

# THE UNIVERSE

A cosmic background image featuring a large, glowing red supergalactic void in the center, surrounded by a dense field of blue and green galaxies and stars.

**Big Bang?**

# ELECTRIC

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THE UNIVERSE

Big Bang?

ELECTRIC





written by

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**David Talbott**

Milky Way Galaxy Center

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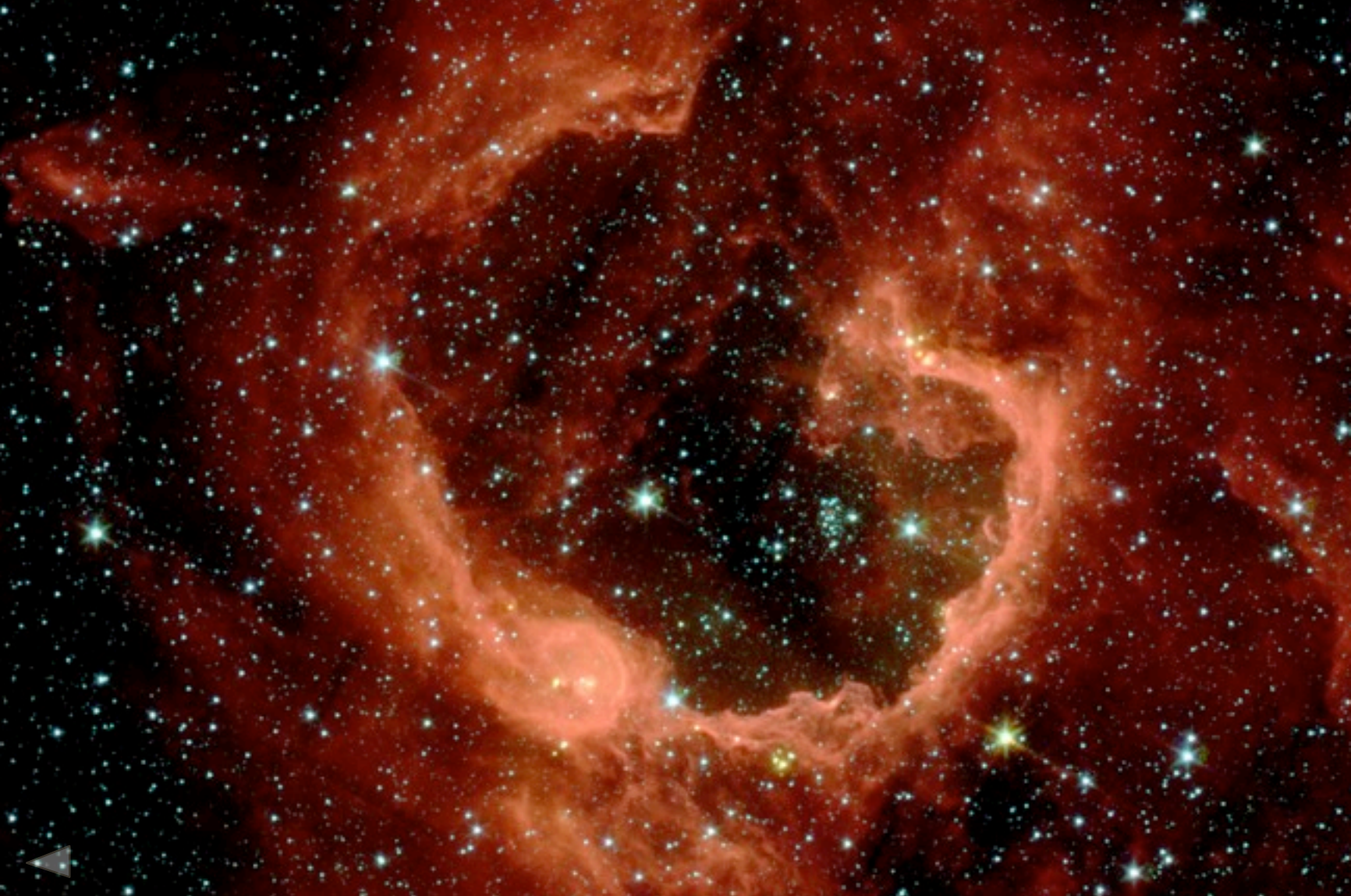
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“Star-Forming Bubble” RCW 79





## foreword

**N**ever has remote space inspired greater awe than in the first part of the 21st Century.

But can it really be said that we understand the new vistas, the exotic structures, and intensely energetic events now revealed to us? As descriptions grow more complex, *unified explanations* seem ever more elusive.

A new vision of the universe is emerging, and it includes something long overlooked—the role of *electricity* in space.

Two galaxies in dynamic interaction, one emitting a powerful jet.





## cosmology & gravity

**C***osmology* is the study of how the physical universe works, and cosmologists have long assumed that across the vast emptiness of space there is nothing that could possibly challenge the rule of *gravity*.



Most astronomers today view gravity as the single dominating force that gives birth to stars, organizes galaxies, and forms massive galactic clusters.

Horsehead Nebula



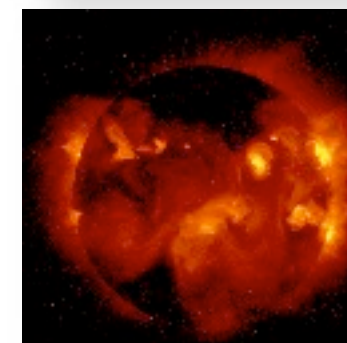


From their confidence in the well-tested law of gravity, astronomers interpret what they see:

In our own cosmic neighborhood they envision gravity creating extreme pressures in the Sun, lighting a nuclear furnace;

They see planets and moons as isolated bodies that have moved with predictable precision for billions of years;

Earth as seen from  
the Space Shuttle





And far removed from the Sun a cloud of debris produces comets, which are seen as “dirty snowballs”.

Periodically a few of these bodies are dislodged from the cloud, falling toward the Sun to create spectacular cometary displays.

Comet Hale-Bopp

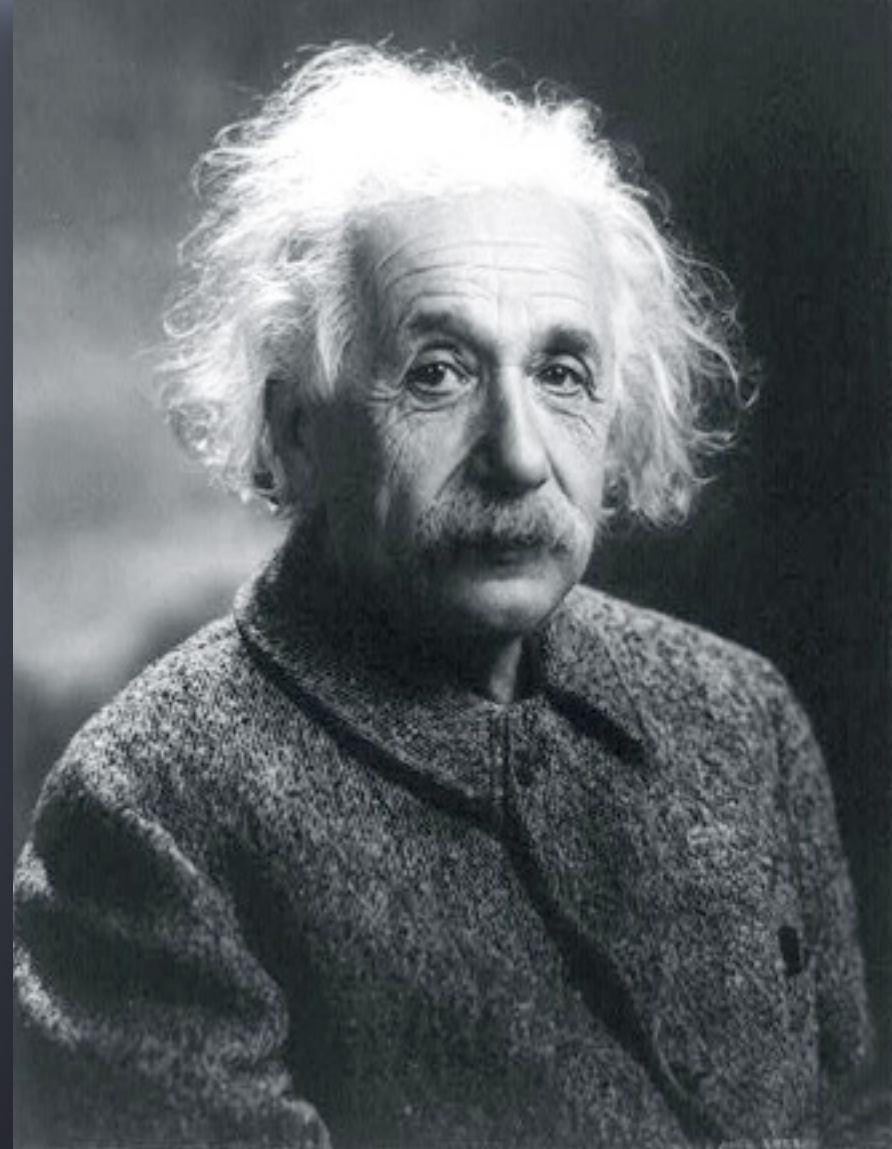






In recent years, new telescopes have given us stunning images of objects in space. Many of these images have come as a great surprise to scientists. Gravitational models did not anticipate them.

Eagle Nebula



Albert Einstein

## newton - einstein - hubble

Prior to the Space Age, in the first half of the 20th century, Albert Einstein redefined Sir Isaac Newton's *gravitational* model. He combined the three physical dimensions of space with the additional dimension of time, creating something that is now popularly termed a "continuum" of space and time.





Einstein's *theory of general relativity* formed this new view of gravity. The apparent successes of general relativity encouraged armies of mathematicians to follow his lead, continually extending his work into untested territory. One result was that astronomy rapidly became a field dominated by abstract mathematics.



Einstein's peculiar geometric theory of gravity no more explains gravity than did Newton's before him. However, in the hands of pure mathematicians *general relativity* provoked an explosion of cosmological abstractions.

In response, critics suggested that astronomical theory had merged with science fiction. The theorized universe could no longer be seen, measured, or tested in traditional ways.

## GENERAL RELATIVITY

### The Supplementary Condition

$$\kappa_{02} = \beta_{02} - \gamma_{02} + 2\gamma_0\gamma_2 - 2\gamma_0 \cot \theta \left( \frac{V_2}{2r} + \frac{V_2}{2r^2} + (\gamma_1 - \beta_1) \right) \times \left( \gamma_{01} + \frac{\gamma_0}{r} \right) + \frac{1}{2} U_{01}$$

$$\times UU_1 + U_1 U_2 - \frac{U_1}{r} \times \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$- \frac{\gamma_{11} UV + (\gamma_1 - \beta_1)}{r} \times \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$\times \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$\times \frac{V_2 + 2\beta_2 V}{2r^2} + r^2 e^{2(\gamma - \theta)} U_1 \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$= \frac{c_{02} + 2c_0 \cot \theta}{r^2} - \frac{2N_0 + c_0}{r^2} \times \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$\Gamma_{01}^2 = -\frac{1}{2} U_1 - \frac{U}{r} - \gamma_1 U + \beta_1 \times \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$\Gamma_{11}^2 = 0, \quad \Gamma_{02}^2 = \gamma_0 + \beta_2 U - r^2 e^{2(\gamma - \theta)} U \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

$$\Gamma_{12}^2 = \frac{1}{r} + \gamma_1 = \frac{1}{r} - \frac{c}{r^2} - \frac{3C}{r^4} + \dots, \quad \Gamma_{02}^2 = \gamma_0 + \beta_2 U - r^2 e^{2(\gamma - \theta)} U \left( \frac{1}{2} U_1 + \frac{U}{r} + \right)$$

"As far as the laws of mathematics refer to reality, they are not certain, and as far as they are certain, they do not refer to reality."

Albert Einstein



"Equipped with his five senses, man explores the universe around him and calls the adventure Science."

Edwin Hubble

By studying the light from distant galaxies, astronomer Edwin Hubble suggested in 1929 that the universe *could be* expanding. This interpretation was embraced by astronomers and, in combination with Einstein's theory of relativity, led to one of the most popular ideas in cosmology today.





## the 'big bang'

**T**he Big Bang theory proposes that approximately 13.7 billion years ago the Universe began with a primordial explosion. A vast cloud resulted. From that raw material, galaxies, stars, planets, and all other celestial bodies eventually formed—all through processes dominated by gravity.



The belief in an “expanding universe” (and by theoretical implication, the primordial Big Bang) arose primarily from an interpretation of changes in the light coming from distant objects in space.

NGC 4258 in visible and infrared light as well as radio and x-ray.



