

# GRAND CANONICAL ENSEMBLE

## ~THE QUIZ

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*By Arnav and Subham*

# PRELIMS RULES

The prelims will have 12 questions.

- Written Round.
- Answers will be shown at the end.
- The teams with the most questions answered will progress to the next round.
- Star marked questions will serve as tiebreakers.



In Longyearbyen, Norway, the burial of dead bodies has been prohibited since 1950 it was discovered that live strains of the 1918 Spanish flu virus could still be present in the bodies of those who succumbed to the flu.

Why was this decree passed?

2\*

The world's longest continuously running experiment was started in 1927 by Professor Thomas Parnell of the University of Queensland in Brisbane, Australia, to break the misconception related to glass-like substances.

This misconception arose due to the way window panes were installed in old Churches and cathedrals.

The experiment repeats itself roughly once every decade, and has since been housed in a glass jar with a live stream.

The substance has traditionally been used for waterproofing ships, and gives rise to the phrase \_\_\_\_\_ - \_\_\_\_\_, which links the substance to its most apparent characteristic.

What is the substance, and what is the setup of the experiment?

“If none of the works under consideration is found to be of the importance indicated in the first paragraph, the prize money shall be reserved until the following year. If, even then, the prize cannot be awarded, the amount shall be added to the Foundation’s restricted funds.”

This is the official statement in the statutes of the Nobel Foundation stating when a prize would not be awarded.

Following lists the years when the Nobel Prize was not awarded in academic disciplines

Physics: 1916, 1931, 1934, 1940, 1941, 1942

Chemistry: 1916, 1917, 1919, 1924, 1933, 1940, 1941, 1942

Physiology or medicine: 1915, 1916, 1917, 1918, 1921, 1925, 1940, 1941, 1942

Literature: 1914, 1918, 1935, 1940, 1941, 1942, 1943

Economics Prize is the only prize that has been awarded on every single occasion.

What could be the reason for this exception?

4

What is wrong with this scene?



5\*

\_\_\_\_\_ was originally conceived and developed to for automatic information-sharing between scientists in universities and institutes around the world working in collaboration with CERN.

The basic idea was to help develop a global information system.  
What is being talked about here?

Albert Einstein was born on 14th March 1888(14/03/1888) in Ulm, Germany. However, contrary to what one would expect 14th March is not celebrated as “Einstein Day” or something similar along the lines, but as “\_\_-Day”.

FITB.

“First of all, I’m an atheist. The second thing is I know that name was a kind of joke and not a very good one. I think he shouldn’t have done that as it’s so misleading.”

The speaker refers to a Nobel prize theoretical physicist's book that popularized the term. What is being talked about here?

8\*

In 1968, Dr. Spencer Silver, a scientist at 3M in the United States, attempted to develop a super-strong adhesive. Instead, he accidentally created a "low-tack", reusable, pressure-sensitive adhesive.

For five years, Silver promoted his "solution without a problem" within 3M both informally and through seminars, but failed to gain adherents.

In 1974, a colleague who had attended one of his seminars, Art Fry, came up with the idea of using the adhesive to anchor his bookmark in his hymn book.

This revolutionary idea sparked a worldwide household product. Identify it.

9

Why doesn't the coin fall off? (Give a complete explanation)



10\*

“Tiny charged particles act as nuclei for condensation of polar molecules like water and alcohol. Water/alcohol vapors being polar are attracted towards the nuclei where they coalesce and condense forming \_\_\_\_\_”

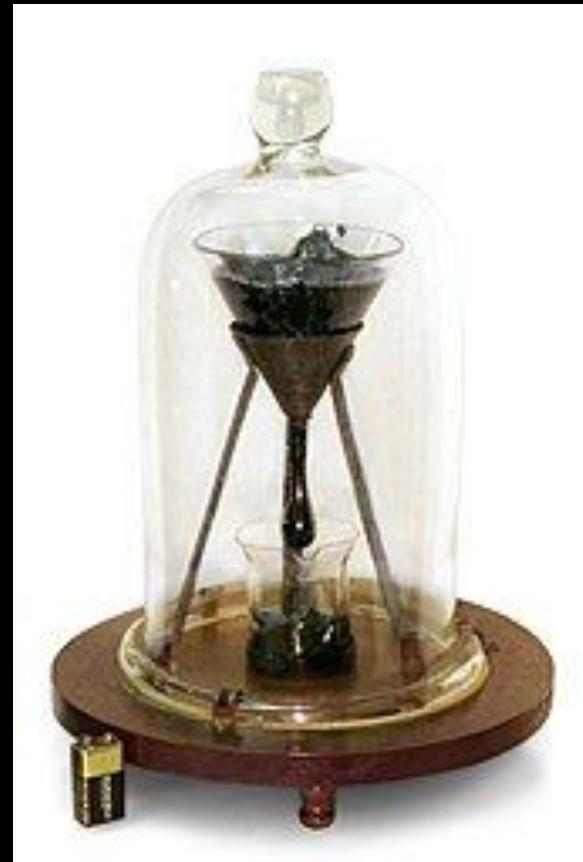
This principle is used in an experimental device that has been used in the forefront of research ever since, leading to several Nobel prizes.  
Identify the device and its contribution to Nobel-worthy discoveries.

1. The permafrost prevents the body from decomposing

---

# 2. The pitch drop experiment

---



3. Economics Prize was introduced in 1968 after the world wars.

---

4. the only forces acting upon Bullock and Clooney should be the tensions of the cables, and these forces should pull them towards the station (making them bounce at first and then becoming zero as the cables retract). In the movie, however, there appears to be another force pulling from Clooney, keeping the cables straight and threatening to break them.

## 5. World Wide Web



# 6. International π-Day



# 7. The God Particle/Higgs Boson



## 8. Post-Its

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9. Hanger provides necessary centripetal force to the coin throughout the motion maintaining the circular trajectory.

---

# 10. Cloud Chambers- Discovery of charged subatomic particles

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# RULES

This quiz will have 5 rounds.

- IB Forward → 9 Questions
- Booster Connect → 4 Questions
- ID the Patent → 5 Questions
- Booster → 3 Questions
- IB Reverse → 10 Questions

Points System and Rules will be specified prior to every round.

Quizmasters' decision is final.

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# ROUND 1

# IB FORWARD

- Infinite Bounce (+10/0) -

First question directed to Team 1  
-bouncing forwards.

10 points for correct answer, no negatives  
- Feel free to take guesses.

- Directed to the team following the team which answered previously.

- Pounce (+10/-5) -

Pounce should have the full answer.  
No part pouncing, unless otherwise specified.

10 points for correct answer,  
-5 for wrong/incomplete answer.

---

John Bardeen's second Nobel Prize in Physics in 1972 for the development of superconductor theory made him a first in something. In 2022, K. Barry Sharpless became only the third person ever to achieve this feat.

What is being talked about here?

# SAFETY SLIDE



Double Laureates in the same academic category.

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Van Goethe's poems praising Luke Howard for his achievements.

