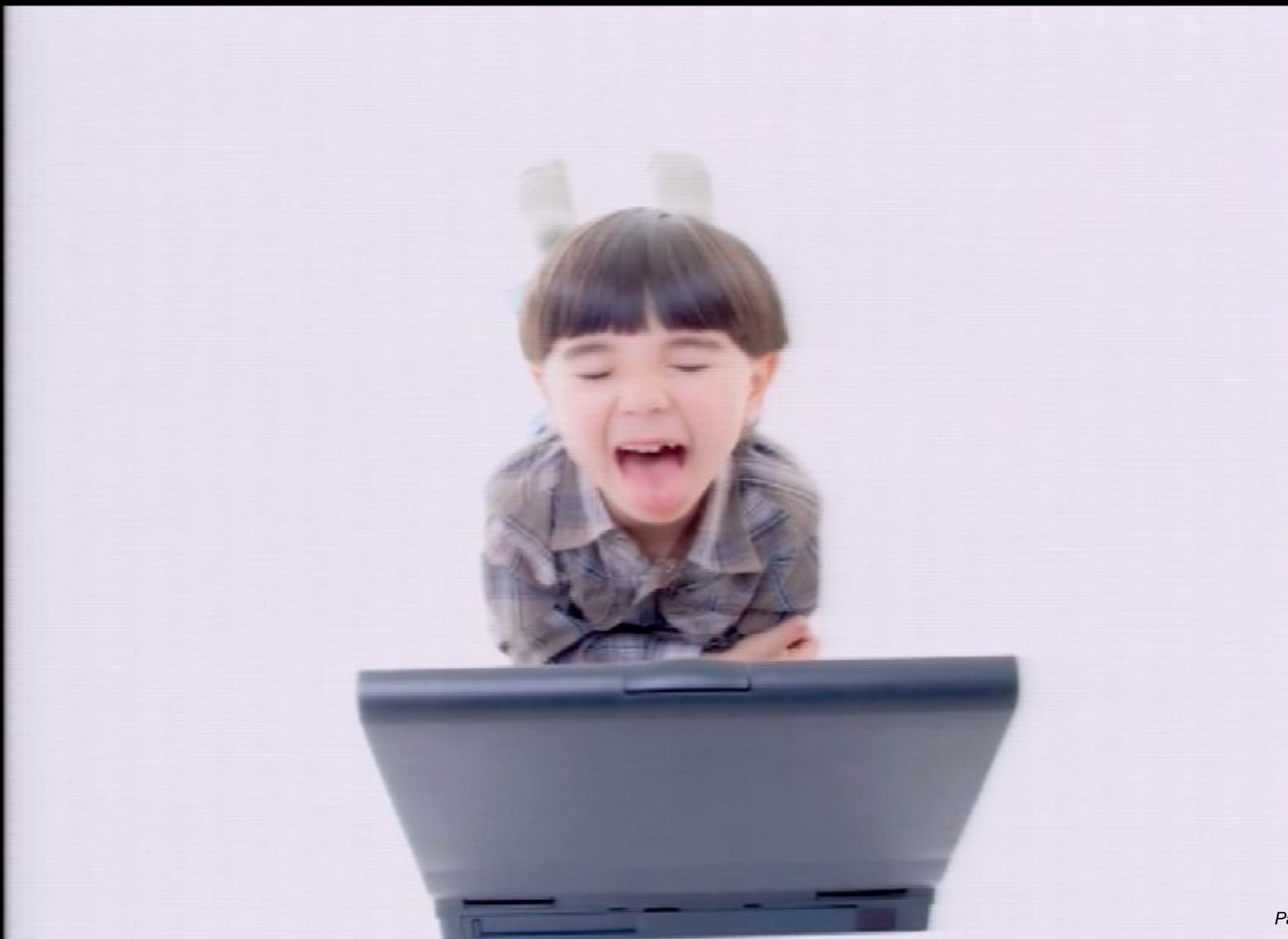


**build** electronics everywhere





build electronics everywhere







build electronics everywhere





**build** electronics everywhere





build electronics everywhere





build electronics everywhere

INSERT  
COINS



build electronics everywhere





build electronics everywhere





build electronics everywhere





**build** electronics everywhere







**build** electronics everywhere





build cool stuff  