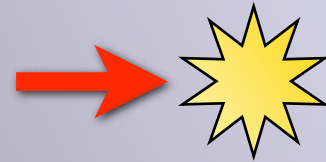
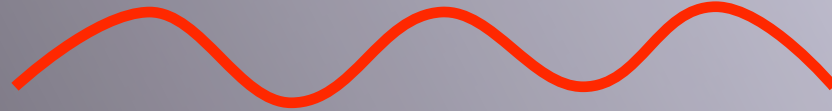
Earth - Observer

Lightwaves

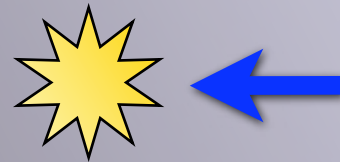
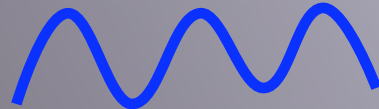
Object: star, quasar etc.



no shift in wavelength



redshift



blueshift

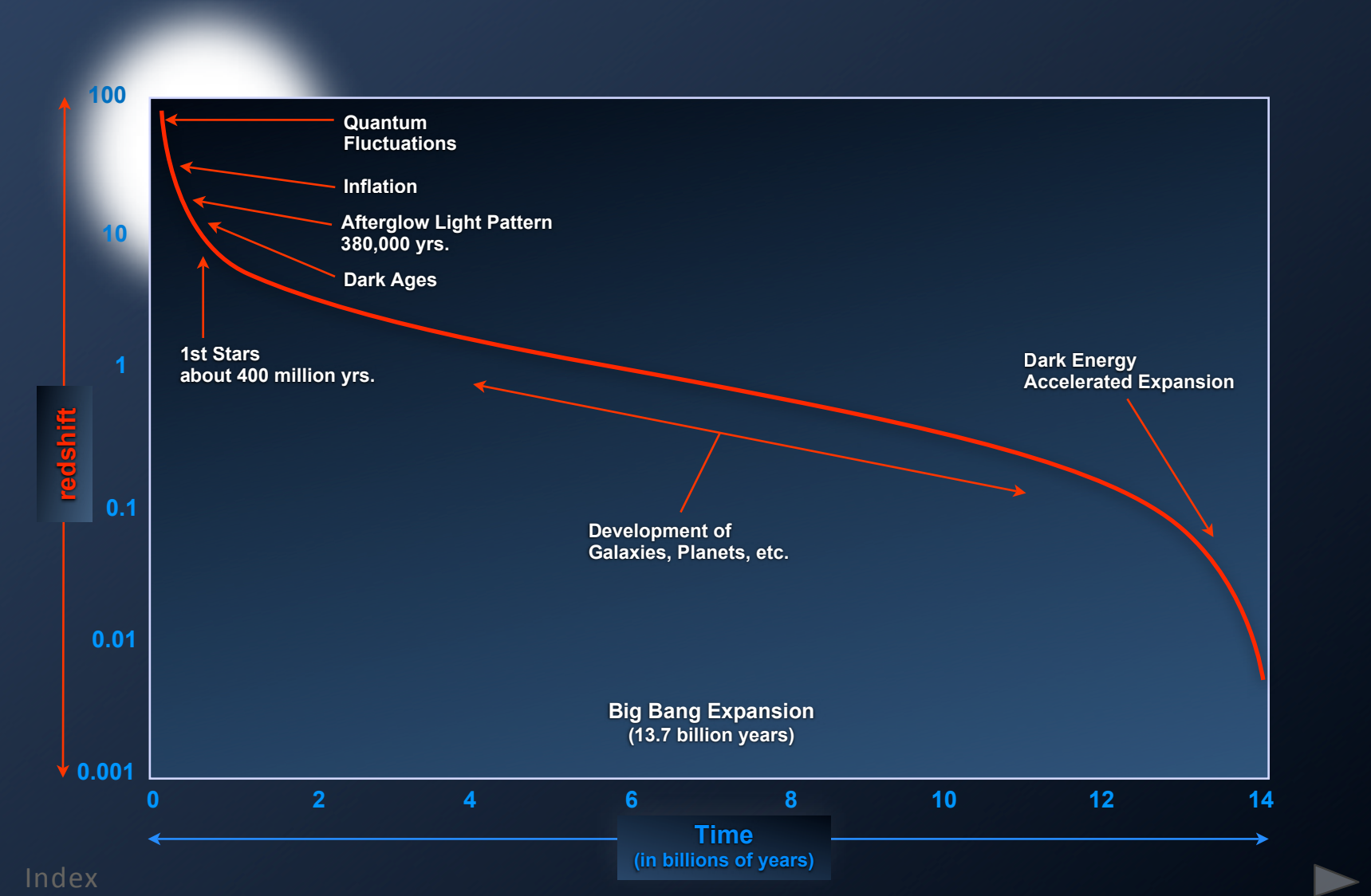
The basic idea: when a celestial object (galaxy, star, quasar) is moving at a high speed *away* from Earth, its light waves will be stretched so that the light appears more red; this is called 'redshift'. If it is moving toward the Earth the light waves will be compressed, causing the light to appear more blue; 'blueshift.'

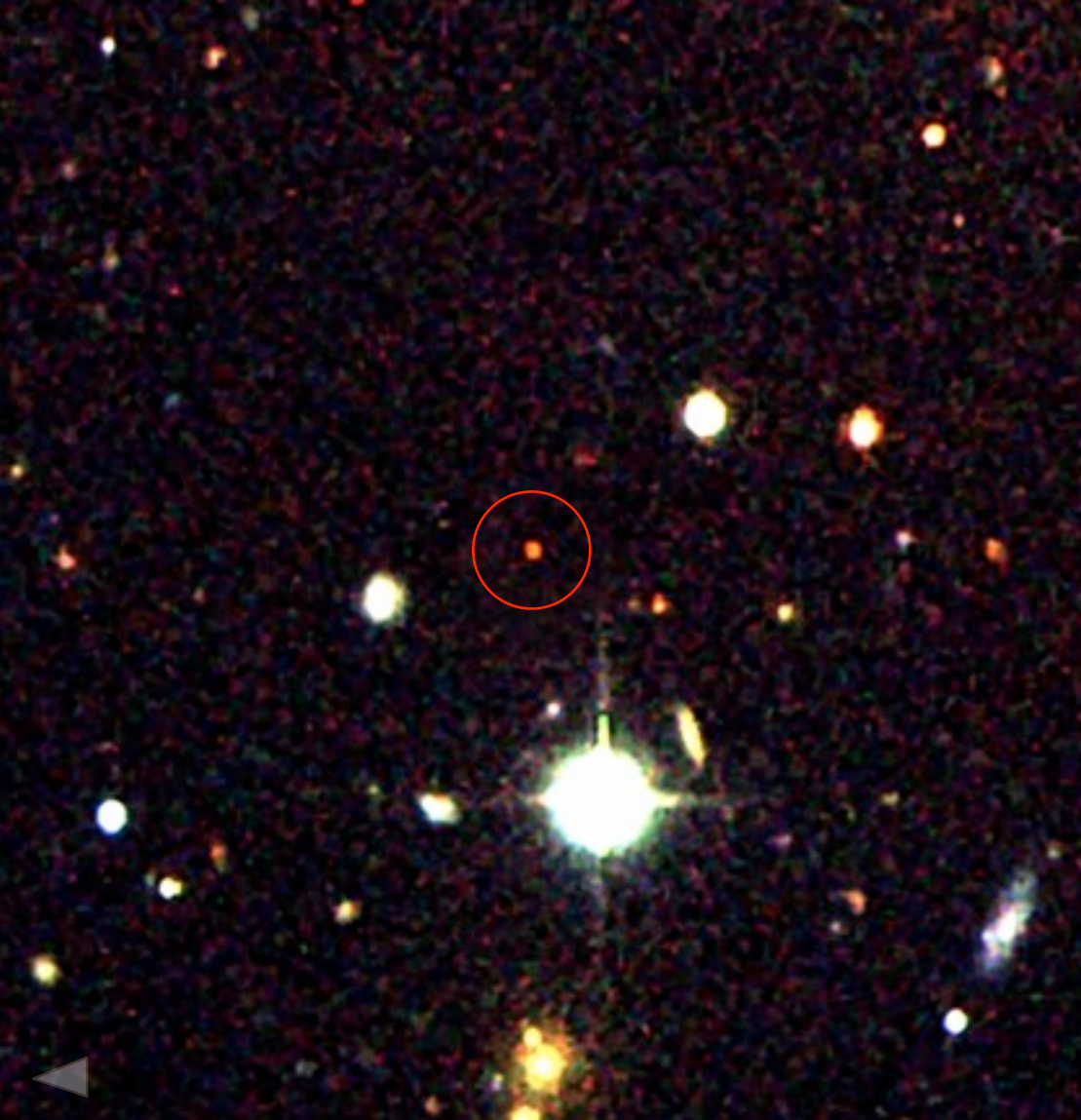




Most astronomers believe that when redshift is observed, it gives them an accurate reading of 'recessional velocity' (how fast something is moving away). So, if they know how fast an object is moving away from us, they can calculate when the universe began and how far away the object is now.

Based on this premise the Big Bang occurred 13.73 billion years ago.





The circled object is a very high redshift *quasar*.

## flaws in the 'big bang' theory?

But the official "age of the universe" has changed with new discoveries. In the late 1950s and early 1960s astronomers identified objects called *quasars*, which have a redshift greater than anything previously observed in the heavens.

Applying the standard interpretation, astronomers concluded that these objects must lie at the farthest reaches of the universe, and the universe must be bigger than previously thought.



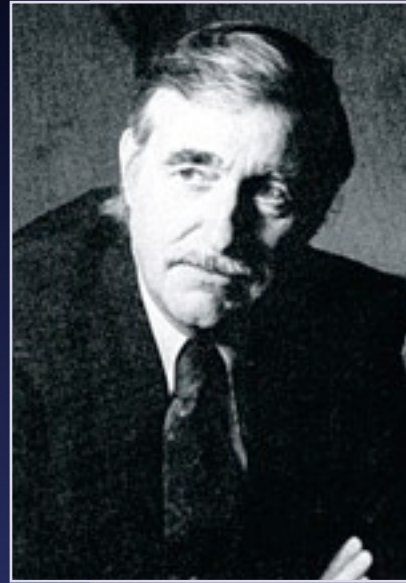
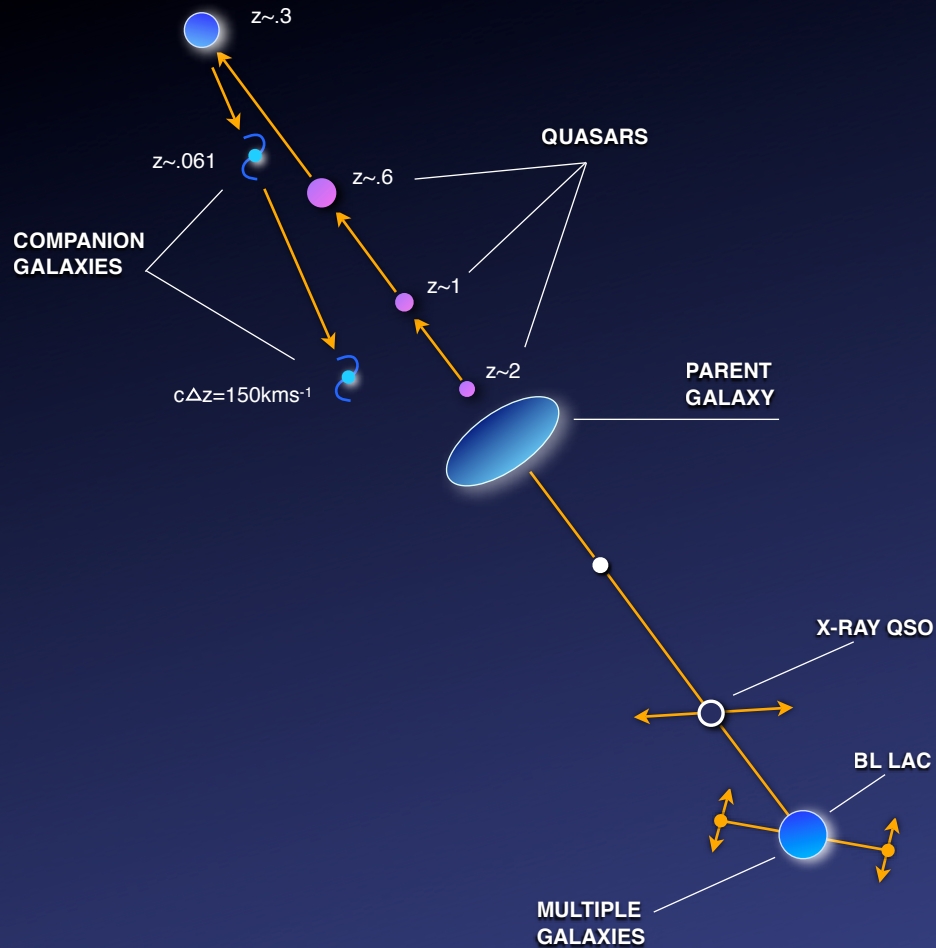


Quasars also posed another dilemma. Based on redshift, astronomers concluded that while quasars appear dim and red in our sky, they are actually very bright, but just very far away.

Based on redshift and at the distances claimed, it would take hundreds of galaxies to produce this brightness as seen from Earth.

Two Chandra observations of the giant elliptical galaxy M87 were combined to make this long-exposure image.