*"To find yourself in the infinite,  
You must distinguish and then combine;  
Therefore my winged song thanks  
The man who distinguished cloud from cloud."*

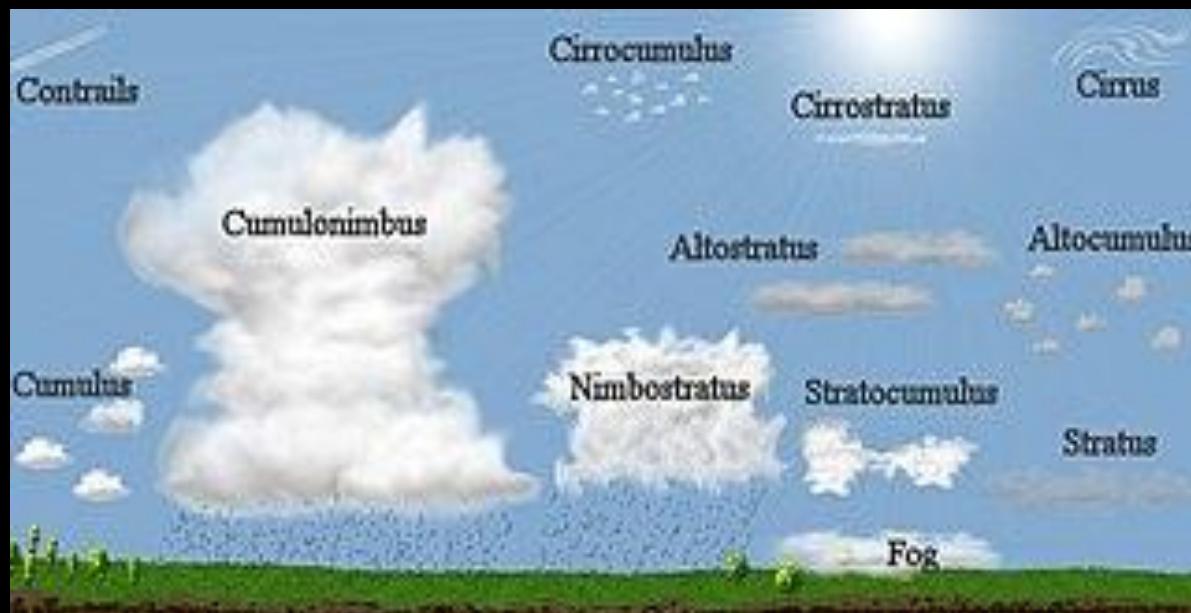
*"bestowing form on the formless, and a system of  
ordered change in a boundless world"*

What was Luke Howard's contribution being praised about here?

# SAFETY SLIDE

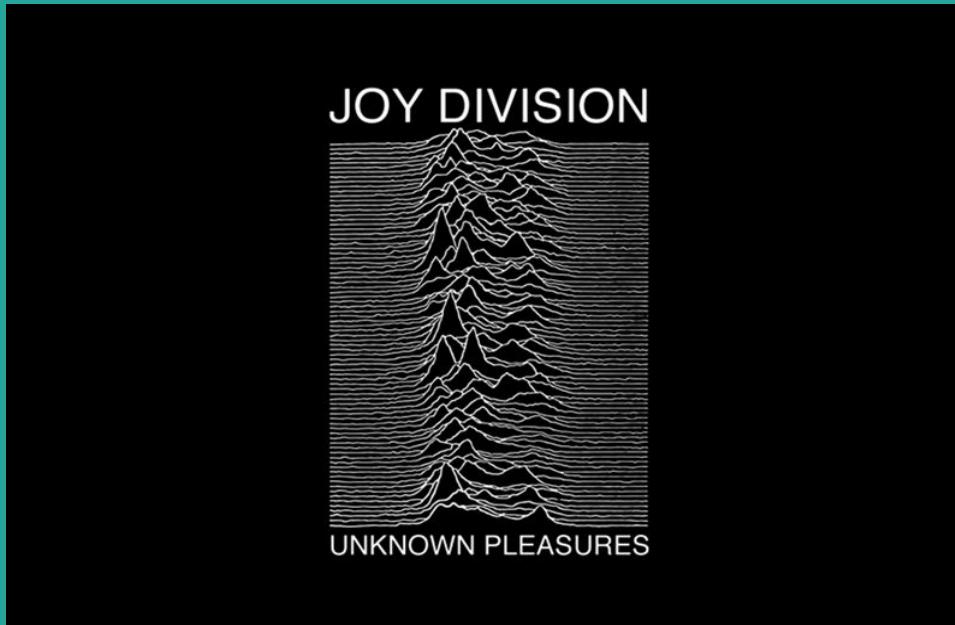


# Classification system for clouds



3

The album cover for Unknown pleasure by Joy Division was inspired by the first signal data from a \_\_\_\_\_(6). Martin Hannett used looping technology for the album which involves **pulsating** short sections to create ostinato patterns. FITB.

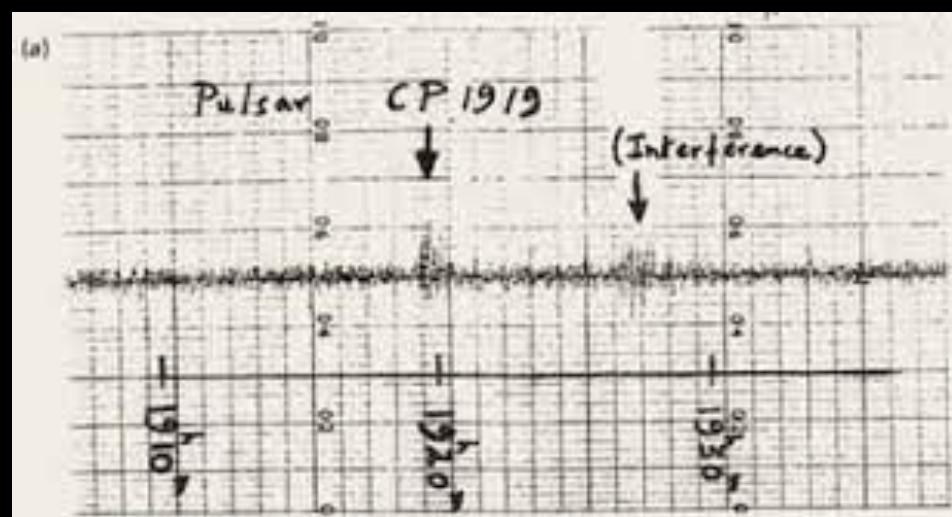


# SAFETY SLIDE



# Pulsar

## Jocelyn Bell's Pulsar data.



4

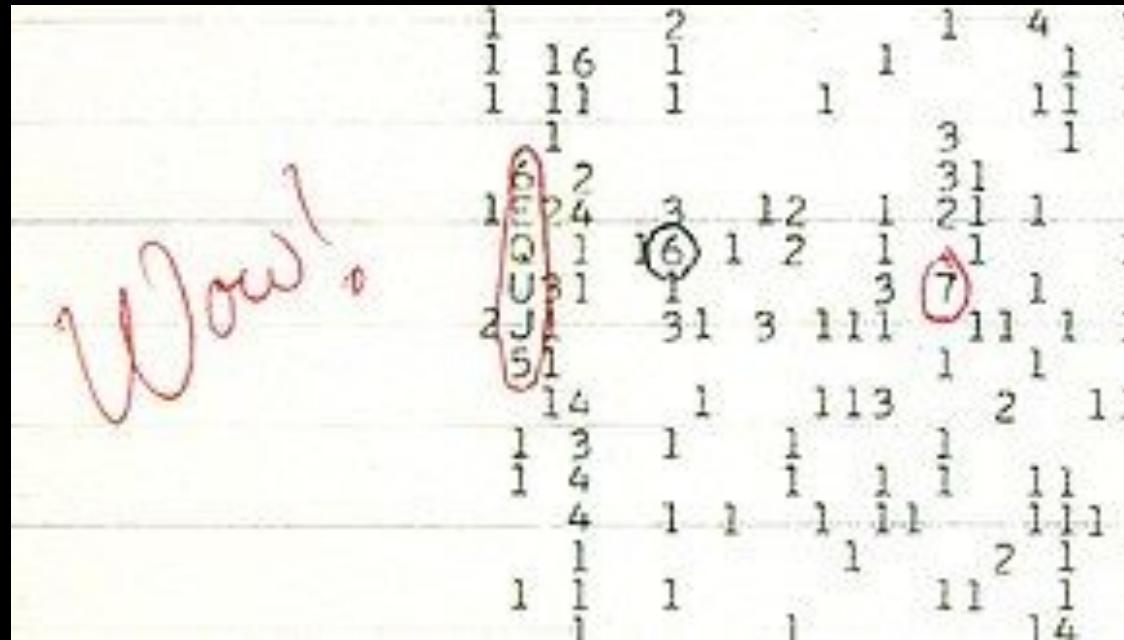
What is being referred to in this music video?



# SAFETY SLIDE



# The ‘WOW’ signal



5

The 6eV mass particle was named “Upsilon” by a team at Fermilab led by Leon Lederman that discovered it in January 1976, however, the group discovered that this particle actually did not exist as the data was not convincing. The result would not have been published as per currently accepted standards. The “discovery” was panned as \_\_\_\_\_ to signify the false alarm.