lasers



build cool stuff  
lasers



build cool stuff  
lasers



build lasers





build lasers





build lasers





build lasers







build lasers



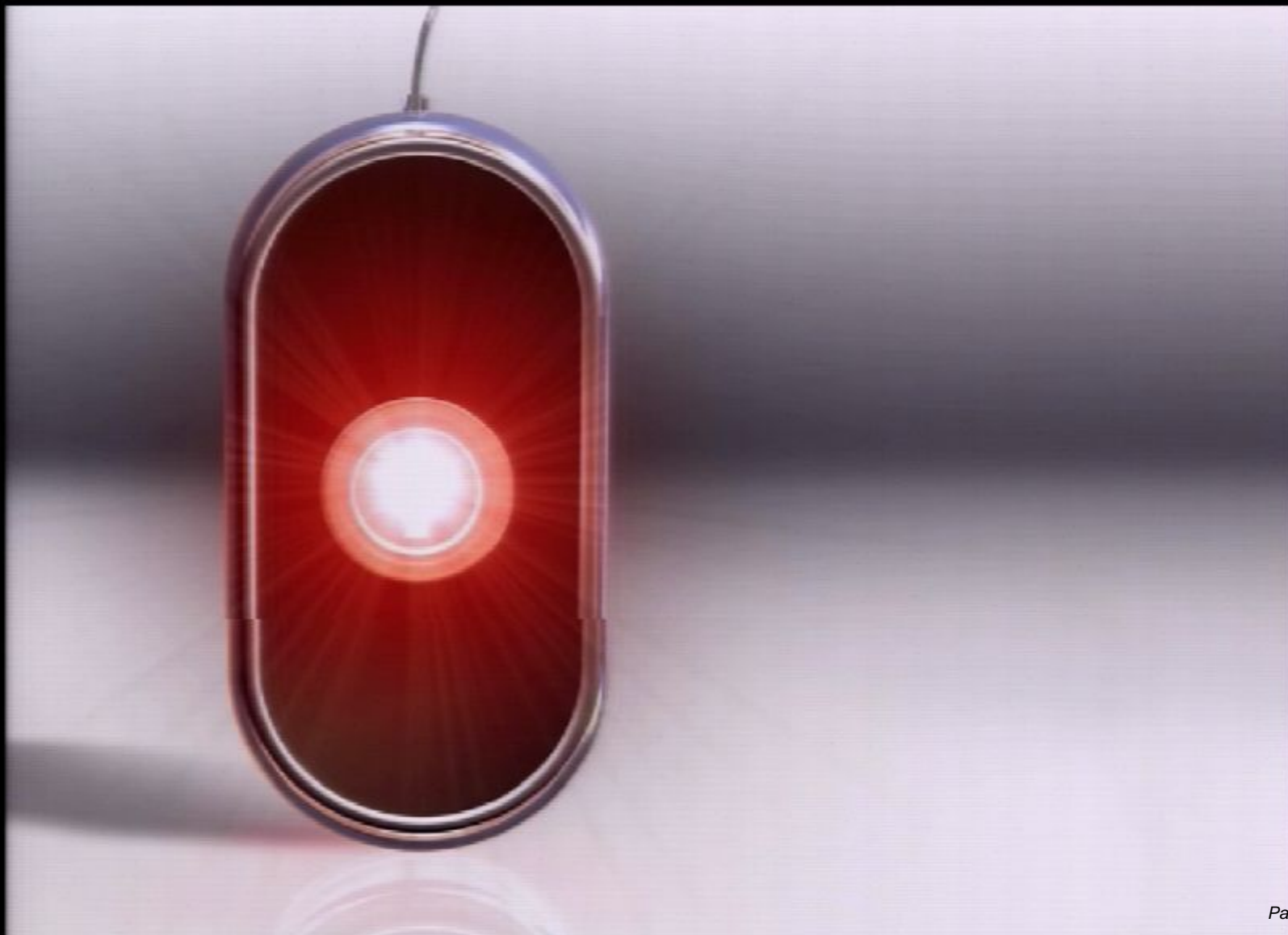


# build lasers





build lasers





build lasers





# build lasers





# build lasers

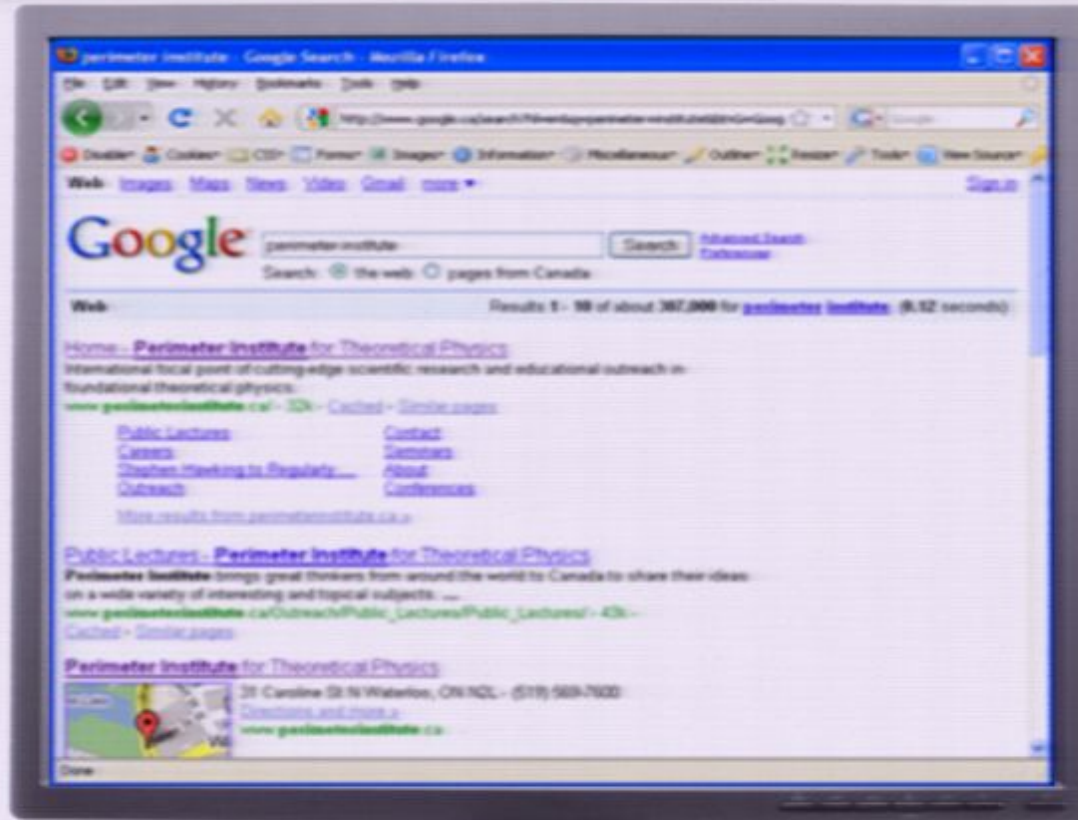




build lasers



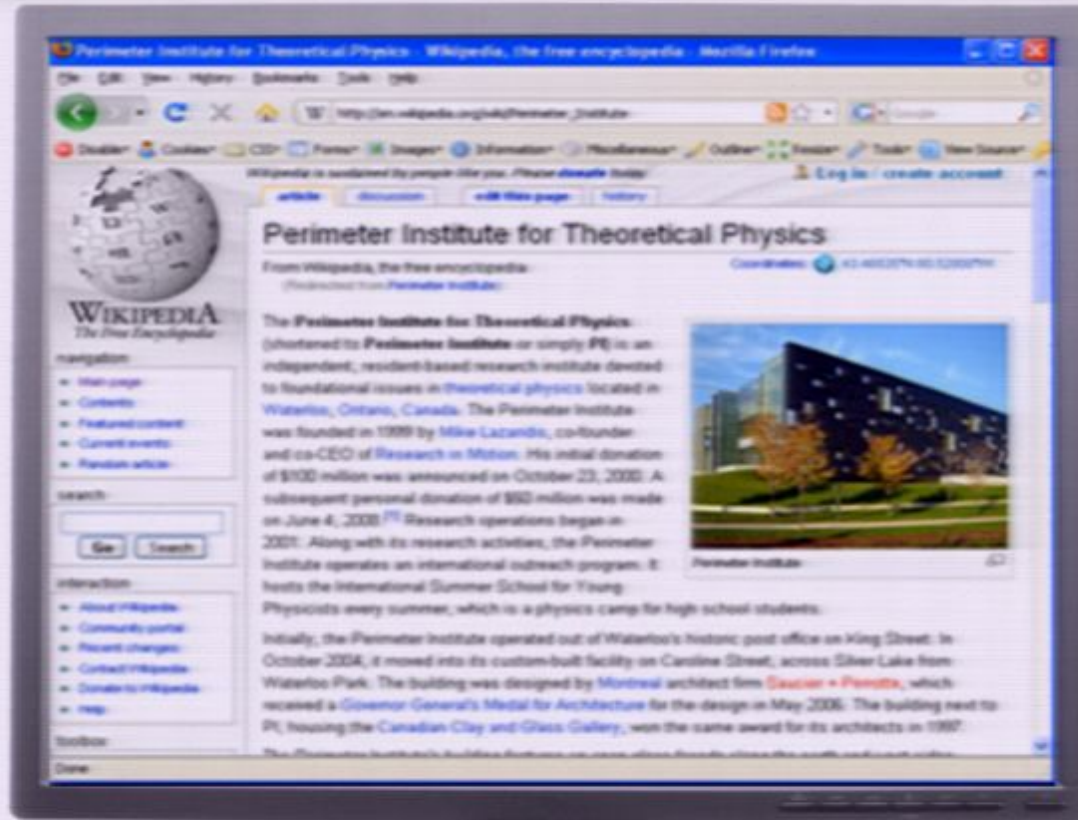