Halton Arp

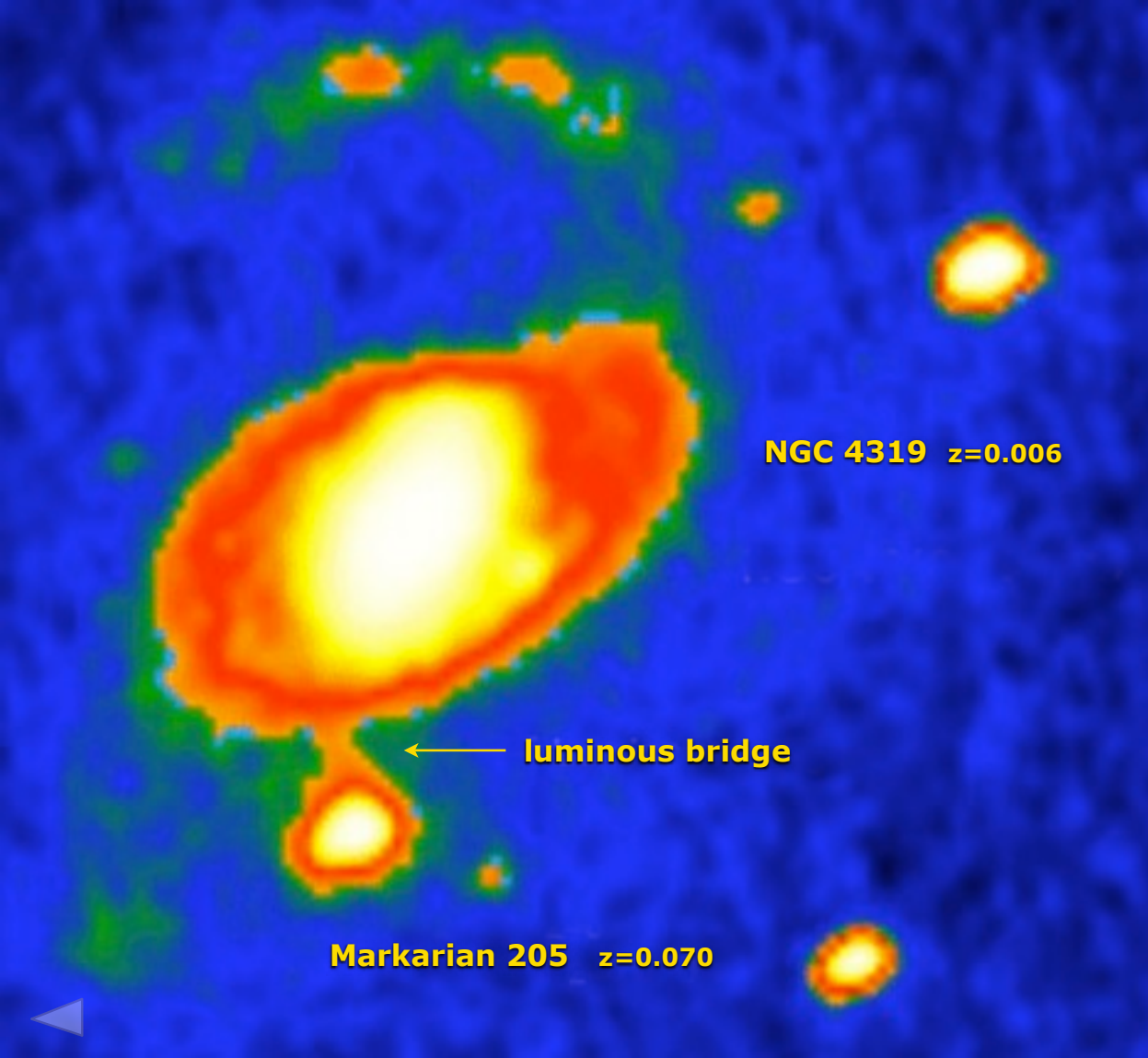
## re-interpreting 'redshift'

In the 1960's the astronomer Halton Arp, a highly respected authority on 'peculiar galaxies,' began documenting instances where low-redshifted galaxies and high-redshifted quasars were interacting, or even physically *connected*.

This would mean that redshift signifies something other than an object's recessional velocity.

If he was right, his observations were pointing to one of the biggest mistakes in the history of modern science.





**NGC 4319  $z=0.006$**

**← luminous bridge**

**Markarian 205  $z=0.070$**

This false color image highlights the "bridge" appearing to connect NGC4319 to the high-redshift quasar Markarian 205

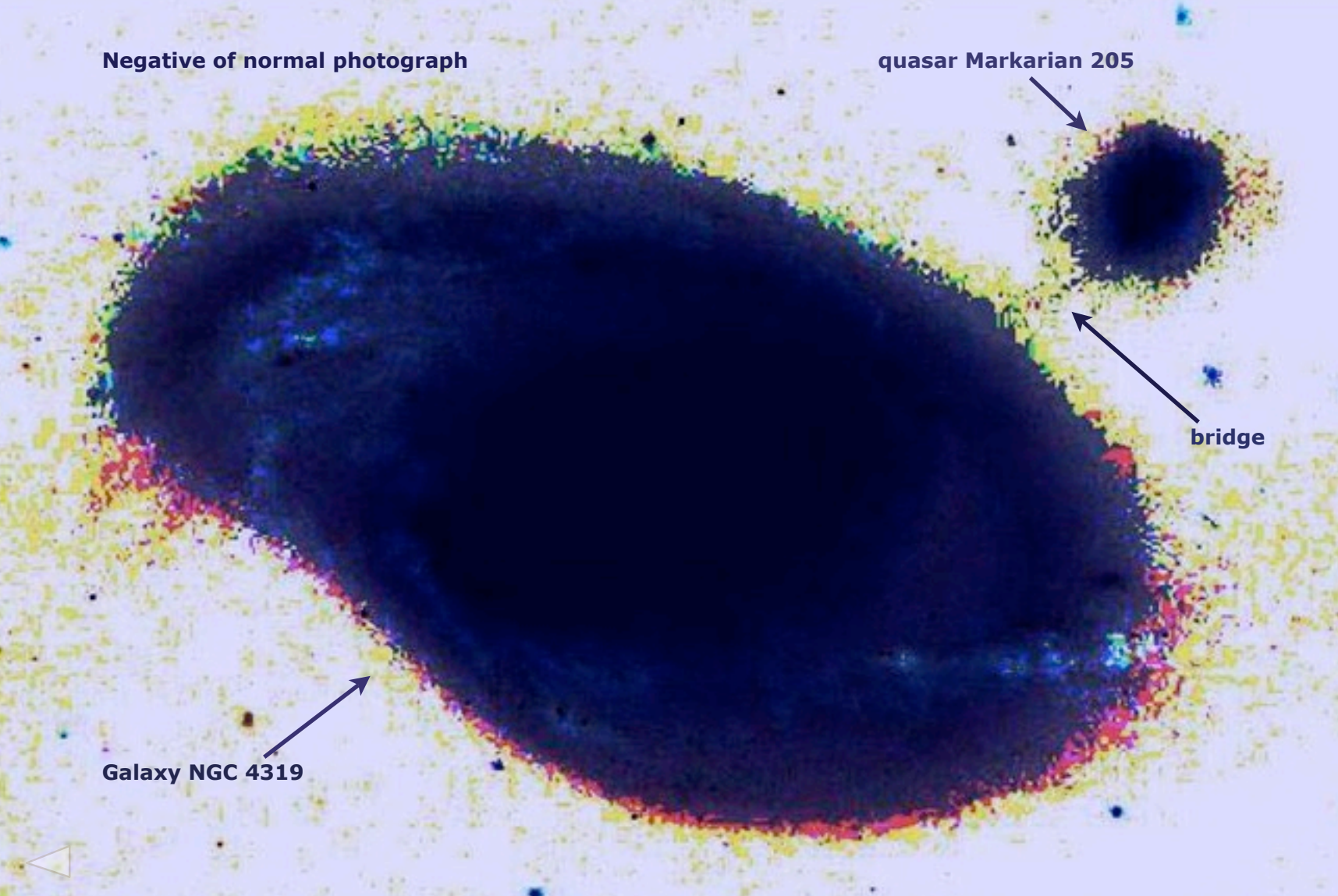
Note: According to the Big Bang theory, the higher the value of 'z', the further away an object is supposed to be.

In 1971, using a 5-meter telescope at Mt. Palomar, Arp discovered a visible "bridge" joining the low redshift galaxy NGC 4391 to the high-redshift quasar, Markarian 205 -- an "impossible" connection, unless popular assumptions about redshift were incorrect. For years thereafter astronomers debated the validity of the "bridge."

Arp was employed by Palomar observatory for almost 30 years. But in 1983, after warning him about the focus of his research, the Time Allocation Committee at Palomar terminated his viewing privileges. To continue his work, he found it necessary to join the staff of the Max-Planck-Institute for Physics and Astrophysics in Munich, Germany.







Negative of normal photograph

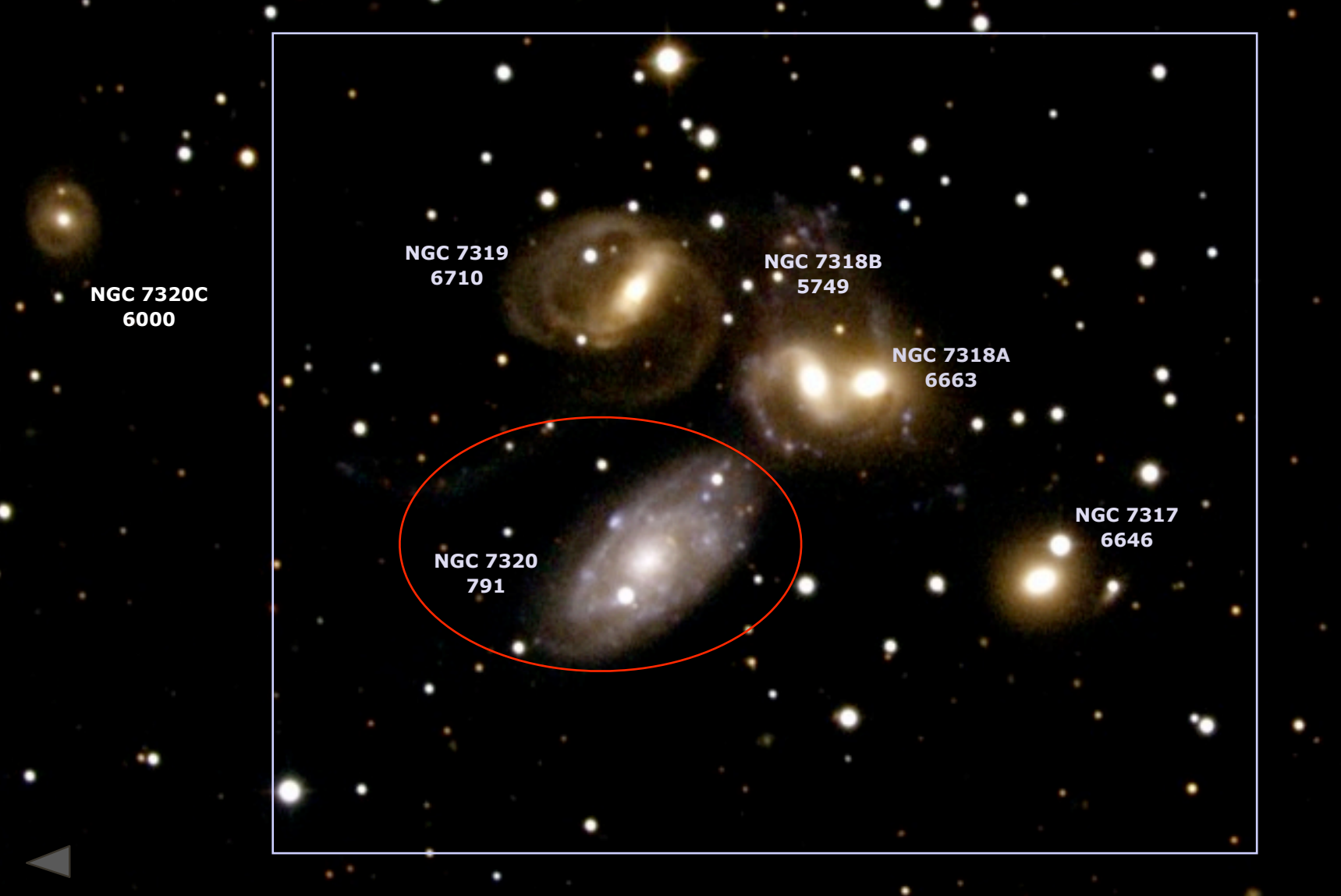
quasar Markarian 205

bridge

Galaxy NGC 4319

Several years later, X-ray images showed that the galaxy NGC 4319 was connected by x-ray filaments to both the quasar Markarian 205 and to another quasar on the opposite side of NGC 4319.

A single image challenged decades of theoretical assumption in astronomy.



Stephan's Quintet is a massive cluster of five galaxies. Four have similar high-redshift. The fifth, NGC 7320, has a much lower redshift, and thus should be much closer to us than the other galaxies.