FITB and give the widely accepted standard in research that would have prevented this result from being published.

# SAFETY SLIDE



# Oops-Leon

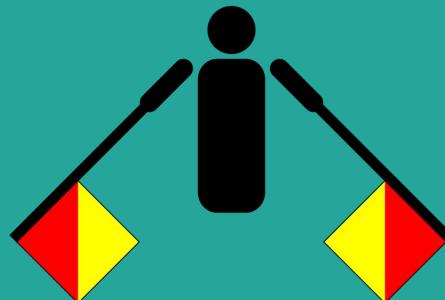
## 6 $\sigma$ rule



6

The \_\_\_\_\_ owes its existence to the Nuclear Disarmament Campaign. The \_\_\_\_\_ was designed by Gerald Holtom for the British Campaign for Nuclear Disarmament in 1958. He used the semaphore signals for ‘N’ and ‘D’ standing for Nuclear Disarmament for the design.

FITB.

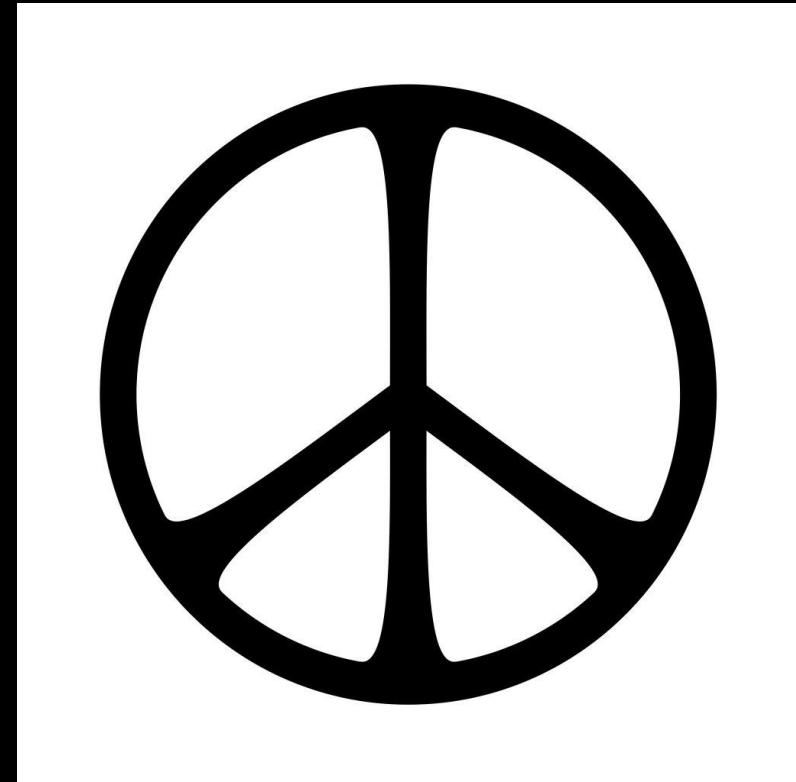


# SAFETY SLIDE



# Peace sign

—



In 1975, Jack Hetherington wanted to publish some of his research results in the scientific journal *Physical Review Letters*. A colleague pointed out that Hetherington had used the first person plural in his text, and that the journal would reject this form on submissions with a sole author. Instead of re-typing the article, he turned to Chester, a close companion, to be the co-author.

Since Chester only went by his first name, Jack decided to include Chester's formal designation as well and is thus stated as **F.D.C. Willard**.

Chester's collaboration shot the paper into fame, and in 2014 the APS stated that all papers published by Chester-like researchers would be made open source. What makes Chester so special?

# SAFETY SLIDE



# APS Announces New Open Access Initiative

April 1, 2014



APS is proud to announce a new open access initiative designed to further extend the benefits of open access to a broader set of authors. The new policy, effective today, makes all papers authored by cats freely available. This open-minded update is a natural extension of APS's leadership in both open access and pet publishing. As early as 1975, APS began publishing papers with feline authors, most notably the contribution by one [F. D. C. Willard](#) [J. H. Hetherington and F. D. C. Willard, Two-, Three-, and Four-Atom Exchange Effects in bcc  $^3\text{He}$ , *Phys. Rev. Lett.* **35**, 1442 (1975)]. Going forward, only single author papers will be considered. APS hopes to evaluate allowing publication by canine authors in the near future. Not since Schrödinger has there been an opportunity like this for cats in physics.

Chester is a cat.

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Around July 1945, Kodak received numerous complaints from its customers about the appearance of dark spots on unopened X-ray films that damaged the product. This was strange because Kodak had taken necessary steps to prevent its X-ray films from getting exposed to radiation (primarily alpha-particles) from a substance in common use in the US during the second World War.

Why did Kodak have to take measures for radiation protection in the first place? Give the substance being talked about here.

# SAFETY SLIDE



# Radium Paint



The Mars Climate Orbiter was launched by NASA on December 1998, but they soon lost contact with the probe in September 1999. An investigation revealed the cause of failure to be a conversion error in a sensor provided by the US aerospace company Lockheed Martin.

What was the error?

# SAFETY SLIDE



The software that calculated the total impulse produced by thruster firings produced results in pound-force seconds, instead of Newton-force seconds

# ROUND 2

## BOOSTER CONNECT

- Pounce Only(+10/-5) -

Pounce should have the full answer.

No part pouncing, unless otherwise specified.

10 points for correct answer.

\*Bonus will only be awarded if the last question is answered correctly.

- All the answers contribute as clues for the last question.

Bonus points will be awarded at the end of the round as follows:-

No. of Questions answered(excluding the last question)x10

---

Two-thirds of the 2020 Nobel Prize in Physics was awarded jointly to Andrea GHez and Reinhard Genzel,

*“for the discovery of a supermassive compact object at the center of our galaxy”.*

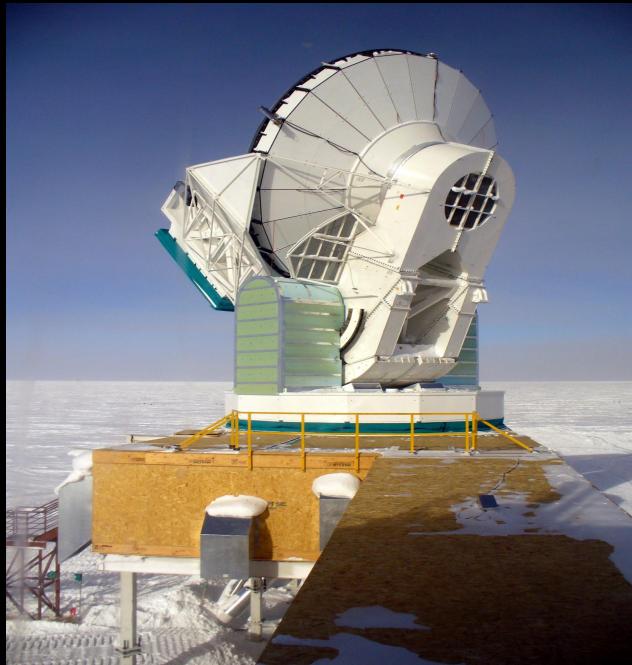
Both of their works include working with X which is famously known for producing a first-of-its-kind image in 2019. On 12 May 2022, an image of Sagittarius A\* was released making it only the second such image ever produced.

ID X.

# SAFETY SLIDE



# Event Horizon Telescope(EHT)



Ultraviolet(UV) radiation is further divided into UVA, UVB, and UVC based on their wavelengths. UVB having just the right energy, is the primary cause of skin cancer in humans.

The Dobson spectrometer operates by measuring the relative intensity of the UVB radiation that reaches the Earth and comparing it to that of UVA radiation at ground level.

The Dobson spectrometer is thus used for the indirect measurement of \_\_\_\_\_(5) in the atmosphere.

FITB

# SAFETY SLIDE



# Ozone



ICESat-(Ice, Cloud, and land Elevation Satellite) provided loads of data on X, cloud, and aerosol heights, as well as land topography and vegetation characteristics throughout its duration of operation. Data on X has been often linked to climate change and used by climate change advocates to “alarm” people about its consequences.