# build internet





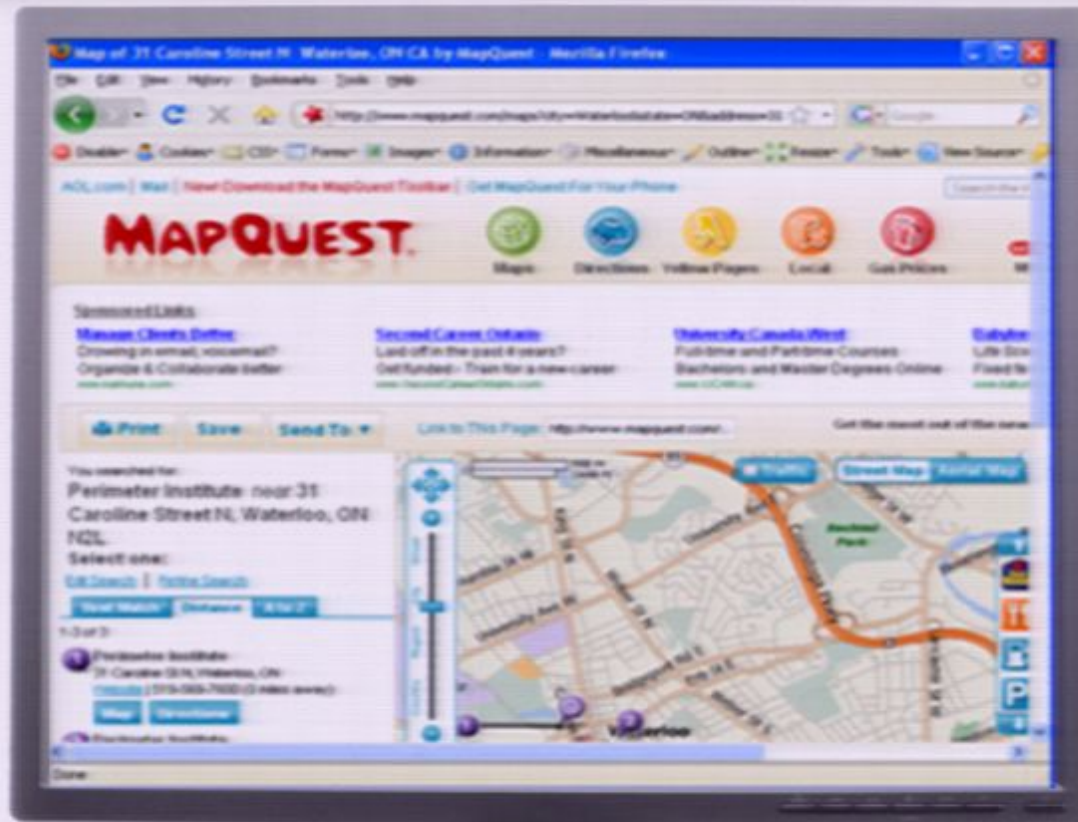


build internet





build internet



WHAT PART OF

$$i\hbar \frac{\partial}{\partial t} \Psi(\vec{r}, t) = \left( -\frac{\hbar^2}{2m} \nabla^2 + V(\vec{r}, t) \right) \Psi(\vec{r}, t)$$

DON'T YOU UNDERSTAND?

UBC  PHYSICS

power of ideas

WHAT PART OF

$$i\hbar \frac{\partial}{\partial t} \Psi(\vec{r}, t) = \left( -\frac{\hbar^2}{2m} \nabla^2 + V(\vec{r}, t) \right) \Psi(\vec{r}, t)$$

DON'T YOU UNDERSTAND?