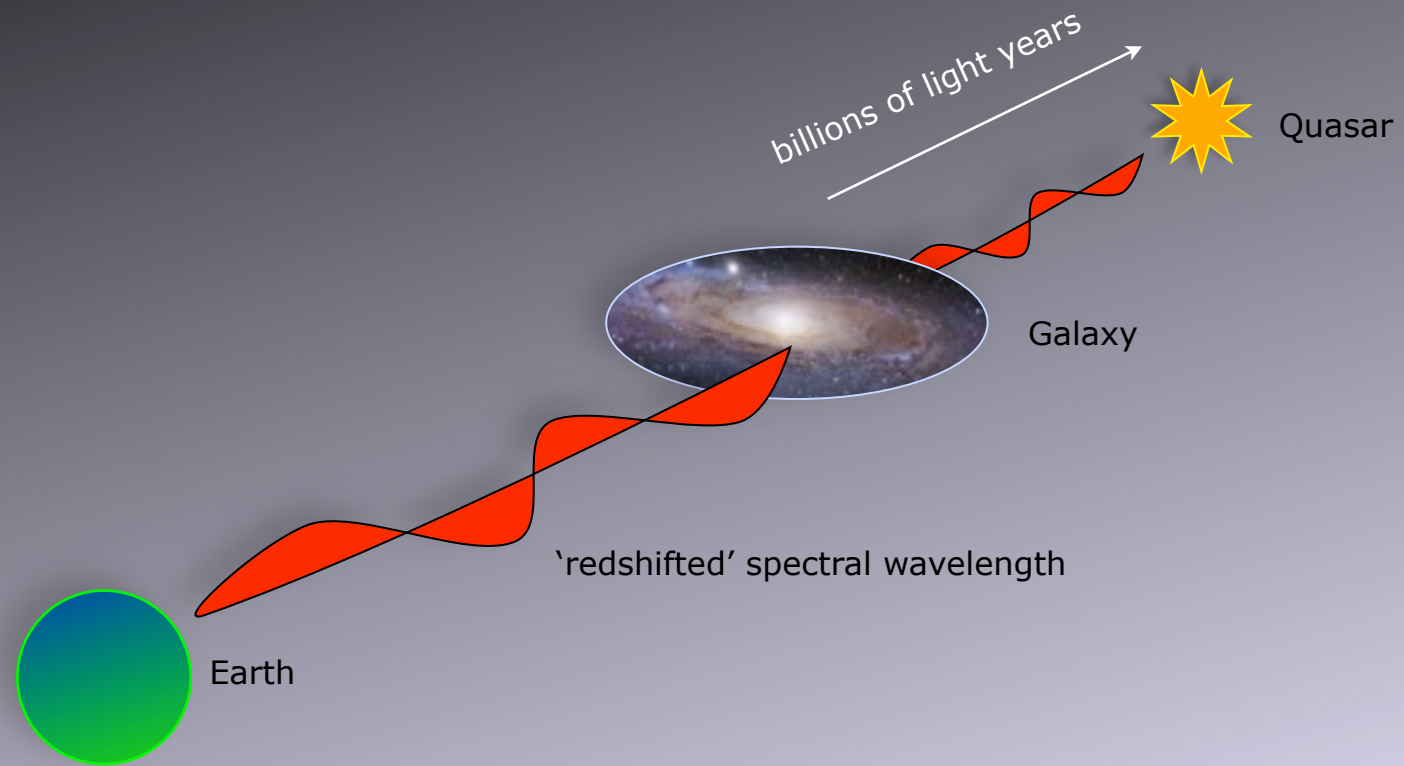
Yet there are debris fields and tails around the low-redshift galaxy that suggest it is interacting with the high-redshift systems, which would require that all five galaxies be in the same vicinity in space.



A stunning confirmation of Arp's claims can also be seen in the galaxy NGC 7319 (picture right). This galaxy is shrouded with such heavy dust clouds that they obscure most of its bright active nucleus. The galaxy has a redshift of 0.0225.

In front of its opaque gas clouds, or embedded in the topmost layers of the dust, is a quasar with a redshift of 2.114.

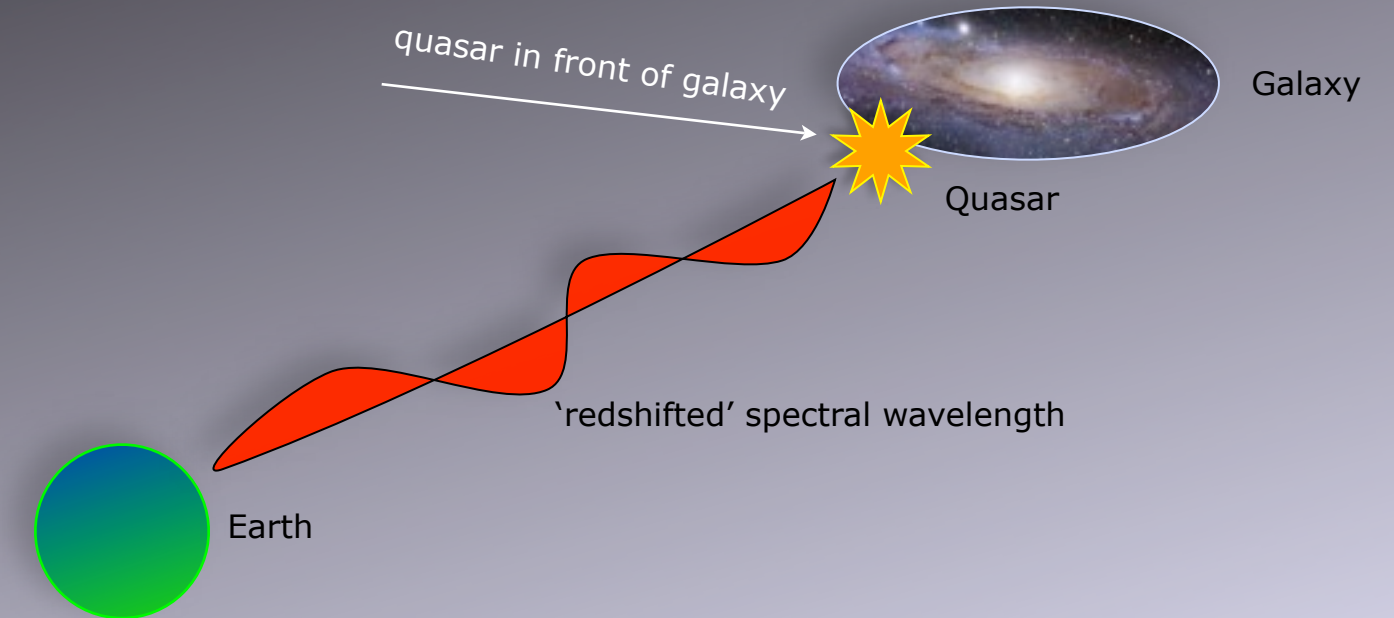


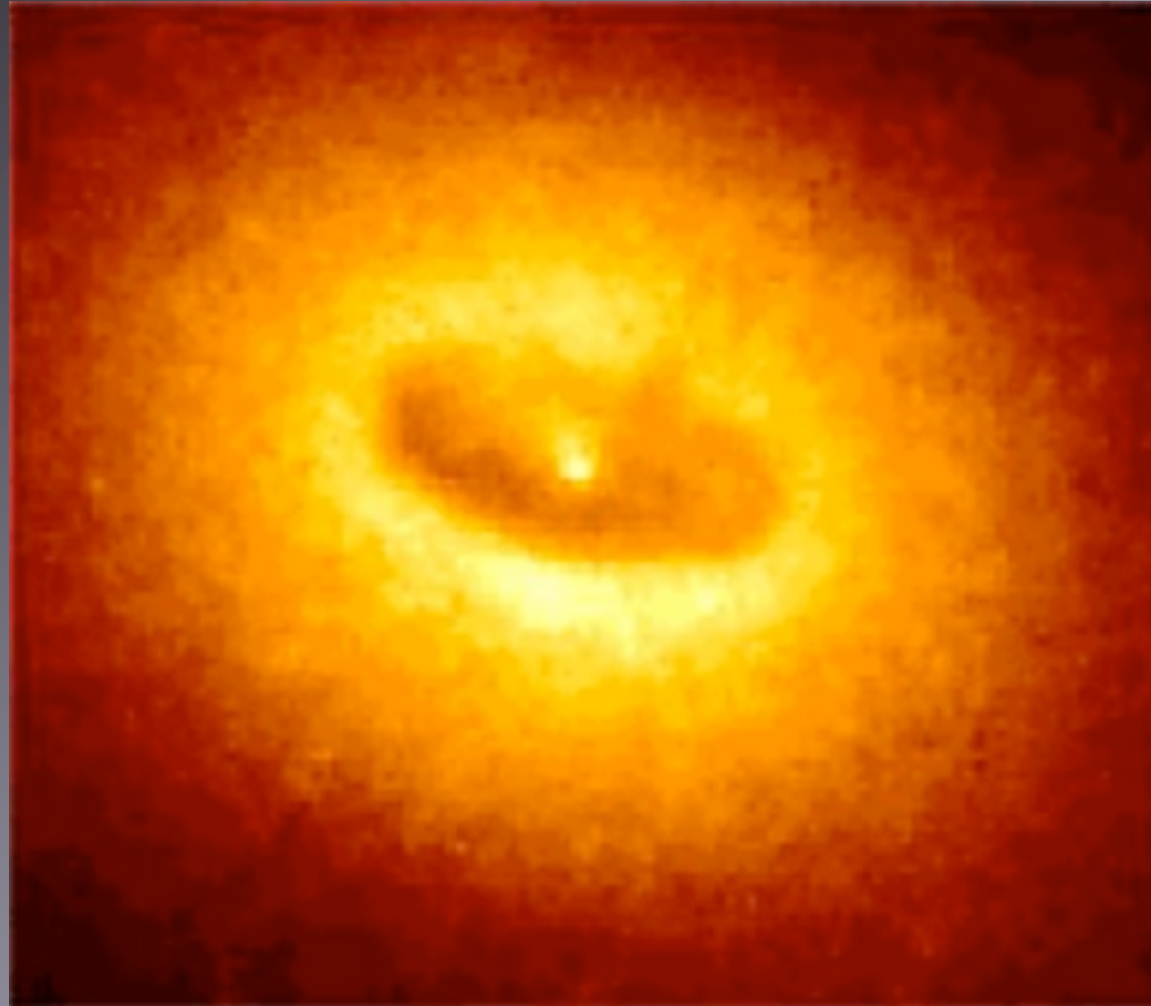


According to Big Bang theory this quasar should be billions of light years farther from us than the galaxy, because its redshift is so much higher.



And yet the galaxy is not transparent, it is opaque. If the quasar were beyond the galaxy it would not be visible. The quasar must be *in front of the galaxy*, not billions of light years farther away.





The central portion of a quasar at the core of the galaxy NGC 4261, supposedly a 'black hole.'

Most of standard cosmology today relies heavily on the traditional interpretation of redshift.

But if Halton Arp and his colleagues are correct, something other than motion is shifting the light of celestial bodies toward red ... some quality *inherent* in the redshifted objects themselves.

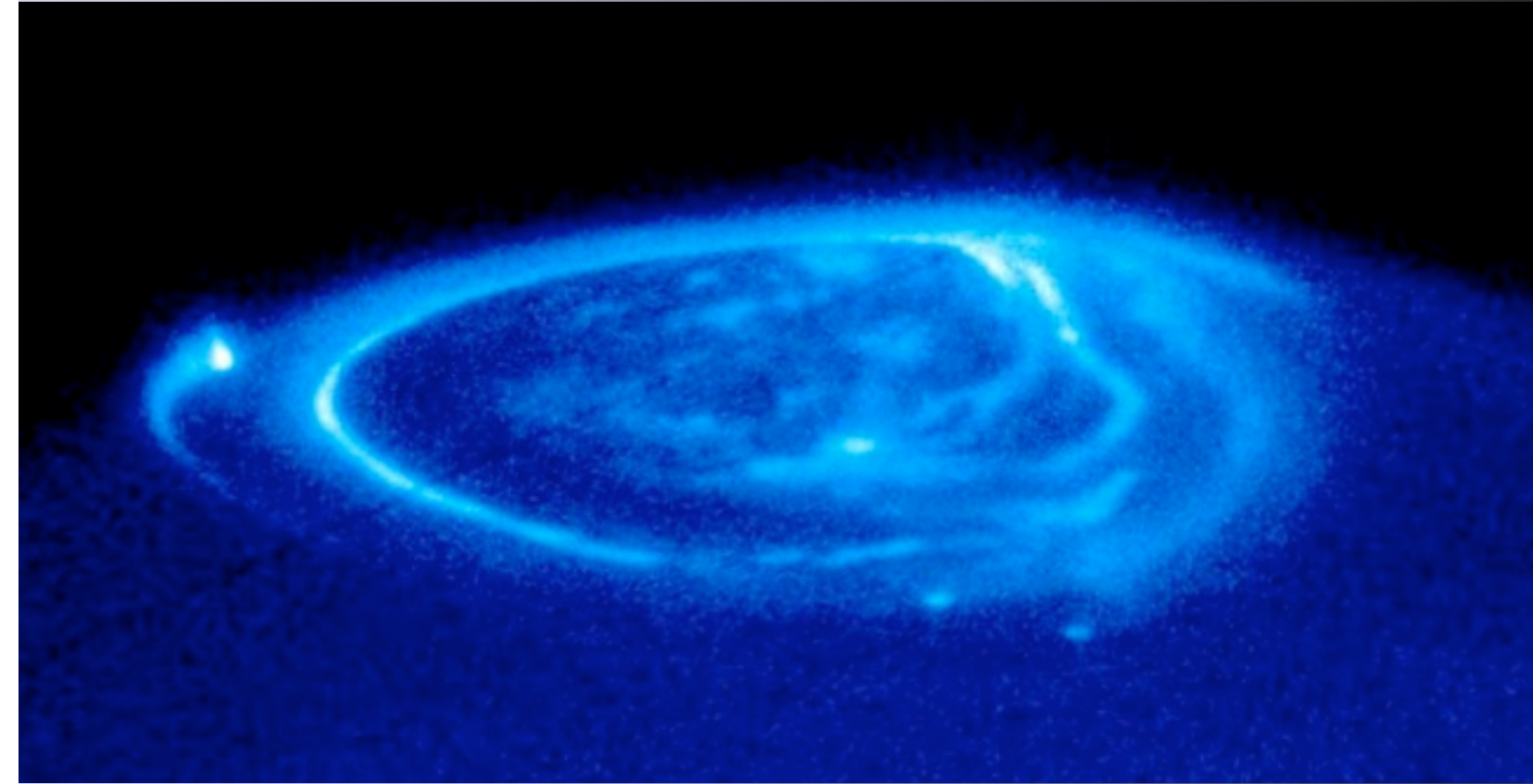
If the traditional interpretation of red-shift is the foundation of the Big Bang theory and it is proven to be incorrect, what then happens to the Big Bang?