ID X.

# SAFETY SLIDE



# Ice sheet mass balance



The 250th anniversary of the first documented crossing of the \_\_\_\_\_ is being marked with a new book that traces its history via 100 artifacts from around the world.

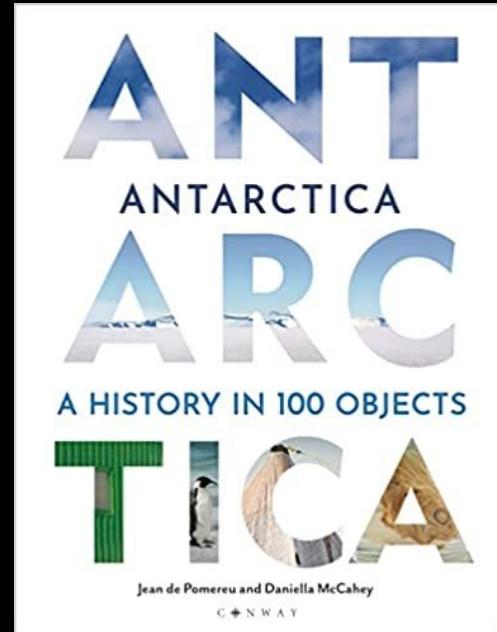
\*Images in the answers to the previous slides were some of the objects used in the book.

FITB.

# SAFETY SLIDE



# Antarctica



# ROUND 3

## ID THE PATENT

- This is a written round (+10,0)
  - Five questions
  - Full points will only be awarded for stating the *exact* purpose/motive of the patent.

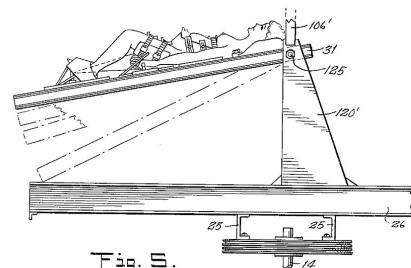
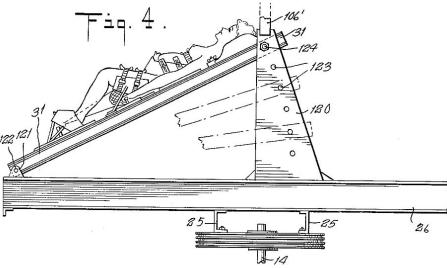


14.

Nov. 9, 1965

G. B. BLONSKY ET AL  
APPARATUS FOR FACILITATING THE BIRTH OF  
A CHILD BY CENTRIFUGAL FORCE

3,216,423  
Filed Jan. 15, 1963  
4 Sheets-Sheet 4

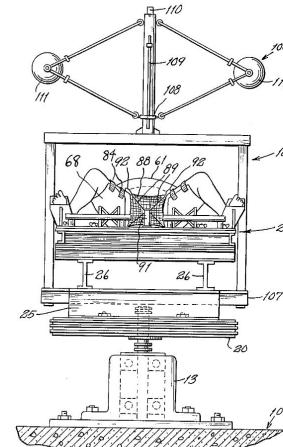


INVENTORS  
GEORGE B. BLONSKY  
BY CHARLOTTE B. BLONSKY  
*Cony, Hart & Sample*  
ATTORNEYS

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GEORGE B. BLONSKY  
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*Cony, Hart & Sample*  
ATTORNEYS

15

U.S. Patent Dec. 2, 1986 Sheet 1 of 6 4,625,468

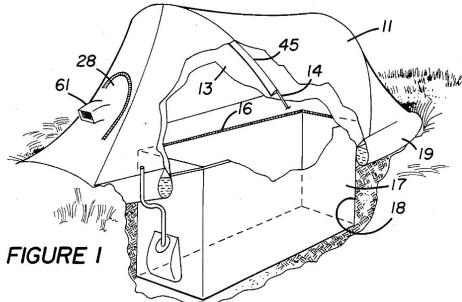


FIGURE 1

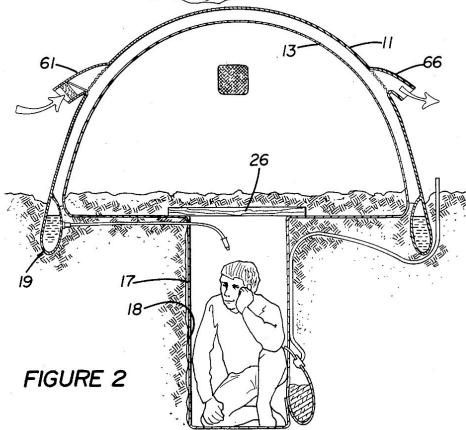


FIGURE 2

U.S. Patent Dec. 2, 1986 Sheet 2 of 6 4,625,468

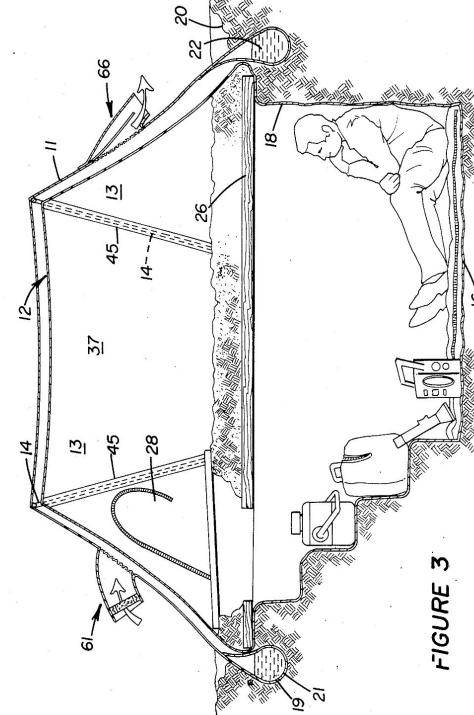
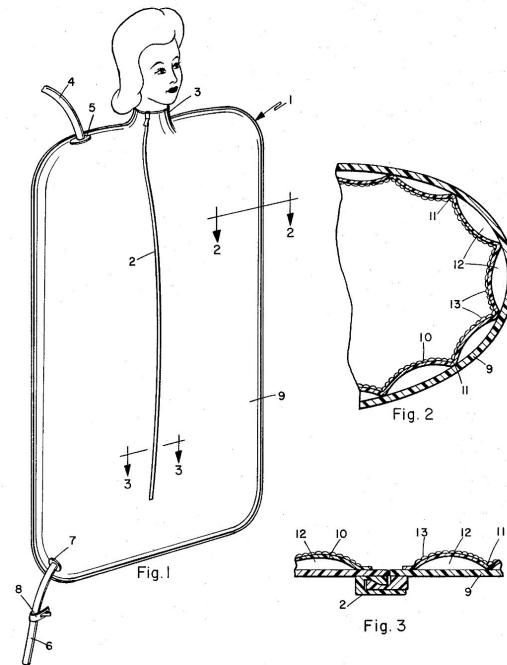


