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## Hidden Truth of Free Fall Experiment

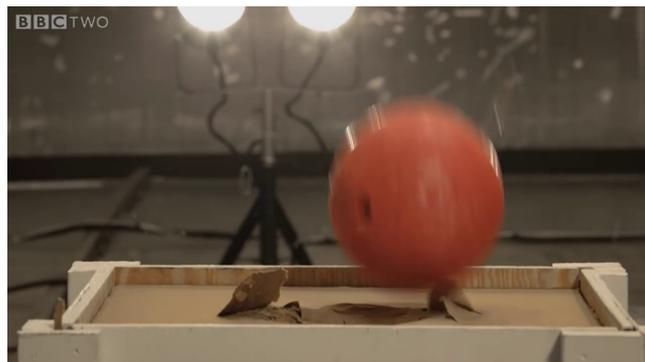
落體實驗隱藏的真相

Cres Huang



Falling ball and feather

NASA's vacuum chamber - Human Universe Episode 4 - BBC Two.



Landing impact of bowling ball

NASA's vacuum chamber - Human Universe Episode 4 - BBC Two.

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Advice and correction are appreciated.  
Please send your correspondence to:  
[cres@mail.org](mailto:cres@mail.org)

**Abstract**

Free fall experiment has been performed countless times for centuries. However, many facts were overlooked. A simple experiment since Galileo tells more than just gravity.

Everyone can do it experiment will not catch much serious attention. Dishing up the same old stuff of few hounded years might seemed child’s play to some. However, many fundamentals of the universe are revealed if looked closer. Significant facts can be overlooked, ignored, or misinterpreted when we rush forward. Nevertheless, free fall experiments reveal:

1. Gravity is a force.
2. Free fall is an action powered by gravity.
3. Gravity contradicts attraction force. It acts exactly like contact force.
4. The infinite independence of space.

This article will discourse the evidences and logics of free fall.

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# 1 Introduction

Falling body is all around us. Nature shows us rain, hail, snow, avalanche, river, water fall, land slide, meteorite; and our fun activities of slide, roller coaster, diving, jumping; just to name a few.

Free fall experiment has been performed countless times for centuries. However, many facts were overlooked. The truth is, this simple and somehow neglected experiment since Galileo [2] tells more than just gravity.

Everyone can do it experiment will not catch much serious attention. Dishing up the same old stuff of few hounded years might seemed child's play to some. However, many fundamentals of the universe are revealed if looked closer. Significant facts can be overlooked, ignored, or misinterpreted when we rush forward.

## 2 Free Fall Experiments

One notable free fall experiment in recent years was done outside of the Earth's gravity by David Scott in his Apollo 15 mission on the Moon[9], Figure 1. Another extent was done in NASA's vacuum chamber on Earth[1], Figure 2.



Figure 1: Hammer feathers Drop by David Scott, Apollo 15.



Figure 2: Free fall in NASA's vacuum chamber - Human Universe Episode 4 - BBC Two.

Equally significant is Galileo's inclined plane experiment, Figure 3. It is a slow-motion examination of gravitational acceleration. It enabled Galileo to derive the mathematics of gravitational acceleration showing all bodies accelerate at the same rate independent of their masses[7]. In modern technology, high speed camera can capture and calculate free fall without inclined plane.



Figure 3: Demonstration inclined plane used in education, Museo Galileo, Florence.

Here, we extend the experiment with an iron ball and a dandelion seed in gravity field.

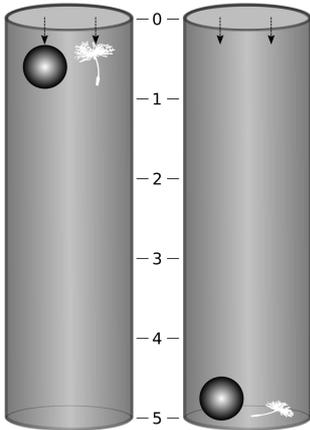


Figure 4: Free fall in vacuum.

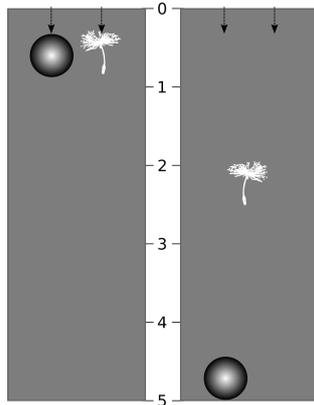


Figure 5: Falling in air.