Over the last century, even as the Big Bang theory was introduced and gained a popular acceptance, another viewpoint was emerging.

Based on decades of observation and laboratory experimentation this viewpoint offers a compelling alternative to Big Bang cosmology.

Jupiter's high-voltage aurora





"It seems likely that red-shift may not be due to an expanding Universe, and much of the speculations on the structure of the universe may require reexamination."

Edwin Hubble 1947

Galaxy M33

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## electric pioneers



James Maxwell

Nikola Tesla

Irving Langmuir

Kristian Birkeland

Hannes Alfvén

The dominant cosmology of the 20th century held that all of space is a near perfect vacuum in which electricity plays no appreciable role.

But many surprising discoveries have challenged that view. As early as the late 19th century, a number of scientific pioneers saw evidence of *electrical* phenomena in space—and they began to reproduce these phenomena in their laboratories on Earth.

## james clerk maxwell

Considered by many to have achieved the greatest advances of nineteenth century science, James Clerk Maxwell combined the prior work of others (observations and mathematics) into a comprehensive description of electromagnetism.

His work 'unified' electricity and magnetism as aspects of one underlying phenomenon—electromagnetism. For this reason many scientists, including Einstein, considered his contribution as equal to that of Isaac Newton some 150 years earlier.

Maxwell's equations provided the basis for understanding electrical events in space, unknown in his own time.

James Clerk Maxwell  
1831 – 1879



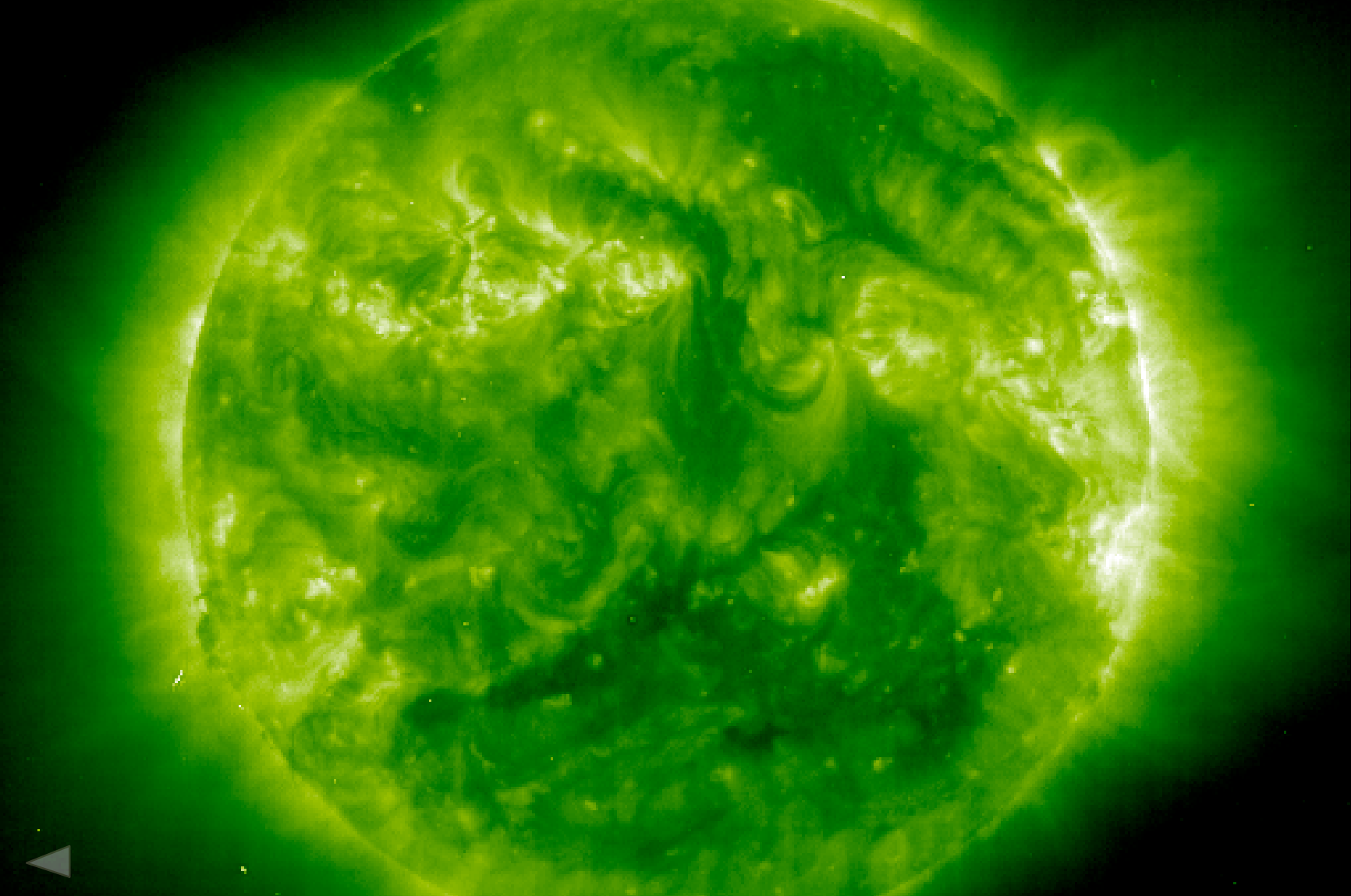




Kristian Birkeland  
1867 – 1917

## kristian birkeland

Nominated for the Nobel Prize seven times, Norwegian physicist Kristian Birkeland based his electrical hypotheses on experiment and observation.



## **auroras**

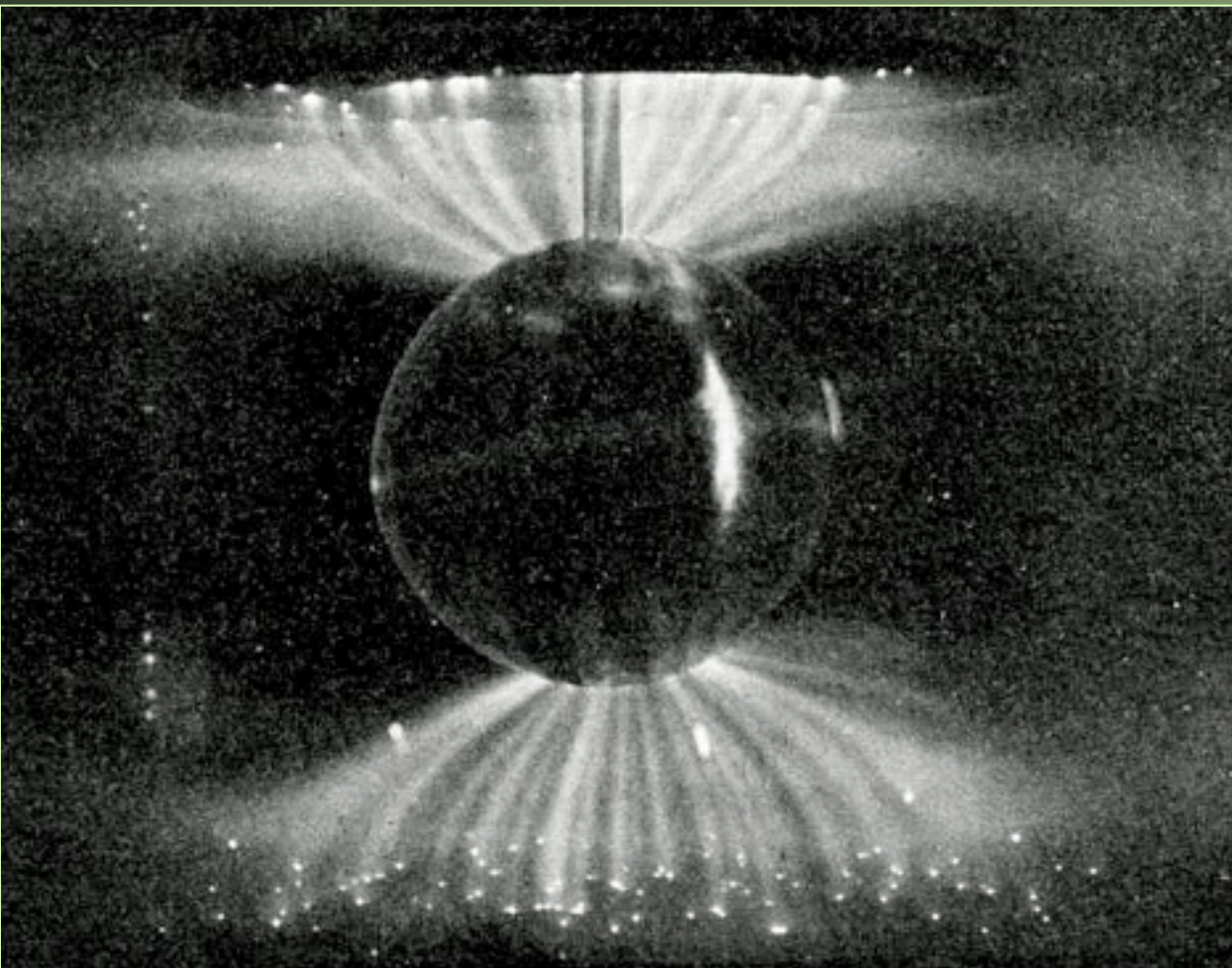
From the findings of Birkeland's Arctic expeditions, he was the first to suggest that the earth's auroras are powered electrically by charged particles from the Sun.

The Sun seen  
in extreme  
ultraviolet light.



For many decades, most astronomers dismissed Birkeland's hypothesis, but in the early 1970's his theory was confirmed when satellites detected electric currents in the auroras ... and these currents could be traced directly to solar activity.





Birkeland's terrella  
("little earth")

## terrella

In his terrella experiments, Birkeland used an electrified globe in a vacuum chamber. His results pointed the way to later explanations of solar activity, auroras on Earth, Jupiter and Saturn, and other electrical activity in the solar system.