FIGURE 3

PATENTED JUL 18 1972

3,677,263

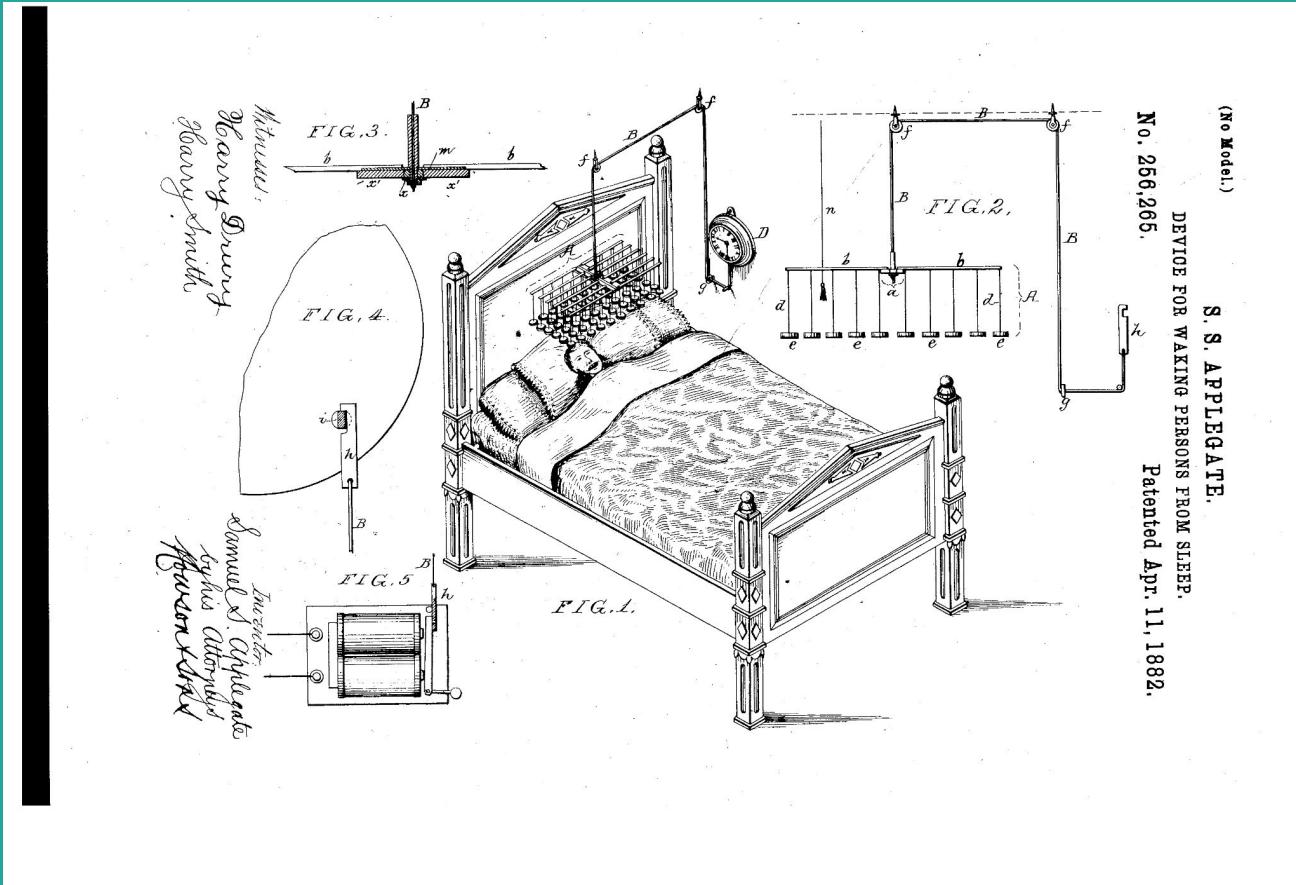
16.



INVENTOR.  
FRANCES MIGNON ALLEN  
BY *Knox & Knox*

Explain how it works.

17.



18.

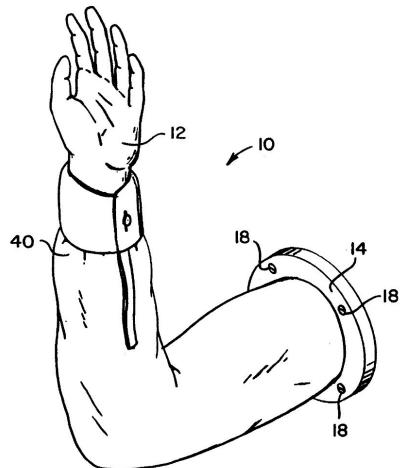


FIG. 1

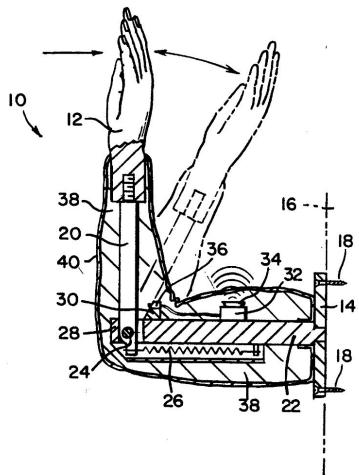


FIG. 4

U.S. Patent

Oct. 18, 1994

Sheet 1 of 3

5,356,330

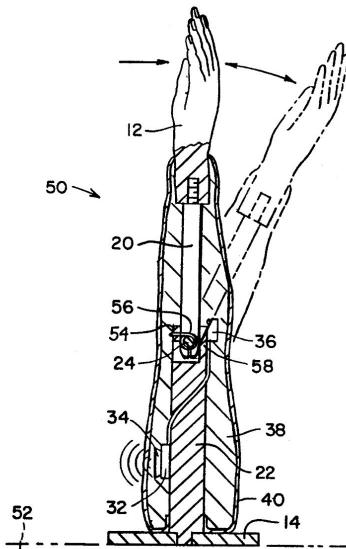


FIG. 5

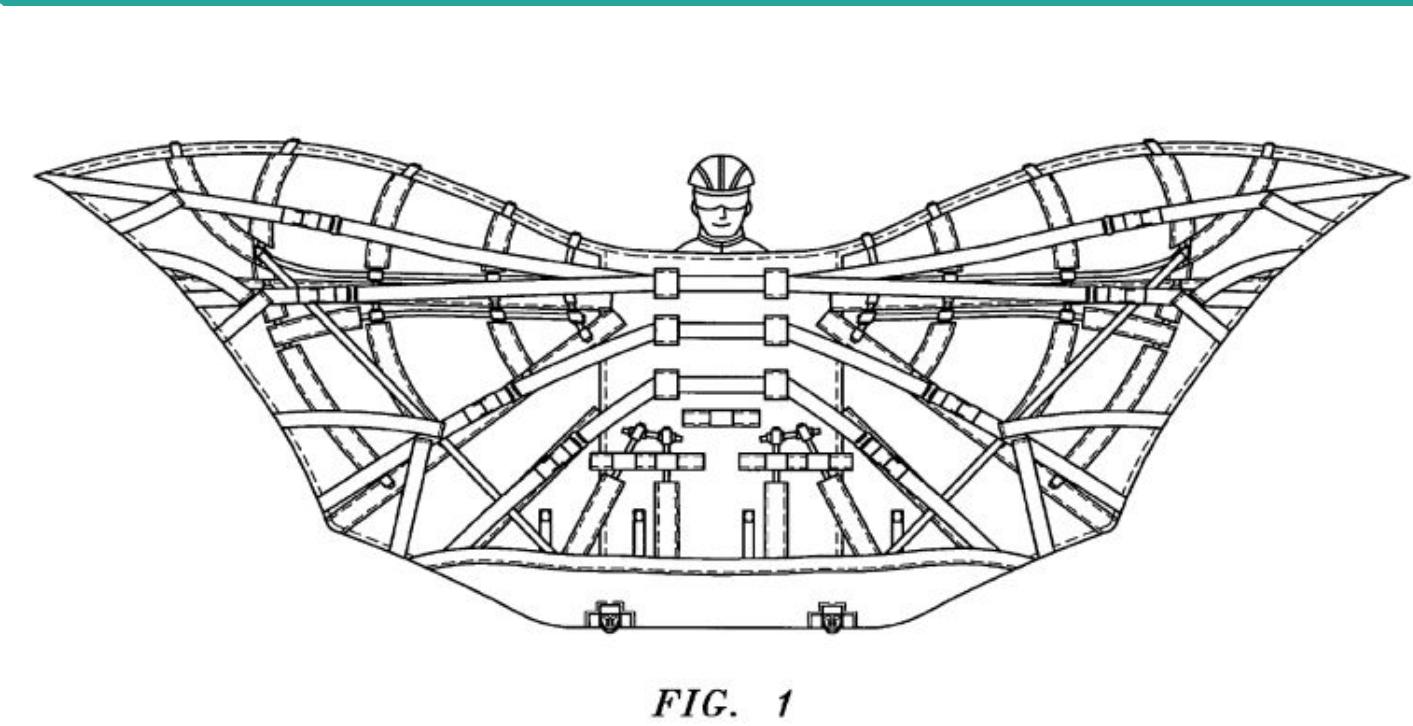
U.S. Patent

Oct. 18, 1994

Sheet 3 of 3

5,356,330

19



# SAFETY SLIDE



14.Apparatus for facilitating  
the birth of a child via  
centrifugal force

---

# 15.Temporary/portable nuclear fallout shelter

---

# 16. Portable bathing capsule

---

17. Drops the frame of blocks  
onto the person's face

---

# 18. Machine for simulating a “high five”

---

# 19. Human powered flying suit

---

# ROUND 4

## BOOSTER

- Pounce Only(+10/0) -

Pounce should have the full answer.