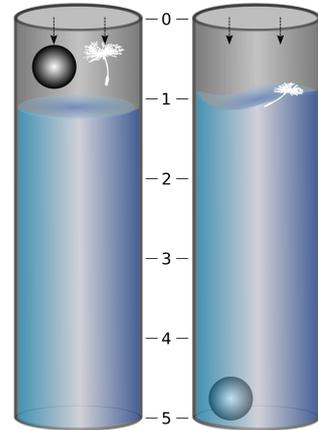


Figure 6: Falling into water.

1. Absence of disturbance in first experiment, Figure 4. Iron ball and seed fall in uniform acceleration in vacuum. The action is powered by gravity and stopped by the bottom of the chamber at the same time.
2. In second experiment, dandelion seed drafts down slowly by interacting with air. On the other hand, dense iron ball does not show visible interactions with air due to short fall. It would be red hot in long drop. Figure 5. The action is also stopped by the bottom of the chamber, ball earlier than seed.
3. In third experiment, Figure 6. Dandelion seed can not continue to fall. Its motion is stopped by water of higher density. The falling of iron ball would be altered by water, even it may not be visible but can be measured with precision instrument. Here, water is disturbed by ball and seed and its level raises. Again, iron ball is stopped by chamber bottom.

Next set of experiments is performed outside of gravity field. The relative positions of ball, seed, and chamber remain unchanged. In this case, there is no free fall when gravity is absent, Figure 7, Figure 8, and Figure 9.

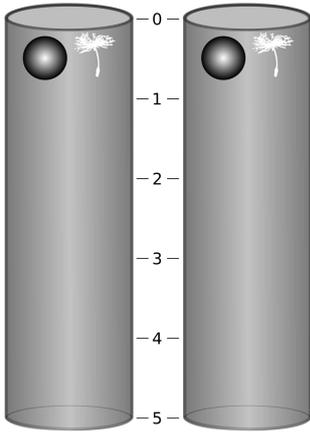


Figure 7: In vacuum without gravity.

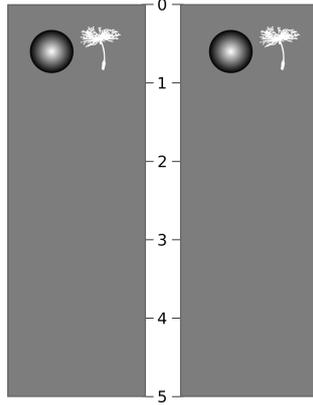


Figure 8: In air without gravity.

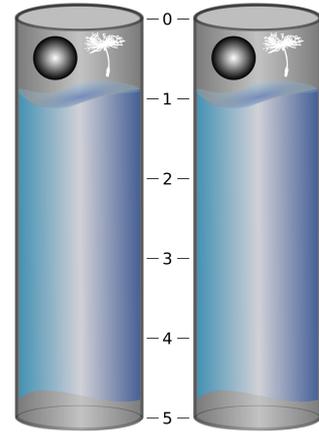


Figure 9: In air and water without gravity.

Now, let's take a closer look of the falling and landing of bowling ball of the experiment performed in NASA's vacuum chamber[1]. First run was done in the chamber filled with air.

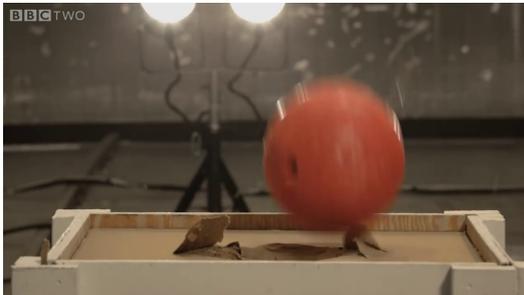


Figure 10: Landing and bouncing of bowling ball in air.



Figure 11: Drifting feathers in air.

Figure 12 is an animated illustration of ball landing. Please note that some PDF viewer might not display it properly.

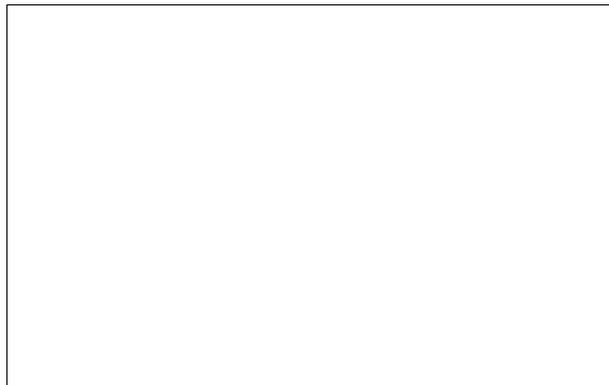


Figure 12: Animated landing and bouncing of bowling ball in air.