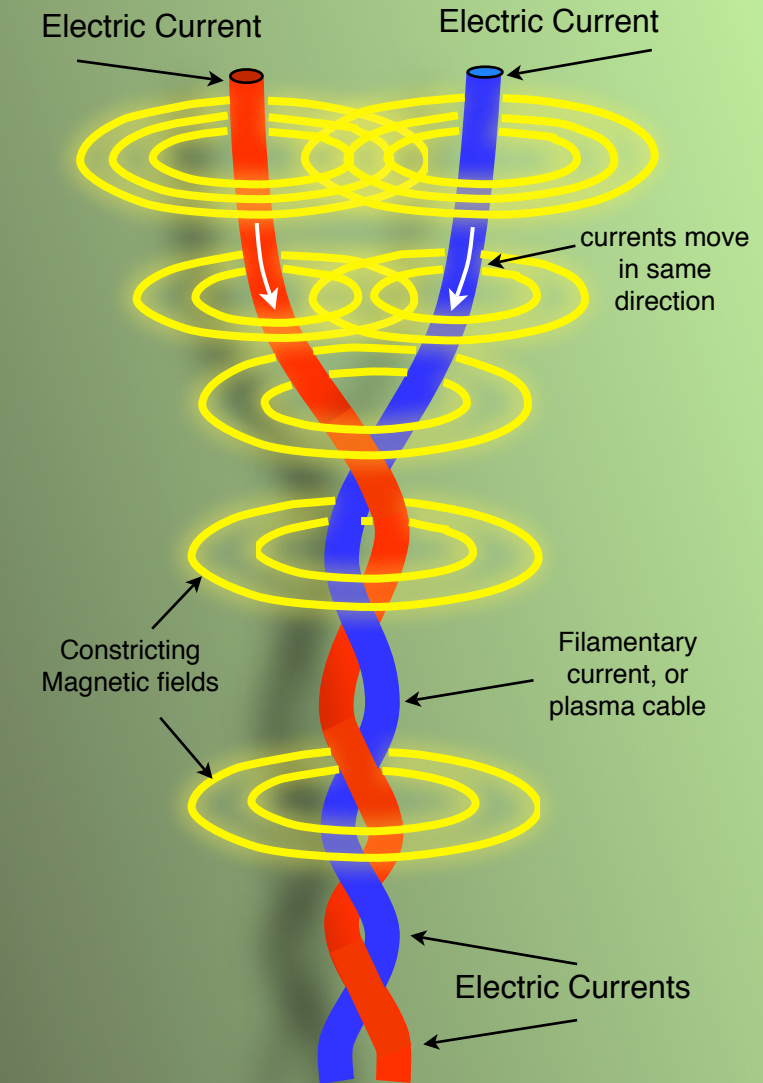


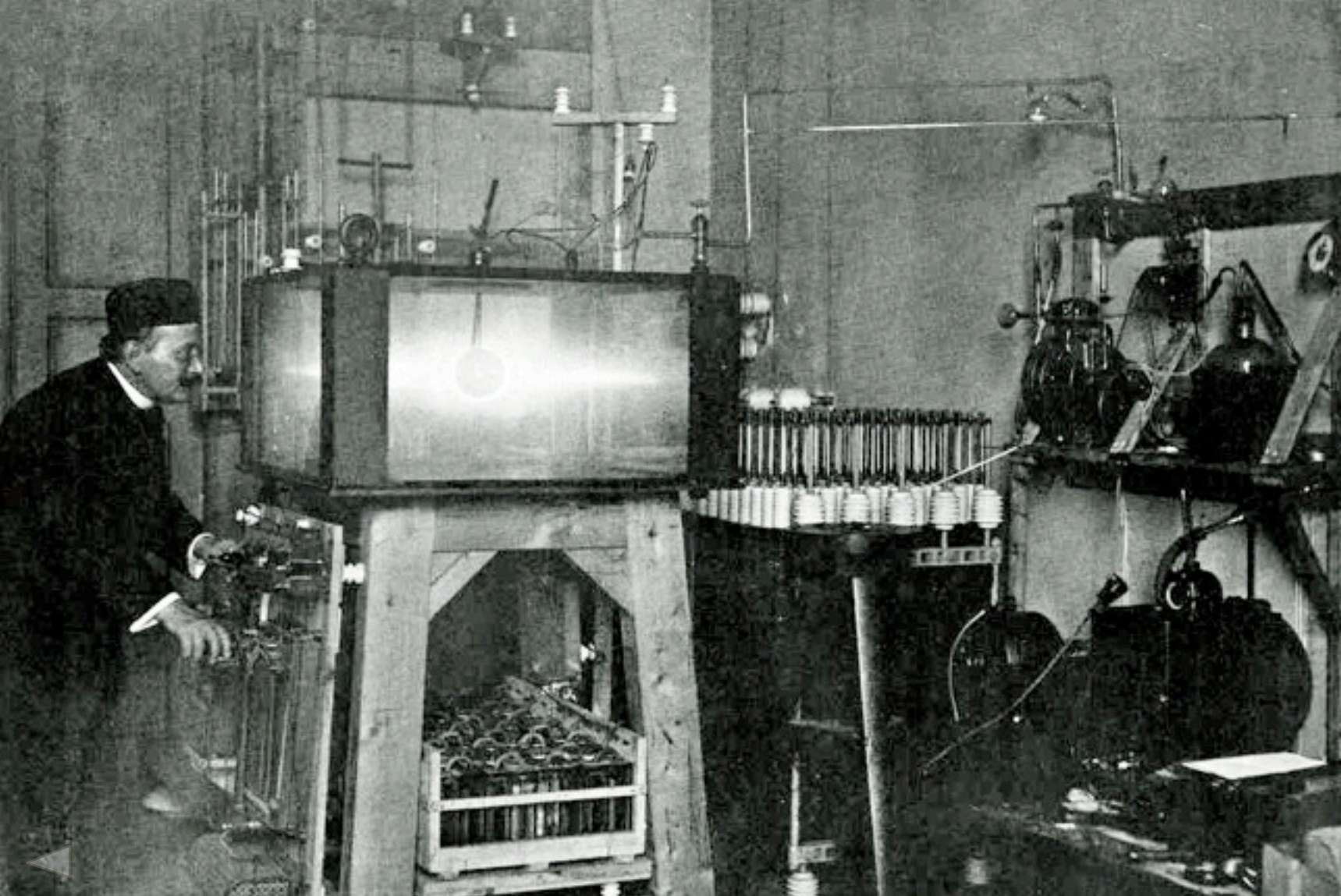
## birkeland currents

Birkeland showed that currents flow along twisted filament pairs shaped by magnetic fields. (Every electric current produces a magnetic field.)

The term 'Birkeland current,' referring to this natural configuration of current flow in plasma, first appeared in the scientific literature in 1969.

Birkeland's Currents





Kristian Birkeland and  
his terrella experiment

## electricity in space

It is likely that Birkeland was also the first to suggest that space is not empty, but is a sea of plasma or charged particles—though the name “plasma” was not yet coined in Birkeland’s time.



A studious observer of celestial phenomena, Birkeland believed that experimental knowledge of electric currents in space could pave the way to a unified cosmology, one "in which solar systems and the formation of galactic systems are discussed perhaps more from electromagnetic points of view than from the theory of gravitation."

"Merging" pair of  
Antennae galaxies





## ‘magnetic ropes’

More recently, NASA's THEMIS spacecraft stunned scientists when it detected giant "magnetic ropes" that reached all the way from the earth to the Sun—a pathway for the charged particles from the Sun.

For those who have followed the discoveries of electrical activity in space, this was no surprise. Thanks to space age technologies, the THEMIS instruments had identified the pathways of the Birkeland Currents from the Sun to the Earth, the very current streams that light the auroras.

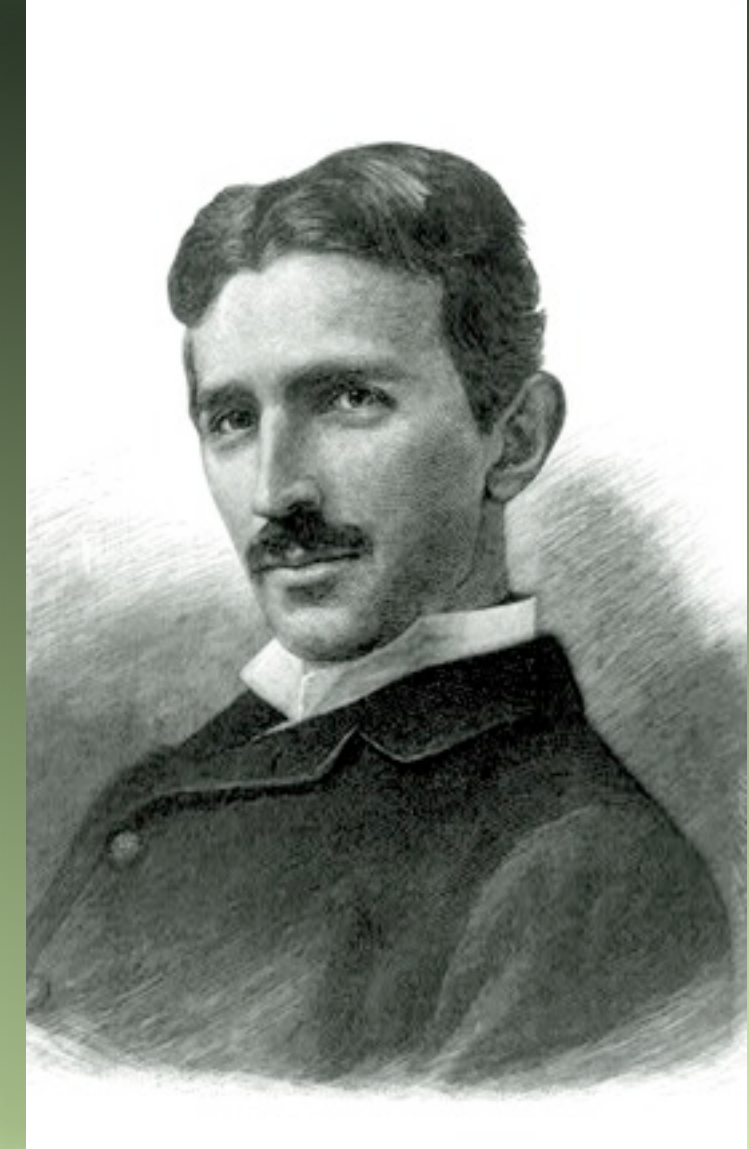


## nikola tesla

Best known for his demonstrations of the advantages of alternating current, Nikola Tesla also produced the first AC induction motor and the first demonstration of wireless communication (radio).

In his laboratory in Colorado Springs he conducted numerous high voltage experiments, producing artificial lightning with discharges of millions of volts with what came to be known as the 'Tesla coil.'

Nikola Tesla  
1856 – 1943





## experiments with lightning

The “lightning” discharges from Tesla coils have provided backyard experimenters with numerous opportunities to explore the behavior of electric arcs.

Distinctive features include the braiding of filaments, dendritic branching patterns, and the common parallelism of discharge streamers, all bearing directly on the understanding of electric discharge events in space.

Tesla Coil at Questacon,  
the National Science and  
Technology center in  
Canberra, Australia

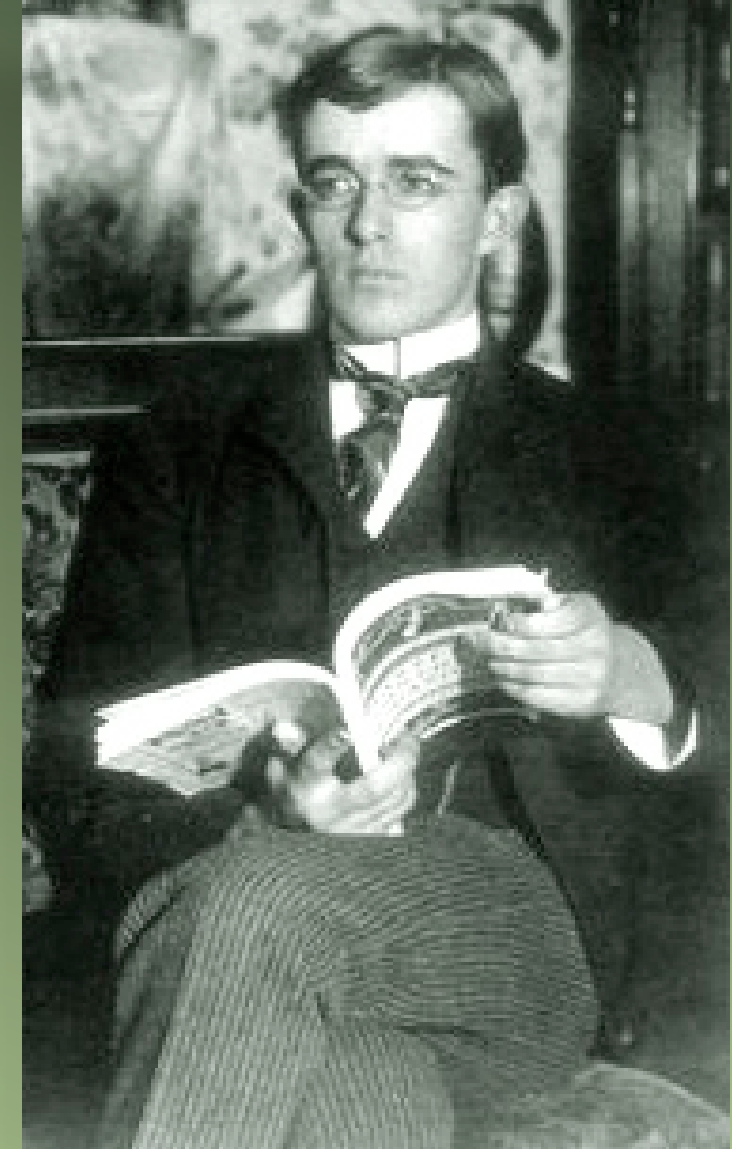




## irving langmuir

A distinguished physicist and chemist, Langmuir was the first industrial chemist to receive the Nobel Prize. It was Langmuir who employed the word 'plasma' to describe ionized gas. The life-like behavior of charged particles in this unique state of matter reminded him of the qualities of blood plasma.