No part pouncing, unless otherwise specified.

10 points for correct answer.

\*Bonus will only be awarded if the last question is answered correctly.

- The theme contributes as clues for the last question.

Bonus points will be awarded at the end of the round as follows:-

No. of Questions answered(excluding the last question)x10

---

20.

On 18th May 2003, voters in Belgium went to the polls. The voting was done digitally(memory used was in **binary**) on computers in many municipalities. Election officers detected a problem with results from the municipality of Schaerbeek when the counting was being done, Maria Vindevogal, with **4610** votes, had received more votes than was possible. After a manual recount, they found that Maria had been cast only **514** votes making the initial tally an excess of **4096** votes. After running multiple checks, the computer experts concluded that some soft error(due to reasons unknown) had to be at the heart of the problem.

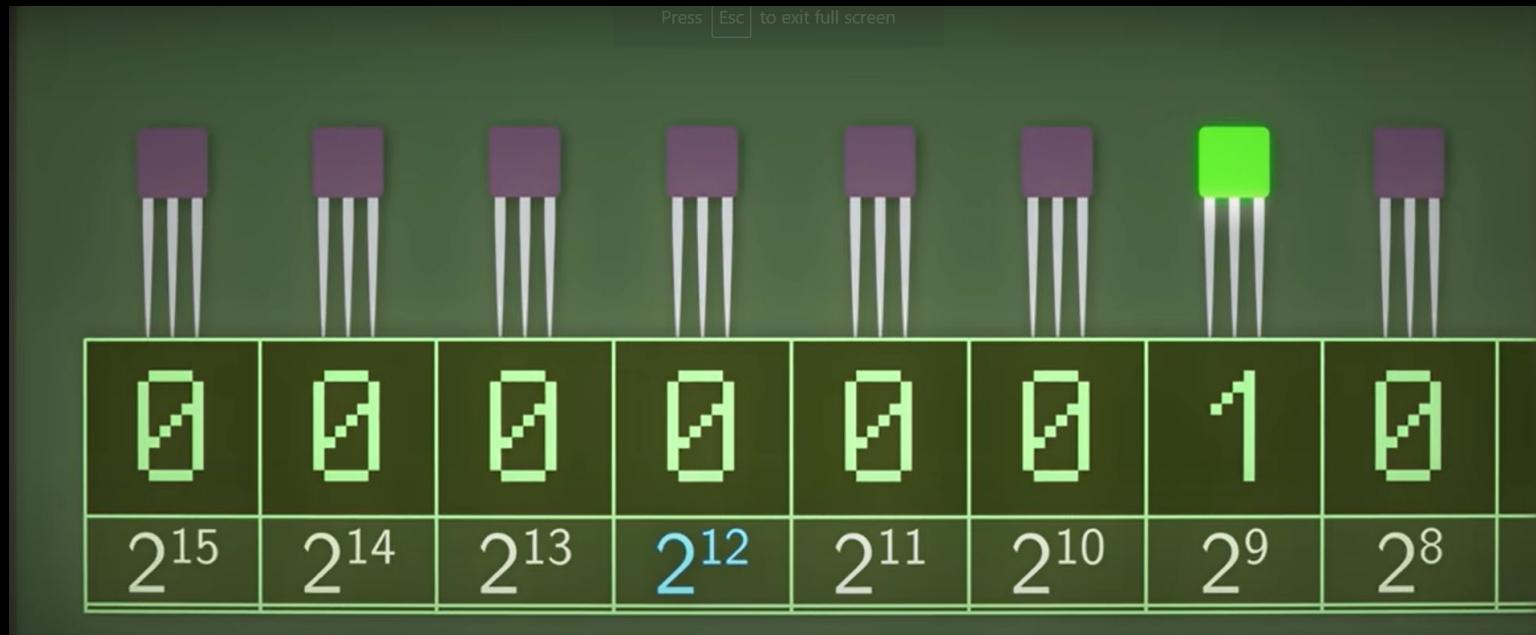
What soft error caused the miscount?

# SAFETY SLIDE



# Bit-flip

converting 0 in 13th bit in the memory to a 1



**Around the 1970s**, Intel reported strange errors in their DRAMs. 1s would spontaneously flip to 0s with no apparent cause. The problem was found to be in the ceramic packaging of the chips which happened to have radioactive elements. 1s and 0s in the hardware represented by the absence and presence of electrons respectively were vulnerable to ionising radiation and thus alpha particles from radioactive elements knocked out electrons switching 0s to 1s. This problem however did not exist in the early days of digital computers (primarily because of their **bulky design**), the problem is very closely related to an important revolution in the digital electronics industry.

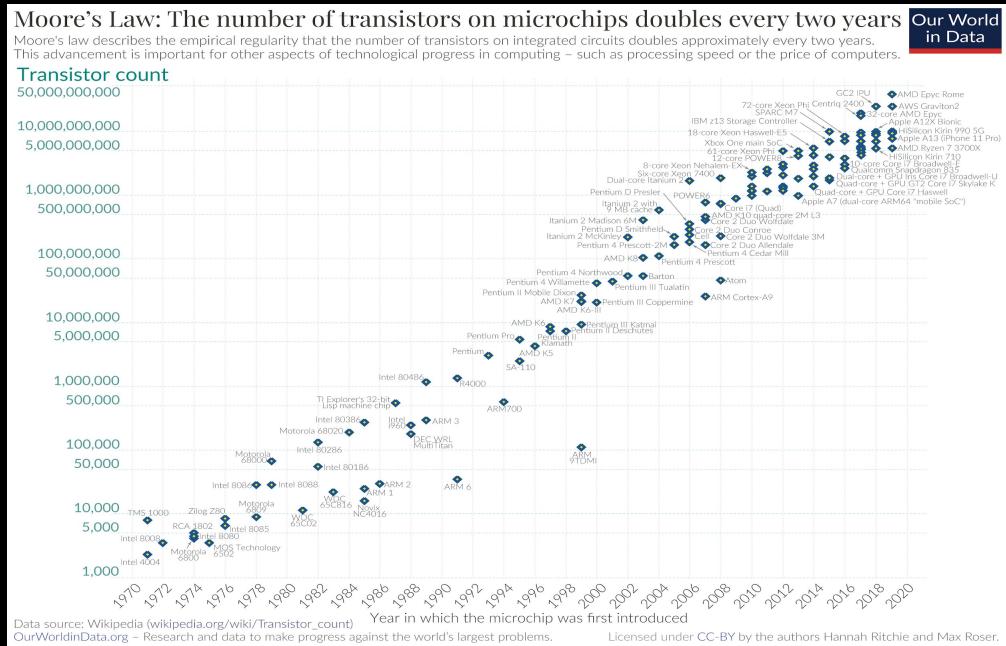
What revolution is being talked about here?

# SAFETY SLIDE



# Mini-transistor revolution

Transistors started getting smaller therefore becoming more vulnerable to radiation



Subsequent efforts were made to eliminate radioactive elements from the packaging materials to prevent bit-flipping which were successful. However, numerous yet rare software glitches similar to that of the Belgian 2003 elections have ever since been reported, for example, malfunction in airplane computers, glitches in digital games resulting in unusual high-scores, etc.