UBC  PHYSICS



build cool stuff  
more quantum stuff



build cool stuff

more quantum stuff



build cool stuff

more quantum stuff



build cool stuff

more quantum stuff



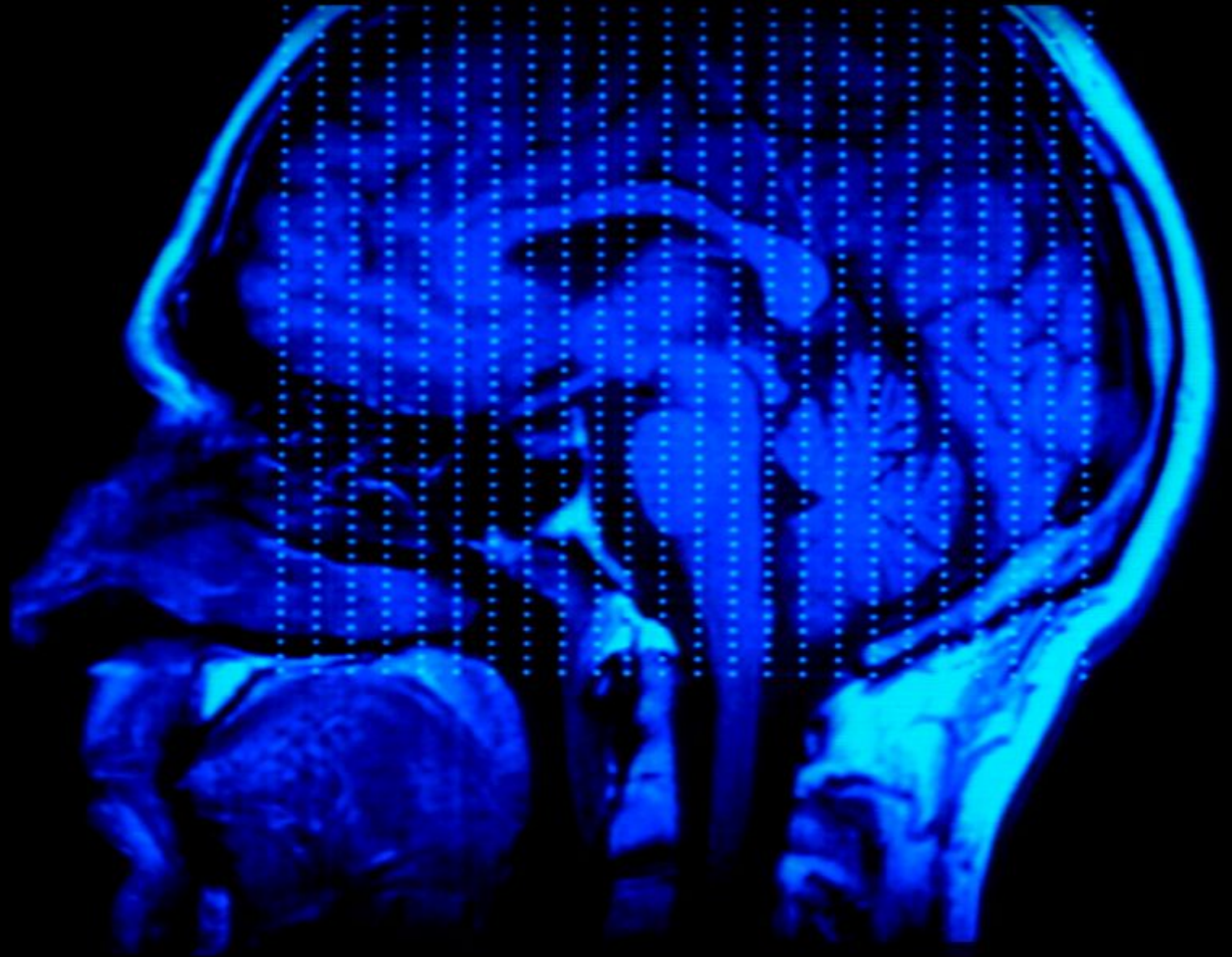


build medical imaging technologies





build medical imaging technologies



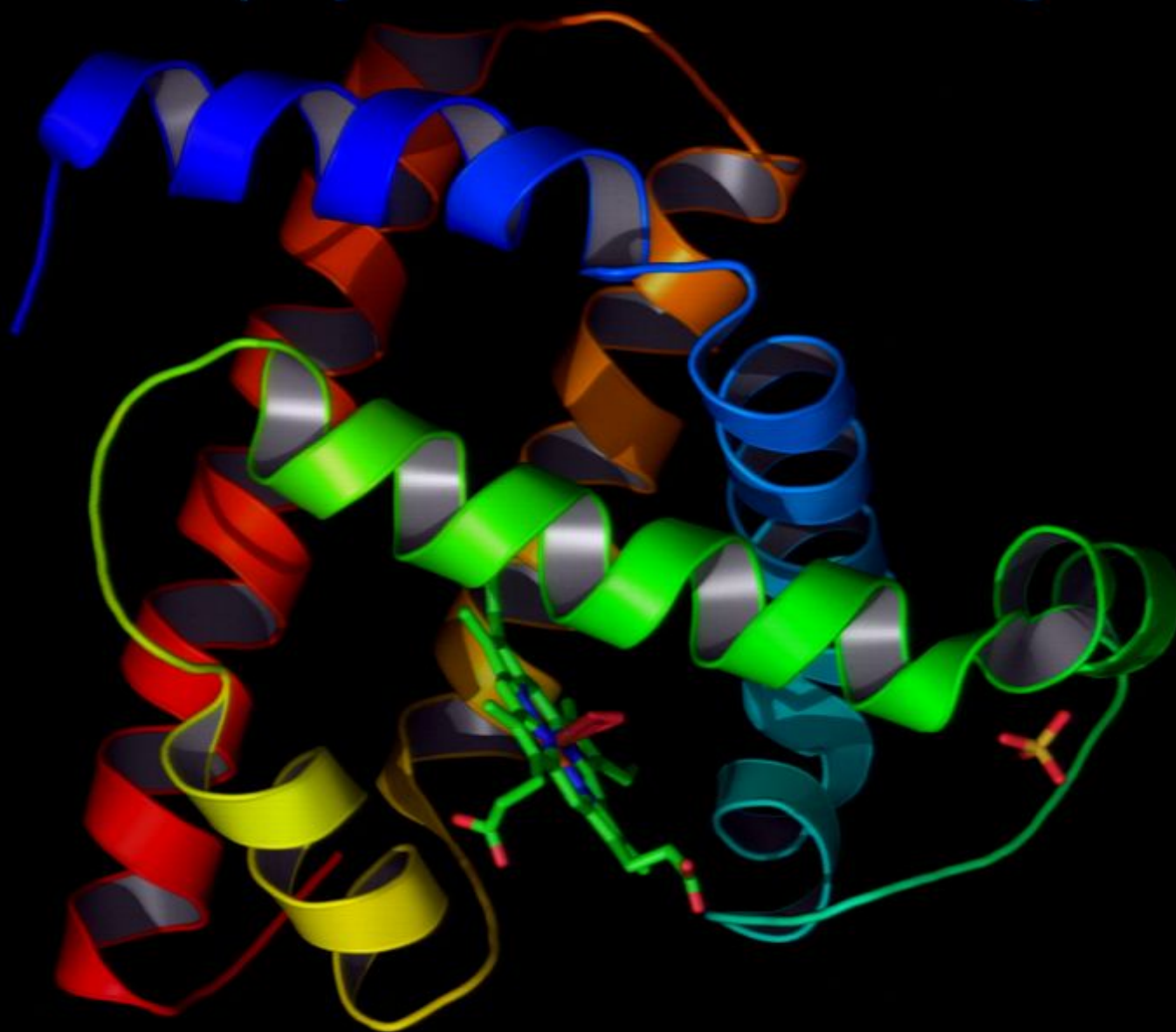