We see the bowling ball reached the landing pad much earlier than feathers, Figure 10. It crashed into the landing pad, bounced, and made few splashes. On the other hand, feathers drifted around in the air for a while after the bowling ball had landed, Figure 11. In this case, air disturbed the fall. There were collisions with air molecules, despite bowling ball did not show visible display. The relative positions among individual feather and bowling ball were changing during the fall. To the chamber or background, both of their relative positions were also changed.

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In the video, the drifting feathers closer to the bowling ball did not shown any sign of been pulled closer or faster fall by bowling ball, despite there might be static electricity on feathers. It did not show any sign of force of action-at-a-distance (non-contact force) between bowling ball and feathers per distance.

Second run was done after air was nearly fully pumped out of the chamber. The interference of air was nearly eliminated.



Figure 13: Arriving ball and feathers in vacuum.



Figure 14: Landing impact and bouncing in vacuum.

Figure 15 is an animated illustration of ball and feather landing in vacuum. Please note that some PDF viewer might not display it properly.



Figure 15: Animated landing and bouncing in vacuum.

We see the bowling ball and feathers accelerated in sync and landed together at the same time, Figure 13. The impact force of bowling ball on landing pad was much the same, Figure 14. Note that, the bundle of soft feathers retained it's formation during the fall. Again, there was no sign of non-contact force at work causing the deformation of feathers. Individual feather fell uniformly with each other and the bowling ball. Feathers were too light to make significant trace on landing pad in air or vacuum. Nevertheless, feathers collided with landing pad and broke the formation.

### 3 Cognizance of the Experiments

Here summarized the facts cognized from the experiments.

1. All objects float weightlessly in free space. Free objects do no have center aiming potential outside of gravity field.
2. All objects in gravity field possess potential of moving toward gravity center.

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3. Falling is an action powered by gravity moving toward gravity center. The force of gravity of an object is perceived as intrinsic weight.
  4. Falling objects fall with uniform acceleration regardless of their mass and distribution of mass. Or, gravitational acceleration is independent of mass, shape, size, surface, and structure. Shape, size, surface, and structure are function of mass and distance, hence, distance is also irrelevant.
  5. Denser object possesses stronger gravitational energy. The impact force was revealed by the collision of bowling ball and feathers with the landing pad. Including gravity, all forces are function of mass and velocity.
  6. There would be interaction, or exchange of momentum, in free fall when upon contact. In the experiments, presented air or water, and landing pad had disturbed the fall. Falling force would be redistributed to all participants, namely ball, feather, seed, air, water, landing pad, chamber, or ground; upon contact.
  7. Gravity behave exactly like contact force. Experiments did not show any sign of non-contact force at work in all experiments performed. Otherwise, objects would not fall in uniform acceleration, and soft body would display deformation by nonuniform acceleration.
  8. Free fall alters the relative position of falling object and it's background.
  9. Background does not disturb the fall. It is independent reference of the action regardless it can be detected or not.
  10. Vacuum does not disturb the fall. Or vacuum does not interact with the object in motion. Reversely, mass and action can not disturb vacuum. It is considered part of the background.
  11. There is space in the chamber. Therefore, space does not disturb the fall. Or space does not interact the object in action. Reversely, mass and action can not disturb space. Space is considered the background of all actions.

## 4 Summary

Some people might be counter-intuitively surprised by the synchronized falling of the bowling ball and feather presented by the video. It may had contradicted to our perception of weight fro long. However, it reveals more truth than just gravity when we look deeper into the experiment.

### 4.1 Gravity Force

Truth: Gravity is a force.

Proofs:

1. Free objects accelerate toward gravity center in gravity field.

2. The force of gravity of an object is perceived as intrinsic weight.

## 4.2 Action of Free Fall

Truth: Free fall is an action powered by gravity.

Proofs: Interactions, landing, and relocation of objects.

1. Feathers drifted around in the air, crashed on landing and bounced.
2. Water was disturbed by falling iron ball.
3. Bowling ball crashed into the landing pad, bounced, and made few splashes.
4. Bowling ball and feathers had relocated to the bottom of the chamber.

If saying falling bodies in gravity field are not *falling* as interpreted in the video[1]; The logical statement is, free objects are *moving* toward the center of gravity powered by force of gravity. The truth of falling force and action stands regardless of background. Falling force is the function of mass and gravitational acceleration. And, the falling velocity and acceleration can be calculated precisely. More in *Motion of Free Falling Object*, Glenn Research Center NASA[8].

## 4.3 Gravity vs. Attraction

Truth: Gravity contradicts attraction force. It behaves exactly like contact force.