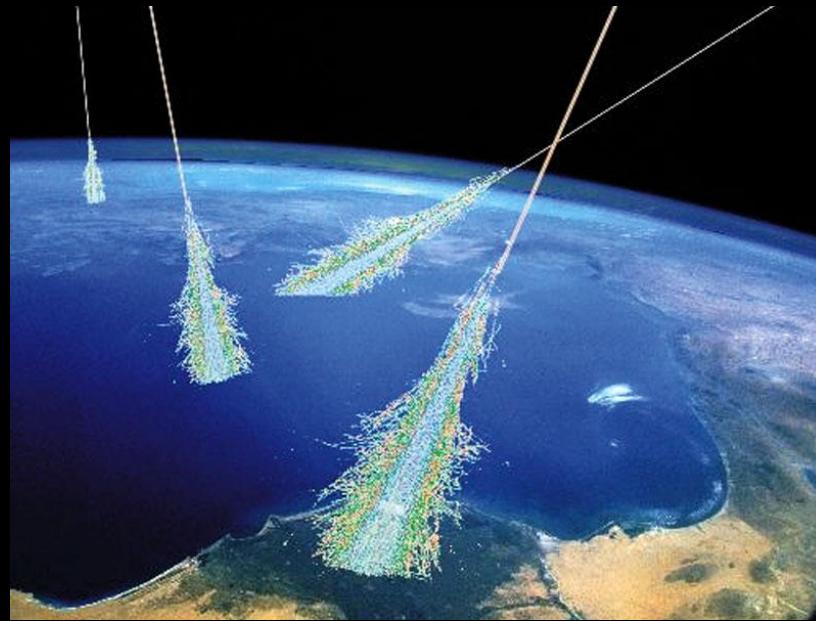
The only possible explanation for such glitches are X whose discovery won Victor Hess the 1936 Nobel Prize in Physics.

ID X.

# SAFETY SLIDE



# Cosmic Rays



# ROUND 5

## IB REVERSE

- Infinite Bounce (+10/0) -

First question directed to Team 1  
- bouncing backwards.

10 points for correct answer, no negatives  
- Feel free to take guesses.

- Directed to the team preceding the team which answered previously.

- Pounce (+10/-5) -

Pounce should have the full answer.  
No part pouncing, unless otherwise specified.

10 points for correct answer,  
-5 for wrong/incomplete answer.

---

The following is a list of recorded sightings of “guest stars”:-

185- Circinus constellation

1006- Lupus constellation

1572- Cassiopeia constellation

1604-Ophiuchus constellation

1987-Dorado constellation

\*not an exhaustive list

What phenomenon is being talked about?

# SAFETY SLIDE



# Naked eye Supernova Sightings.

---

Storax Sedan was a shallow underground nuclear test conducted in Nevada National Security Site in 1962, as part of Operation Plowshare, a program to investigate the use of nuclear weapons for mining, cratering, and other civilian purposes. The radioactive fallout from the test contaminated more US residents than any other nuclear test.

In 2005, Ellen Tauscher, a Democratic member of the U.S. House of Representatives from California, used Sedan as an example of a test which produced a considerable amount of radioactive fallout while giving congressional testimony on the containment of debris from nuclear testing.

However, her statement led to international uproar and temporarily dulled international relations  
What was the issue?

# SAFETY SLIDE



"Sedan" was incorrectly transcribed as  
"Sudan" in the Congressional Record.

---

Baker was a nuclear test conducted by the US in 1946 to evaluate the effect atomic weapons had on warships at sea. The Navy initially attempted to decontaminate many of the surviving ships from the Baker test by ordering the sailors to merely mop the deck, but since the primary contaminant after the explosion was plutonium which the Navy's geiger counters failed to register, volunteers were put at risk. Dr. Stafford Warren recognised and demonstrated the threat to the Navy by pulling a fish out of the ocean and throwing it on a photographic plate.

Why did this convince the Navy to stop the cleanup?

# SAFETY SLIDE



The image is an autoradiograph-  
the fish took its own X-ray

---

Paul Franklin won his 2nd Academy award for **Best Achievement in Visual Effects in 2015.**

**OPEN ACCESS**  
**IOP Publishing**

Class. Quantum Grav. **32** (2015) 065001 (41pp)

Classical and Quantum Gravity  
doi:10.1088/0264-9381/32/6/065001

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**Gravitational lensing by spinning black holes in astrophysics,** [REDACTED]

[REDACTED]

**Oliver James<sup>1,\*</sup>, Eugénie von Tunzelmann<sup>1</sup>,  
Paul Franklin<sup>1</sup> and Kip S Thorne<sup>2</sup>**

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Received 27 November 2014, revised 12 January 2015  
Accepted for publication 13 January 2015  
Published 13 February 2015

**Abstract**

 CrossMark

What is Paul Franklin's contribution to this paper?

# SAFETY SLIDE



# Creating the Interstellar Black hole simulation



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Classical and Quantum Gravity

PAPER • OPEN ACCESS • FEATURED ARTICLE

Gravitational lensing by spinning black holes in astrophysics, and in the movie *Interstellar*

Oliver James<sup>1,2</sup>, Eugenie von Tunzelmann<sup>1</sup>, Paul Franklin<sup>1</sup> and Kip S Thorne<sup>2</sup>

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Article PDF

Article information

**Abstract**

*Interstellar* is the first Hollywood movie to attempt depicting a black hole as it would actually be seen by somebody nearby. For this, our team at Double Negative Visual Effects, in collaboration with physicist Kip Thorne, developed a code called Double Negative Gravitational Renderer (DNGR) to solve the equations for ray-bundle (light-beam) propagation through the curved spacetime of a spinning (Kerr) black hole, and to render IMAX-quality, rapidly changing images. Our ray-bundle techniques were crucial for achieving IMAX-quality smoothness without flickering, and they differ from physicists' image-generation techniques (which generally rely on individual light rays rather than ray bundles), and also differ from techniques previously used in the film industry's CGI community. This paper has four purposes: (i) to describe

Gravitational Lensing by Spinning Black Holes in Astrophysics, and in the Movie *Interstellar*

Oliver James, Eugenie von Tunzelmann, Paul Franklin and Kip S. Thorne

00:19 02:42

Download video Transcript

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Three physicists were working on a method to make glass tougher and more resilient to cracking. They struck upon an ingenious method to do so, inspired by the structure of tooth enamel, mother of pearl, and the shell of mollusk, all of which are thousands of times tougher than the material they are made up of. One could say that they were influenced by Kelly Clarkson's most popular song.

What was their method?

# SAFETY SLIDE



By introducing cracks in the structure

---

The construction of the Citicorp Center, a 59-storey skyscraper in NY City faced various challenges. Circumstances meant that the skyscraper could collapse under its own weight above a certain threshold. Chief Structural engineer William LeMessurier designed V-shaped chaperons to give the structure an exoskeleton which at the same time made it much lighter, now vulnerable to NY City's dangerous strong winds. To counter this LeMessier went for another state-of-the-art solution X which would prevent the structure from toppling over.

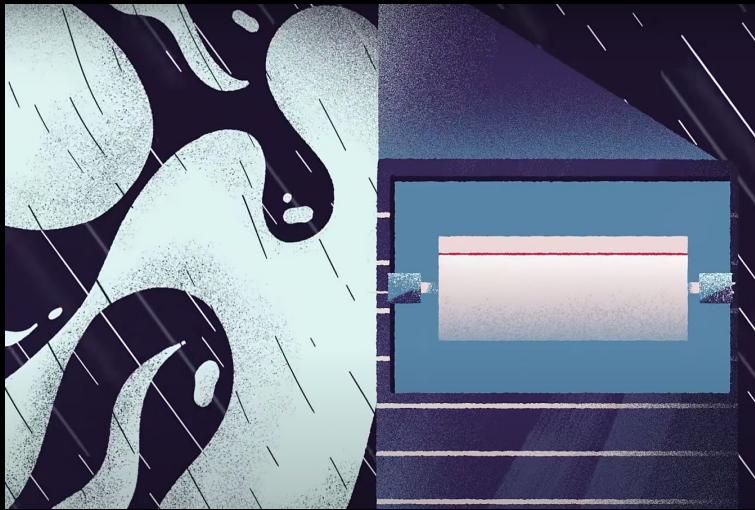
X is commonly used in bridges to prevent large vibrations due to resonance with pedestrian loads.

ID X.