build biophysics understanding



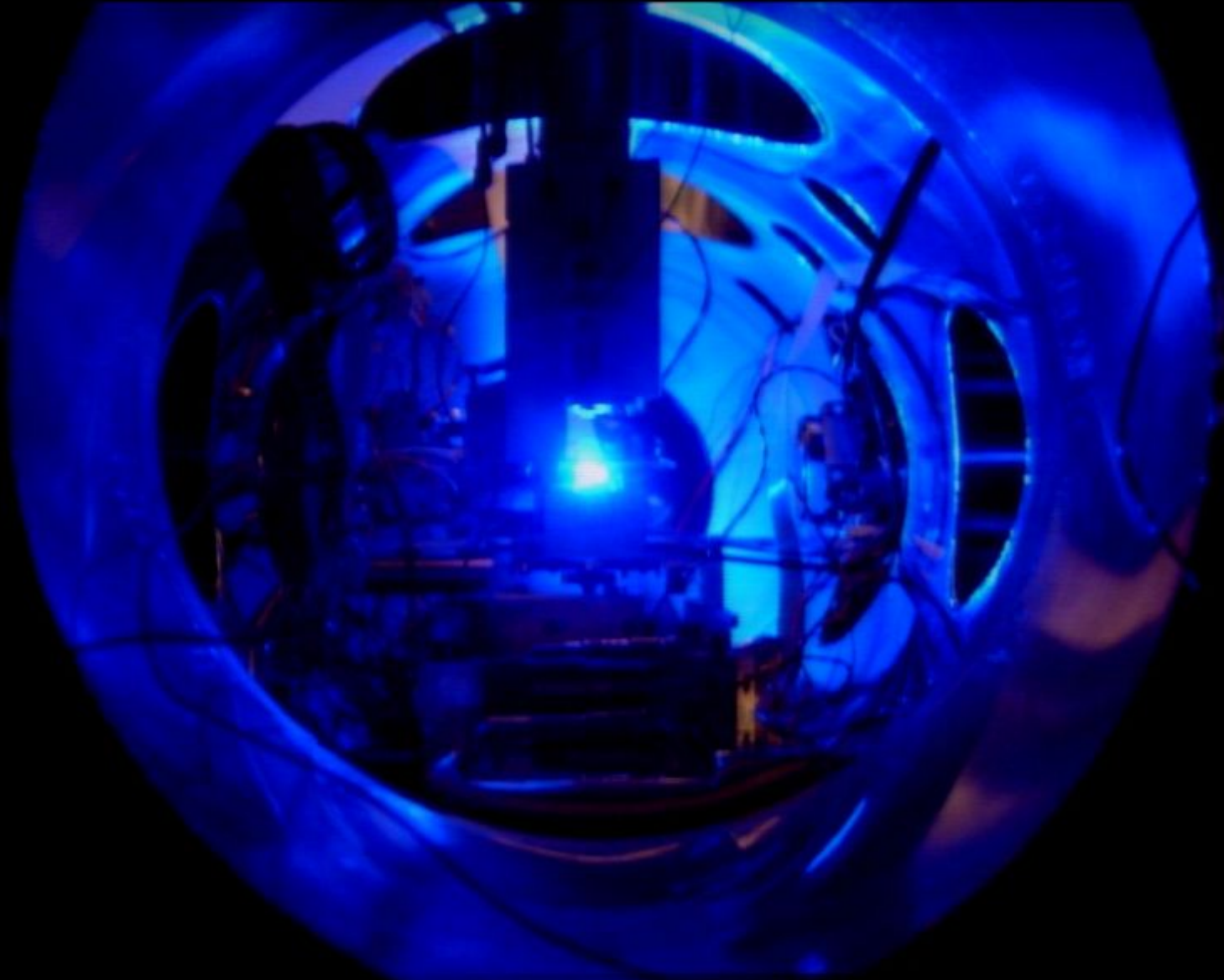


build biophysics understanding





build a nanophysics world





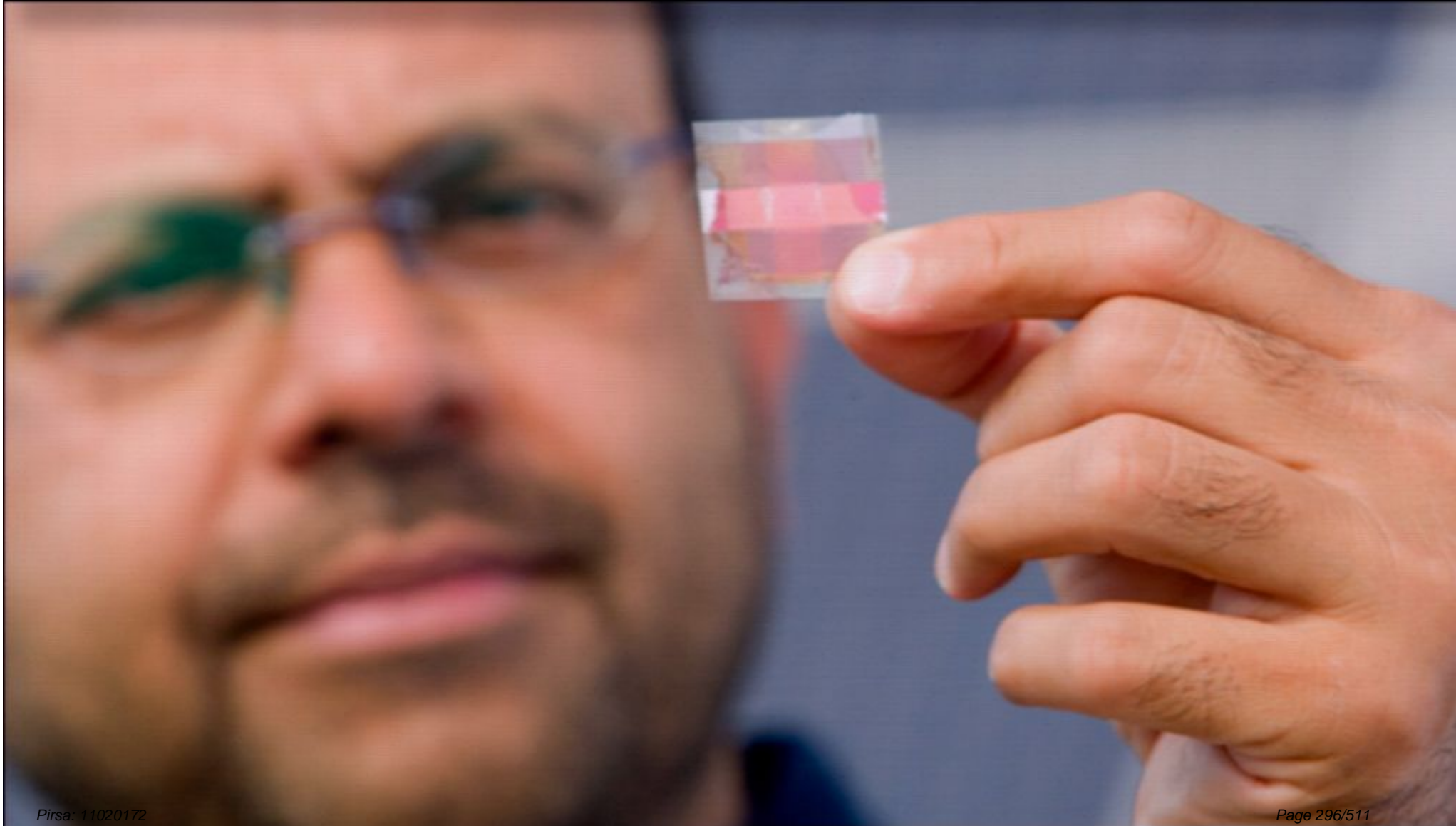
build a nanophysics world



build solar energy technologies



build solar energy technologies

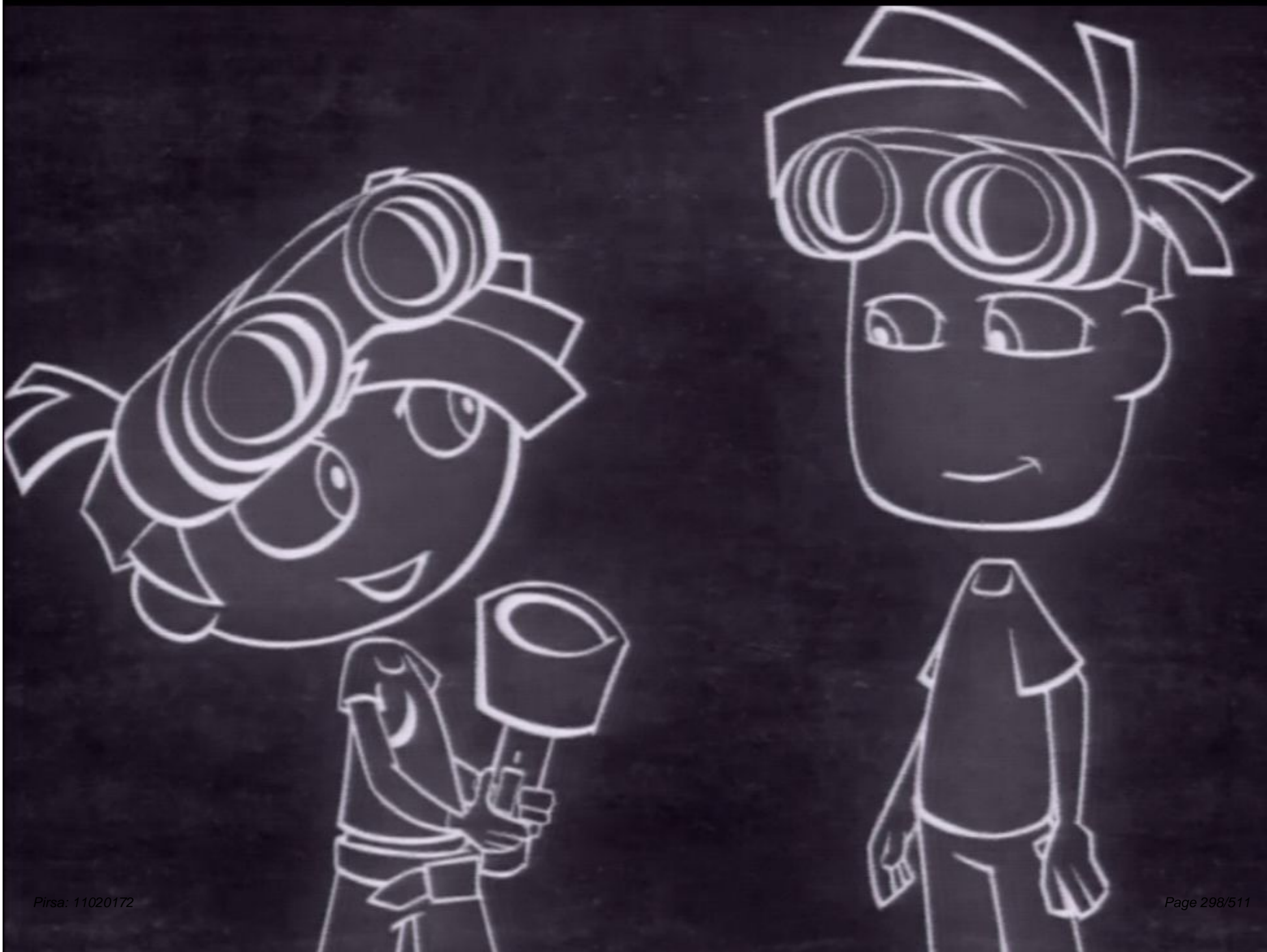