Proofs:

1. Bundle of soft feathers retained it's shape during the fall in vacuum. Individual feather fell uniformly with each other and the bowling ball.
2. Falling objects fall with uniform acceleration regardless of their mass and distribution of mass. Or, gravitational acceleration is independent of mass, shape, size, surface, and structure. Shape, size, surface, and structure are function of mass and distance, hence distance is also irrelevant.
3. Attraction is dependent on mass and distribution of mass (shape, size, surface, structure, and distance).
4. Gravity acted exactly like contact force. It did not show any sign of action at a distance in all experiments performed.

Most of us play magnets more or less. It would be hard to believe anyone never see the high speed action of magnetic attraction. There are many YouTubers showing the natures of magnetic attraction in slow motion. Figure 16 is screen shots of Magnet & Magnetic Putty - Time Lapse by YouTube user Steve Bartlett[6].

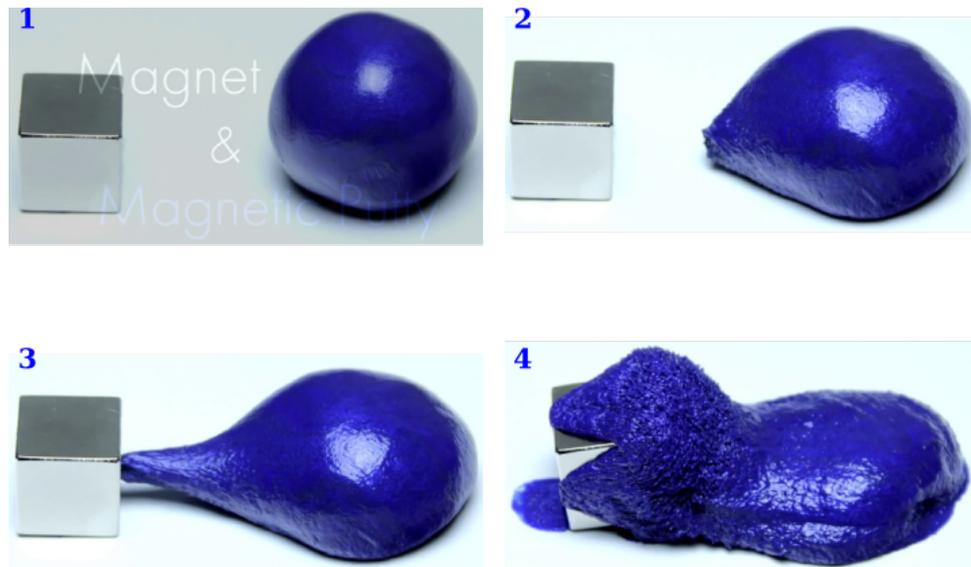


Figure 16: Magnetic attraction slow motion.

Not only it showed the slow motion of the magnetic attraction, but also how attract and tear force at work. The putty slowly stretched toward the magnet and engulfed it. We can see the attracting-tear force is dependent on surface, shape, size, structure, and distance. Different parts of the putty are under different force of traction. The nonuniform acceleration and tear cause the deformation of putty. More studies of gravity are presented in my articles of *The Refutation of Gravitational Attraction*[4]. and *The Making of Planet and Gravity*[3].

#### 4.4 Space vs. Mass and Energy

Truth:

1. Space can not interact with mass.
2. Space can not interact with action.
3. Mass can not alter space.
4. Action can not alter space.

Proofs:

1. Vacuum did not disturb the fall. Or, vacuum is independent of mass and it's action. Reversely, mass and action can not disturb vacuum.
2. There is space in the chamber. Therefore, space is independent of mass and it's action. Reversely, mass and action can not disturb space.

Vacuum in this study stands for lack of air and particles. Logically, we can not detect true vacuum, or complete emptiness. We can only detect the absence of detectable. Absence of detectable is not absolutely equal to complete emptiness. The same logics that we can only prove the absence of detectable matter and energy. It is impossible to prove the absence of space. Neither can we detect the surface and boundary of space.

The absolute independence of space is further verified by any action we observed. From gentle motion to earthquake, candle flame to large scale wild fire, volcano eruption to most powerful nuclear explosions. There is no any evidence that space can be disturbed by matter and energy.

Furthermore, We can only best describe space as infinite vacuum, or endless emptiness. It's boundary and surface can not be defined. If it is finite, there must have boundary and something outside. Yet, it's boundary (sutgsce) can not be defined, and something outside can only be described as more endless vacuum. However, even vacuum can not exist without space, then space has to be outside of the finite space. It can only be infinite in this endless chase. Nevertheless, space can exist without matter and energy, but not vice versa. An experiment to discourse space is presented in my article of *A Brief Experiment of Space*[5].

The nature of space would not allow matter or energy to alter it. Alteration of space would cause the redistribution of mass and energy, even mass and energy were at rest. Not only it can not be proven, alteration of space is a logic paradox impossible to resolve.

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