# SAFETY SLIDE



# Tuned Mass Dampers



The Fosbury flop revolutionized the high jump event forever after Dick Fosbury used his new 'back first' technique to win the high jump gold in the 1968 Olympics.

Unlike traditional jumping methods which solely rely on the brute force generated by the athlete, hurling his/her entire body above the bar, the Fosbury flop allows an athlete to clear higher height bars while applying the same amount of force as the traditional methods by exploiting a simple property of the Center of Mass.

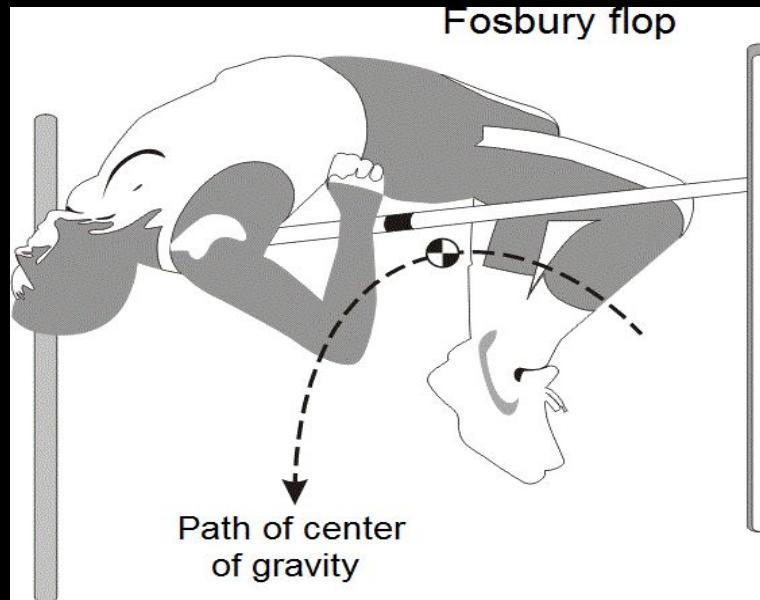
What property of the Center of Mass is being talked about here?

# SAFETY SLIDE



Position of the Centre of Mass can be outside the body.

In the Fosbury flop, the CoM is below the bar while the body of the athlete crosses over over.



During a televised hearing on February 11, Feynman demonstrated \_\_\_\_\_ using a glass of cold water and a piece of rubber, for which he received media attention.

In an interview with CNN, later, he explains the relevance of that demonstration with respect to the accident. Play clip 6:58-8:06 mins.

What phenomenon did Feynman demonstrate at the public hearing on Feb 11?



# SAFETY SLIDE



# Loss of elasticity in rubber.

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The Human Interference Task Force was convened by the US Department of Defense to devise methods that ensured that Humans could avoid waste Nuclear fuel storage areas.

The panel reasoned that since few people can read texts that are only 1,000 years old, written warnings guaranteed to be understood by future humanity could be difficult to create.

The answer may lie in “nuclear semiotics” – future-proof signs.

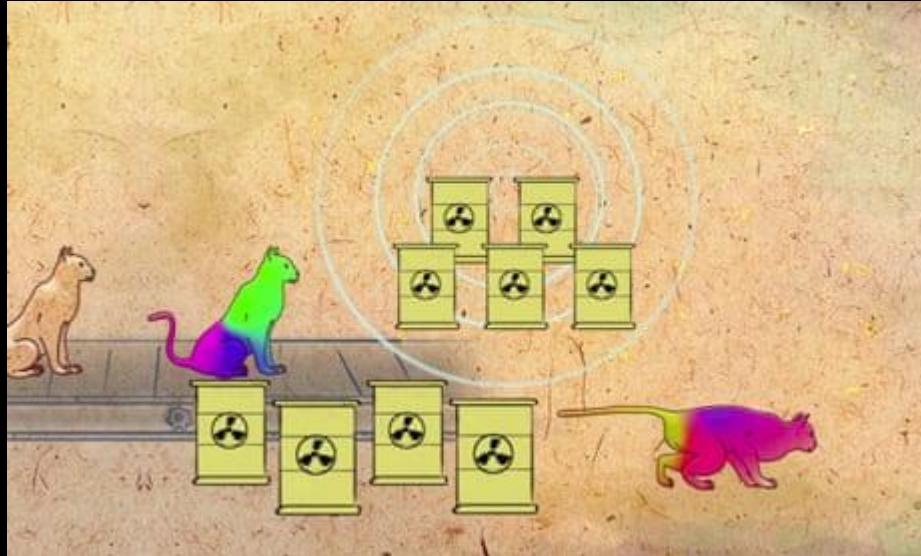
The team came up with an ingenious solution, relying on an animal that is deeply embedded into several cultures and mythologies across the world for millennia.

What animal did they choose, and what was their method?

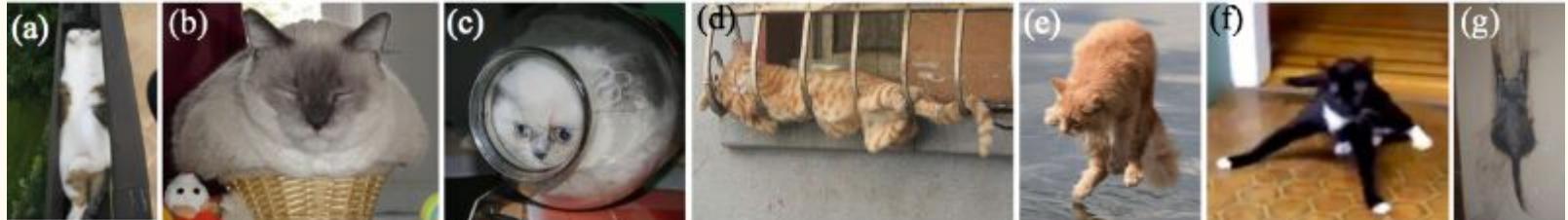
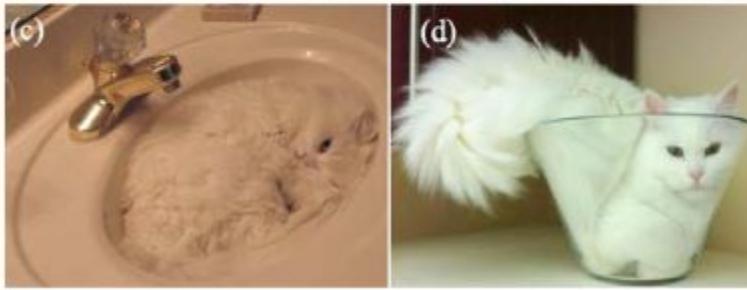
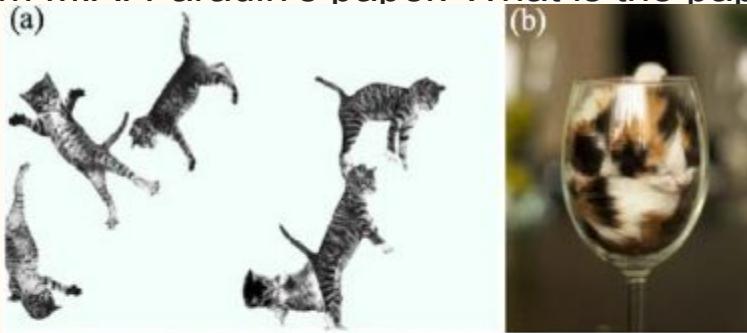
# SAFETY SLIDE



Breeding cats that react with discoloration of the skin when exposed to radiation. A legend, passed on through the millennia, would trigger a response in humans to get out as soon as possible.



Here are some images from M.A. Faradin's paper. What is the paper's objective?



# SAFETY SLIDE



# Determining if cats can behave as solids and liquids simultaneously, and under different conditions

## On the rheology of cats

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(Dated: July 9, 2014)

In this letter I highlight some of the recent developments around the rheology of *Felis catus*, with potential applications for other species of the felidae family. In the linear rheology regime many factors can enter the determination of the characteristic time of cats: from surface effects to yield stress. In the nonlinear rheology regime flow instabilities can emerge. Nonetheless, the flow rate, which is the usual dimensional control parameter, can be hard to compute because cats are active rheological materials.