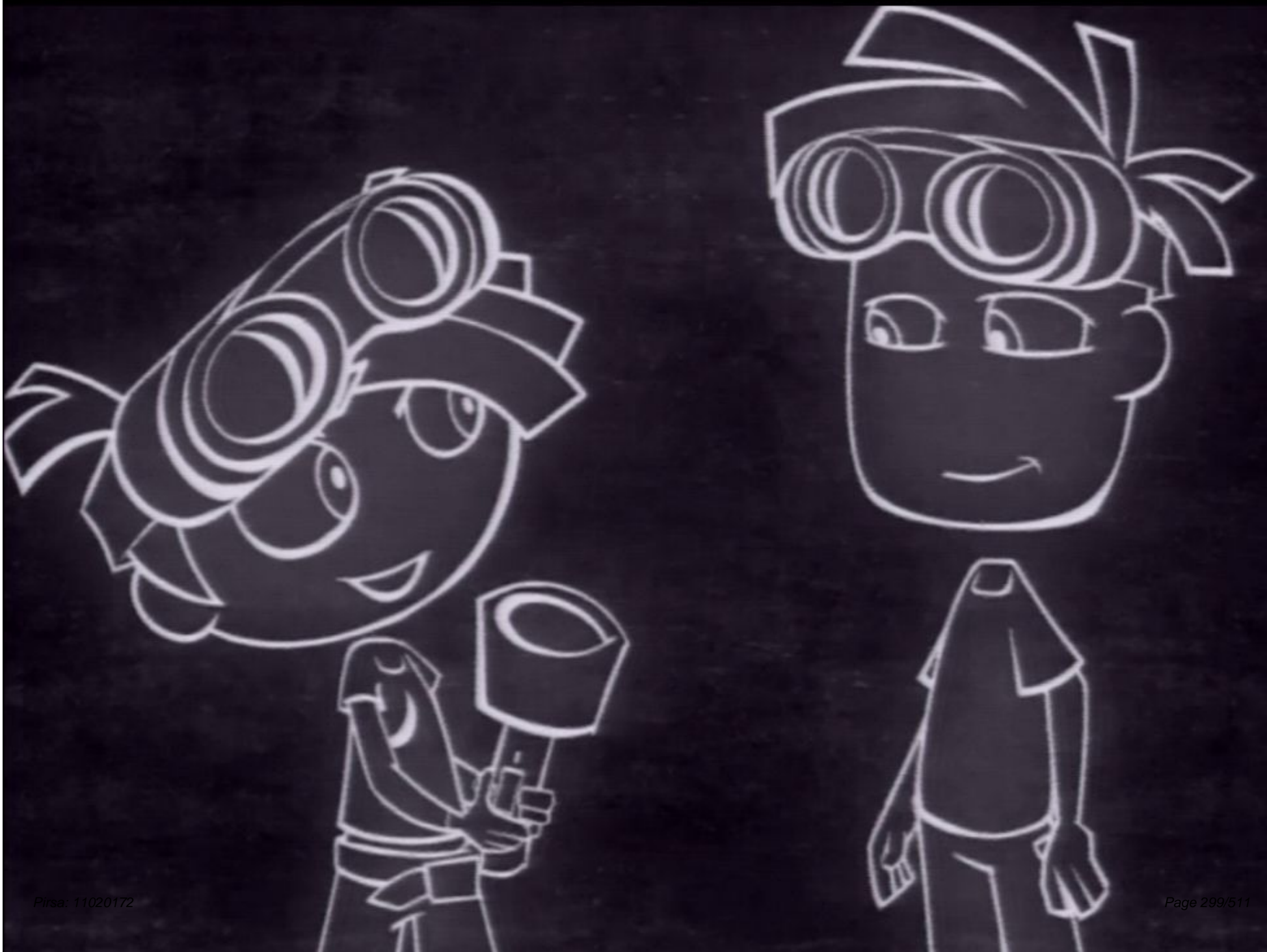




build quantum computers









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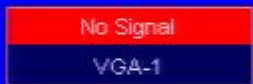
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VGA-1

No Signal  
VGA-1

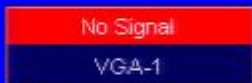
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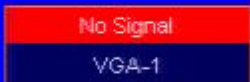
VGA-1

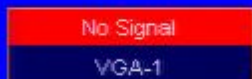
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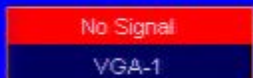


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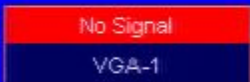
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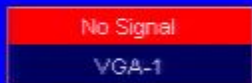
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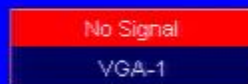


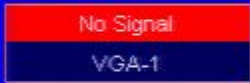


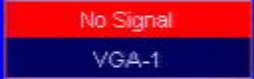












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