Irving Langmuir  
1881-1957

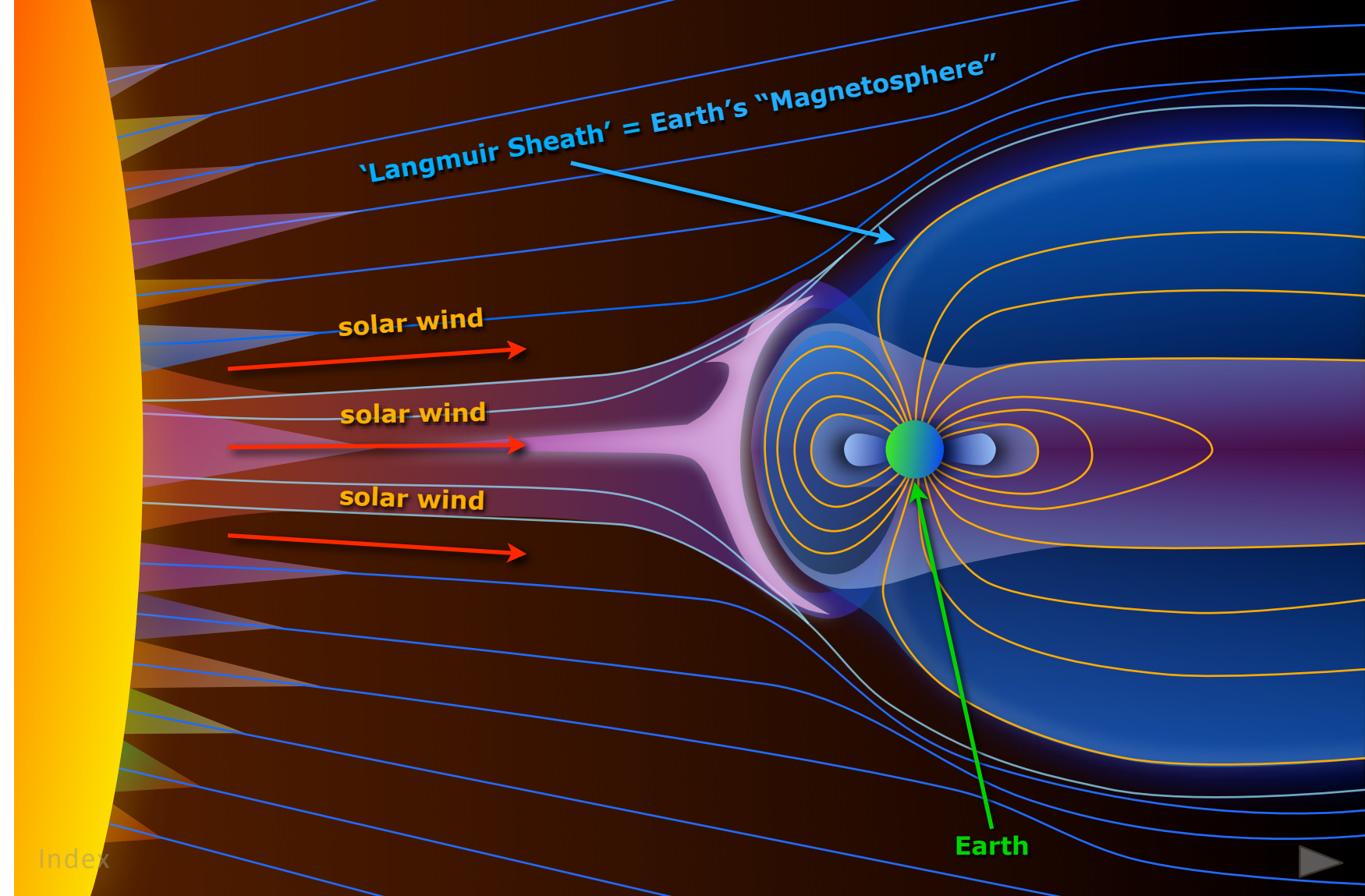


## ‘langmuir sheaths’

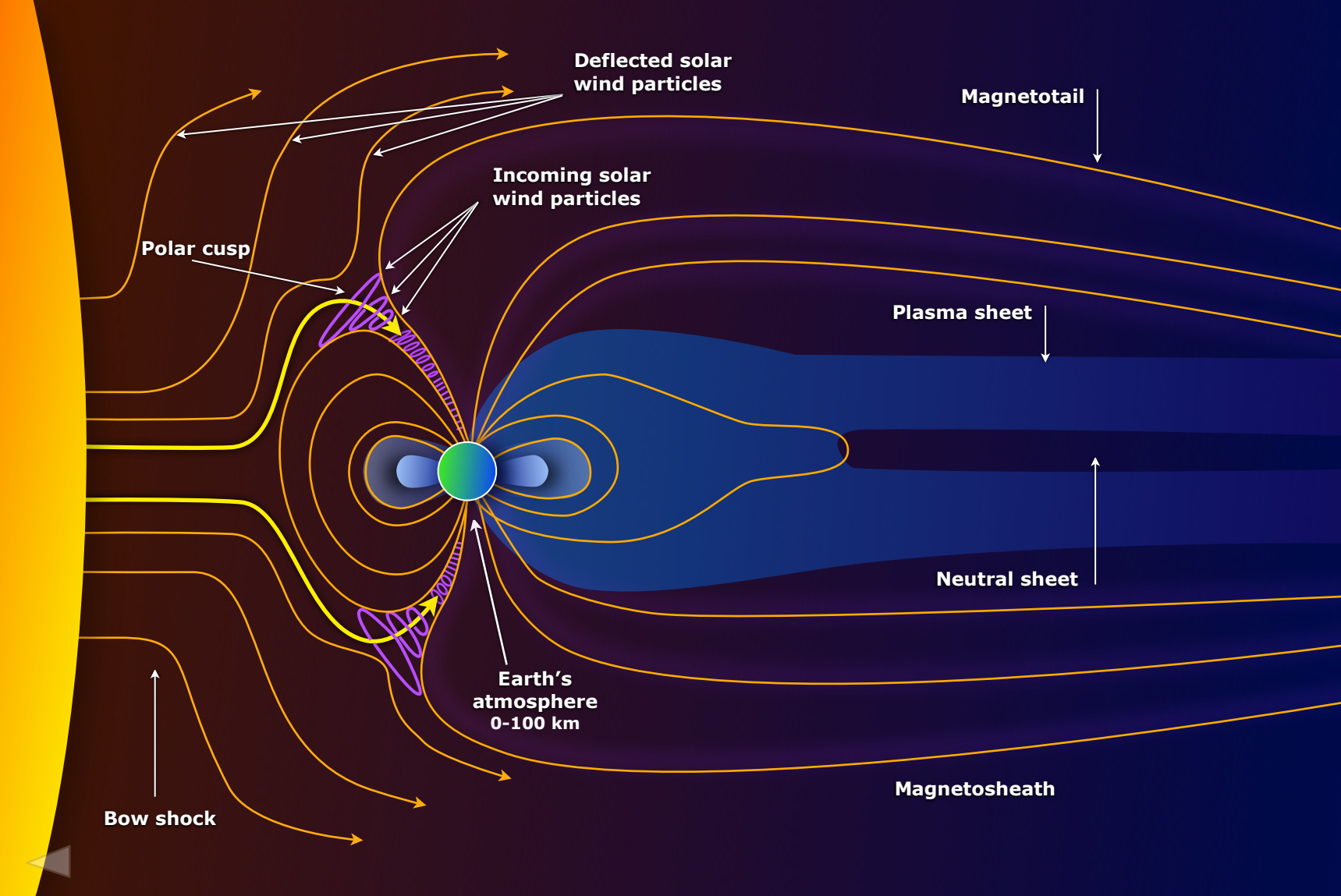
Langmuir observed that plasma responds to charged objects by producing a cellular wall—now called ‘Langmuir sheaths’—around the objects.

The plasma sheaths around planets (commonly called “magnetospheres”) are an example of such behavior.

Graphic rendition of the Earth’s magnetosphere and its structural relationship to the solar wind.







The arterial flow of electric current and cellular formations in plasma require special attention by those seeking to understand the nature of stars and the responses of planets and moons to their plasma environment.

Schematic of Earth's magnetosphere, illustrating its internal structure, including the pathways of charged particles from the Sun flowing into the polar regions of Earth's atmosphere. These particle streams are the source of the Earth's auroras.



## hannes alfvén

Often called the founder of modern plasma physics, the Nobel Prize-winning Swedish physicist Hannes Alfvén built upon the work of Kristian Birkeland and others, establishing a revolutionary model for the role of plasma and electricity in the cosmos.

Hannes Alfvén  
1908-1995

# plasma

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According to the evidence from satellites and space-based telescopes, 99.9% of the visible Universe appears to be made up of plasma.

It is now acknowledged that magnetic fields pervade the Universe, and Alfvén noted that these fields cannot exist without *electric* currents.

Star formation and dust  
in the galactic plane.



Astronomers often refer to plasma as a “hot gas”. But it conducts electricity, is influenced by magnetic fields, and has properties not normally associated with a gas.

Plasma in space is *almost* electrically neutral, but as differing plasma regions move with respect to each other electric currents will be generated in the plasma.

Birkeland currents will form as charged particles move in alignment with the local magnetic field—the most efficient path for electric currents in space plasma. These Birkeland currents act as cosmic power transmission lines in deep space.

Eagle Nebula







Astronomers observe "surprising" X-ray and radio emissions in space. The *gravitational* model requires exotic, invisible, and inconsistent theoretical inventions to explain these observations.

Working from a new model, plasma physicists are able to explain these observations using *known* and well proven science. More than that, they can reproduce the phenomena in the laboratory in a manner that exemplifies the scientific method.

Composite X-ray and optical  
images of galaxy NGC512.

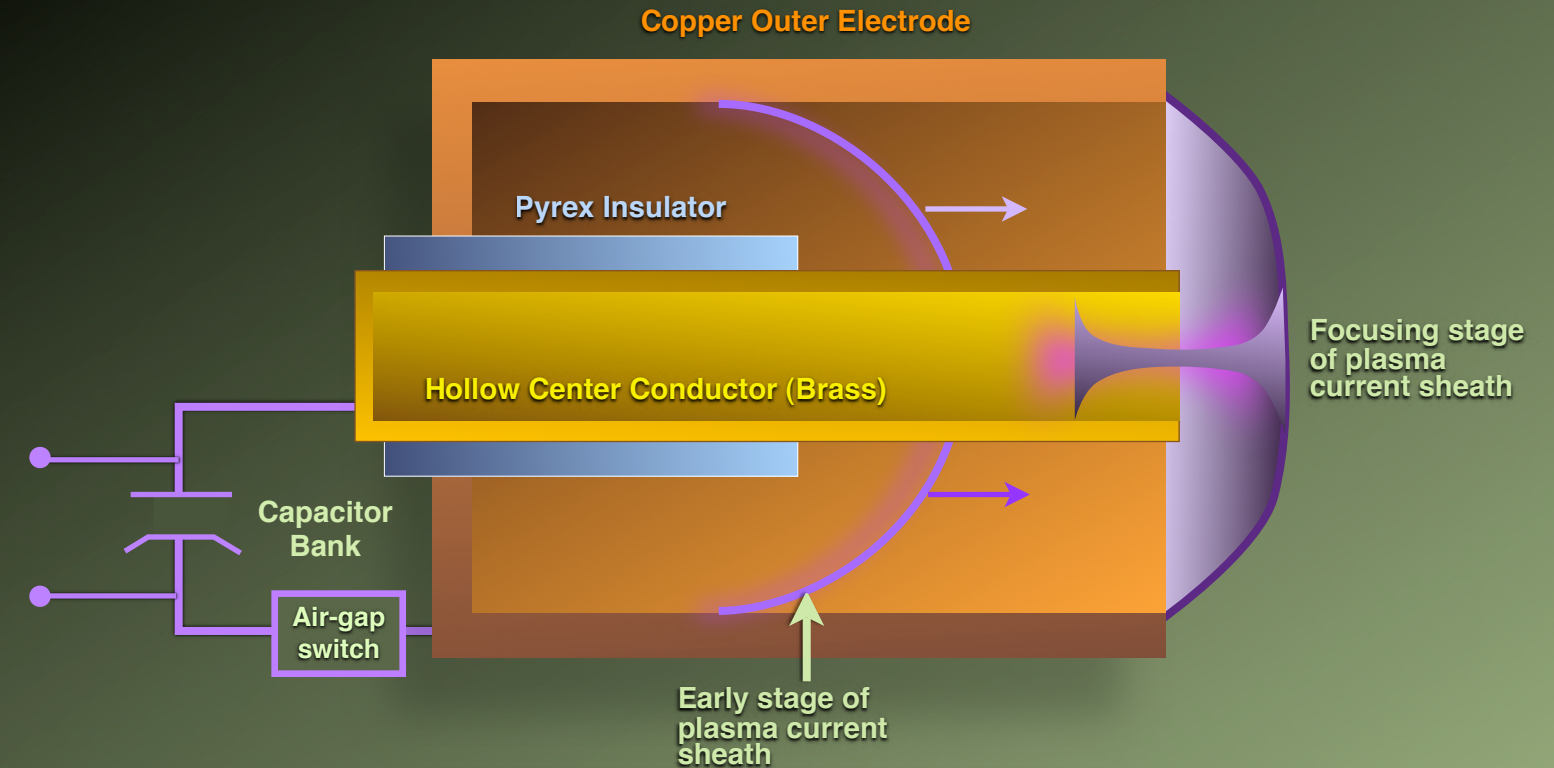


## plasma gun

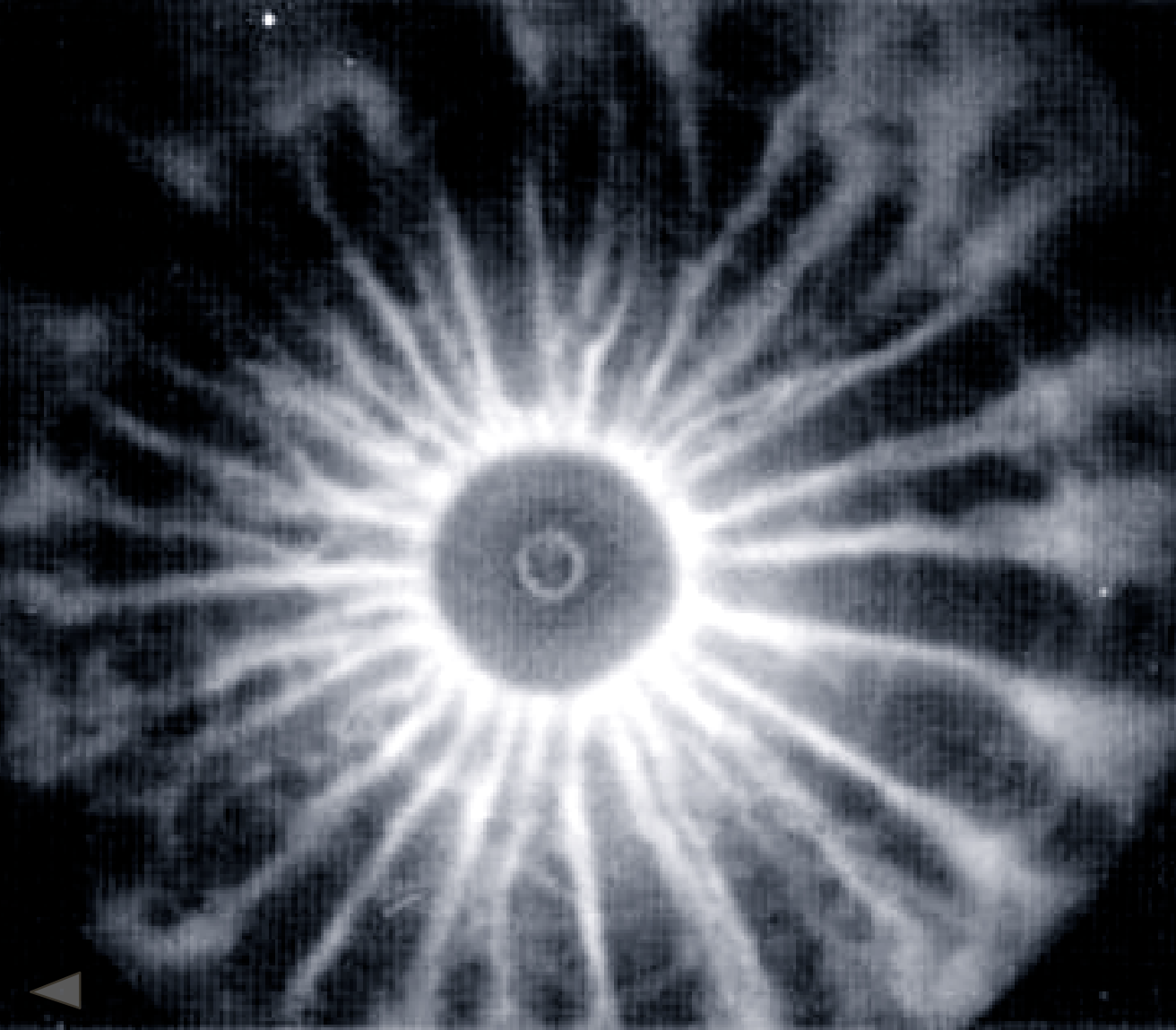
Revealing plasma experiments include the dense plasma focus device (right) that concentrates enormous electrical energy into an exceedingly small source region.

This apparatus enables researchers to study plasma physical processes at energy concentrations similar to those in extraordinary stellar events—such as supernovae or at the centers of active galaxies.

Laboratory work with particle beams and radiation reveals striking similarities to high-energy plasma events in space, including the highest-energy synchrotron radiation, that caught astronomers by surprise.







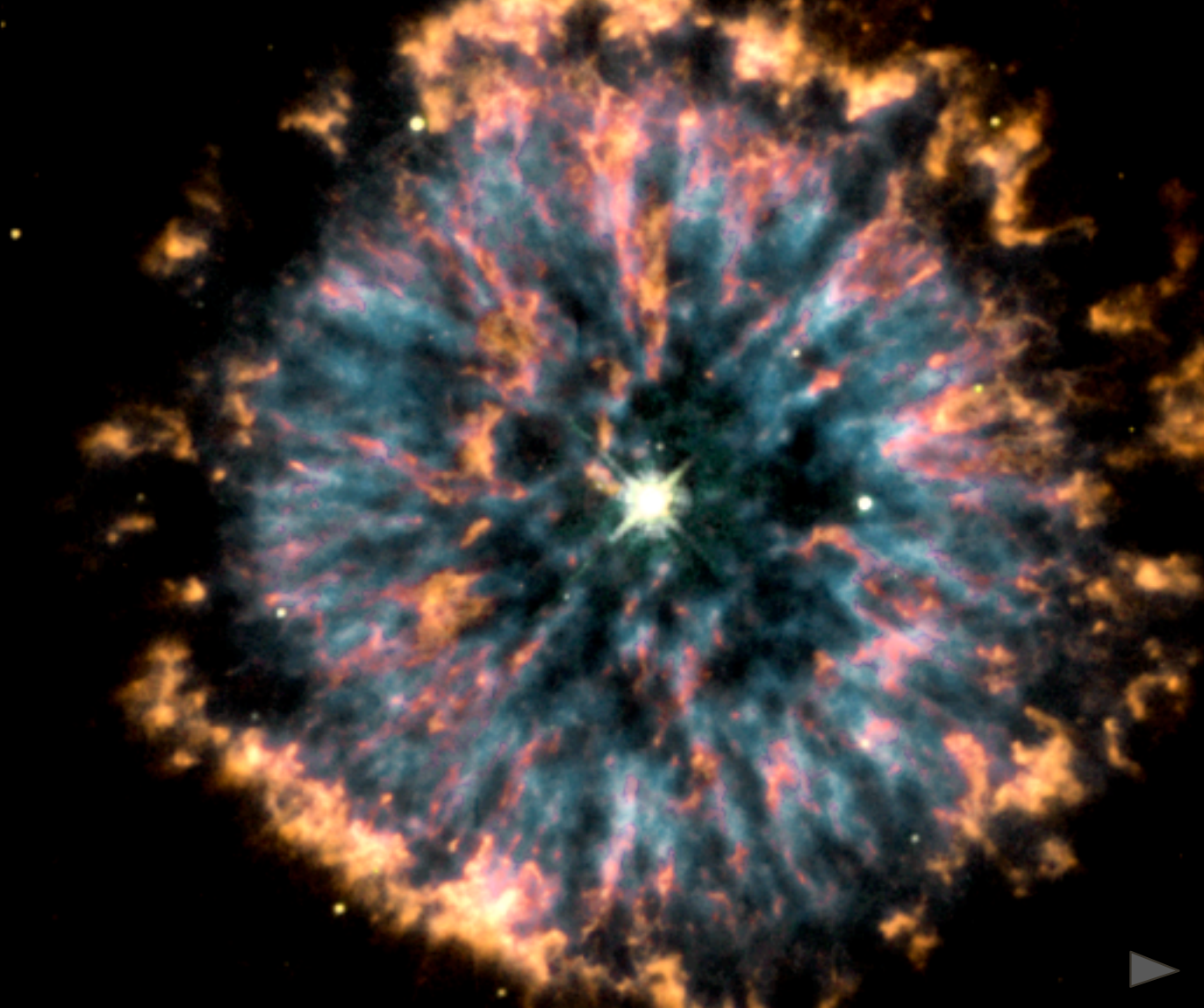
Particle beams in a  
dense plasma focus,  
forming pairs of vortex  
filaments.

Looking down the barrel  
of the plasma gun.

The central donut  
(plasmoid) at the focus  
is only about 1 mm  
across and concentrates  
all of the energy from  
the capacitor bank.

NGC 6751  
the 'Glowing Eye'  
nebula.

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The Orion nebula in  
infrared, ultraviolet  
and visible-light colors.

Electric currents across cosmic distances have the power to shape cosmic structure, spin galaxies, illuminate planetary nebulae, energize the stars, light the sun, generate planetary auroras, and create spectacular comets.

It is becoming apparent to some scientists that the powerful electric force dominates on the larger scale in the universe. Compared to the electric force, the weaker force of gravity plays a minor local (solar system) role.



In 1970, in his acceptance speech for the Nobel Prize for Physics, Hannes Alfvén admonished his colleagues that their models must ultimately fail if they ignored experimental plasma science and the role of electric currents in space.

Those who followed in the footsteps of Alfvén and the other 'electric' pioneers have continued to develop the electric model that is now capable of explaining much of the phenomena that the traditional, gravity-based, model cannot.

Hannes Alfvén receiving the Nobel Prize for Physics, from the King of Sweden, 1970.







"Perhaps in no scientific discipline other than cosmology have so many theories got by on so little positive evidence; imagination has had free rein, often at the expense of common sense."

C. E. R. Bruce  
Electric Fields in Space,  
Penguin Science Survey 1968

**Galactic Cloud**

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# electricity is the solution

In the 'electric' model of cosmic evolution, it was primarily electromagnetic forces that organized matter throughout the Universe.

The mysterious x-rays, gamma rays and extreme ultraviolet radiation detected in celestial gas clouds and galactic jets are not a mystery, but something that is *expected*, based on experiments in plasma laboratories.





## cosmic 'structures & voids'

According to the Big Bang theory, it was gravity alone that organized the rapidly expanding primordial cloud into cosmic structure (galaxies, stars, planets).

Eagle Nebula



Everywhere we look, we observe that the distribution of matter is highly *uneven*.

Both the concentrations of matter (galaxies, stars, planets) and the "voids" (empty space) between these concentrations, appear to contradict the original assumptions of the Big Bang theory.

Galaxy N1333





In the vacuum of space, gases will immediately disperse to fill every void. How a hot, dispersing cloud would ever give rise to concentrated masses and centers of gravity remains an unanswered question.

Subaru Magnetic Field



### the 'electric' model:

However, there is another force that can be attractive *or* repulsive and is almost infinitely more powerful than gravity — the electric force. It is routinely ignored in astronomy because theorists *assume* charge separation does not occur across cosmic distances.

But in space plasma, due to the overwhelming superiority of the electric force, a single charged particle amidst 10,000 neutral particles is sufficient to cause electromagnetic forces to dominate gravity.

**Electric force is...**

**1,000,000,000,000,000,000,000,000,000,000,000**

**...times stronger than gravity.**



Galaxy M33C

If the electric force is responsible for organizing galactic structure, then it should be possible to demonstrate this through simple laboratory experimentation.

And such experiments have been done, with extraordinary success.



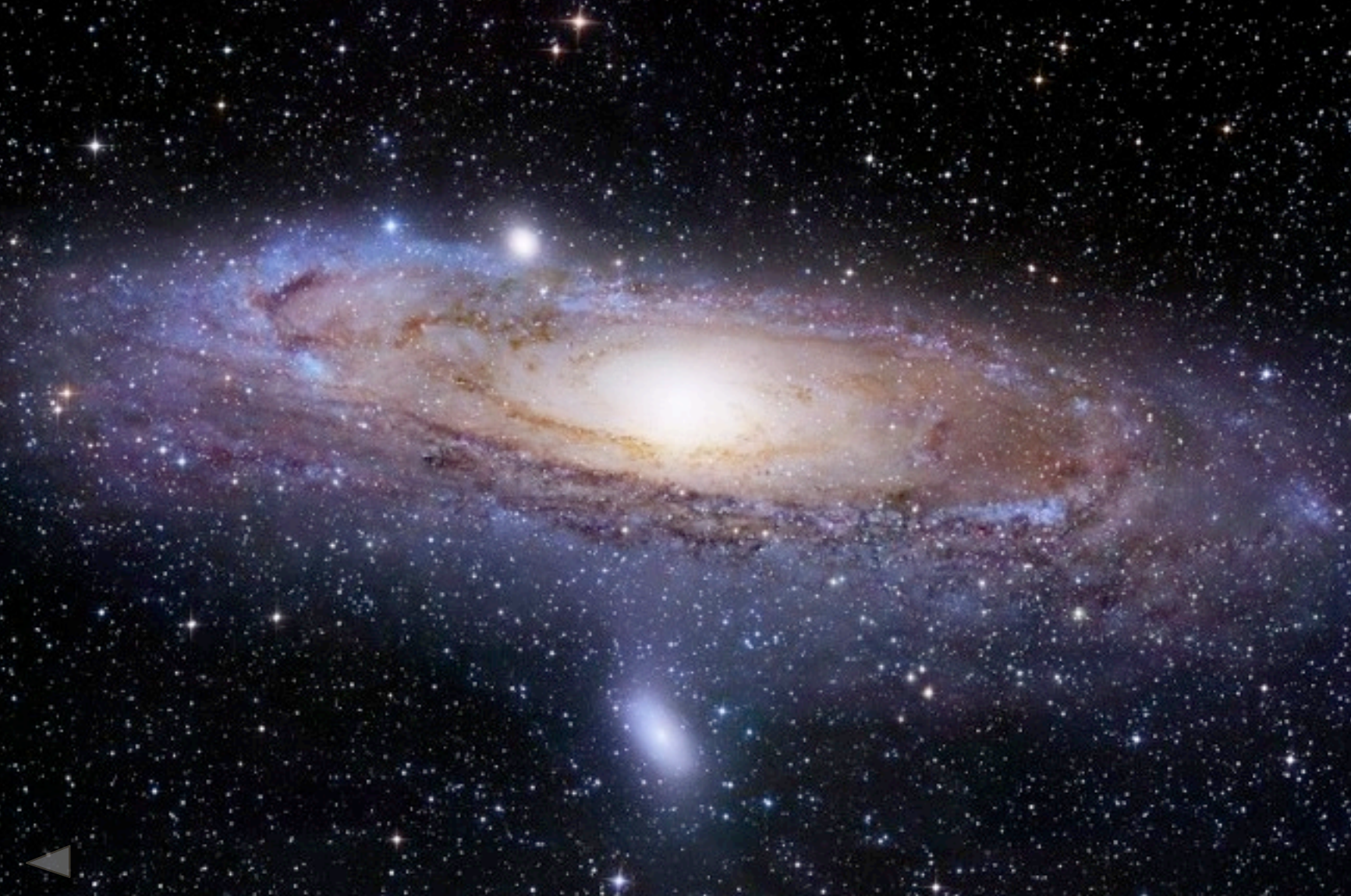
This is a photograph of Spiral Galaxy M81 [right]. Above and below are snapshots from a computer simulation by plasma scientist Anthony Peratt, illustrating the evolution of galactic structures under the influence of electric current filaments in plasma.

Through the "pinch effect", parallel currents converge to produce spiraling structures.

Spiral Galaxy M81







Spiral Galaxy M31

Computer models, based on verified plasma science, show that two current filaments interacting in plasma can reproduce the fine details and motion of spiral galaxies.

Through the 'pinch effect', parallel filaments converge to produce vortexes and spiraling forms.

In contrast, computer simulations based on the *gravity-only* model must *assume* an initial rotation and then rely on "dark matter" placed wherever it is needed to force the simulation to duplicate what is observed in space.



As demonstrated decades ago by Alfvén and others, plasma phenomena are eminently scalable—under similar conditions plasma discharge will produce the same basic patterns at laboratory, planetary, stellar, and galactic levels.

Duration is proportional to size as well. A spark that lasts for microseconds in the laboratory may continue for days at planetary or stellar scales, or for millions of years at galactic or intergalactic scales.

Planetary Nebula M2-9





The energetic stellar jet vortex of HH (Herbig Haro) 49/50, as seen through the Spitzer Space Telescope

## excessive energies

Adding to the mystery of cosmic structure are the narrow, coherent jets of material (plasma) spanning vast distances across the 'vacuum' of space. With the discovery of 'Herbig Haro' objects, or 'jetted stars', astronomers scrambled for explanations.

Released gases normally dissipate explosively in a vacuum. What could possibly hold these filamentary jets together across distances spanning light years? (That's up to *trillions* of miles; a light year is the distance traveled by light in a year, moving at 186,000 miles per second.)

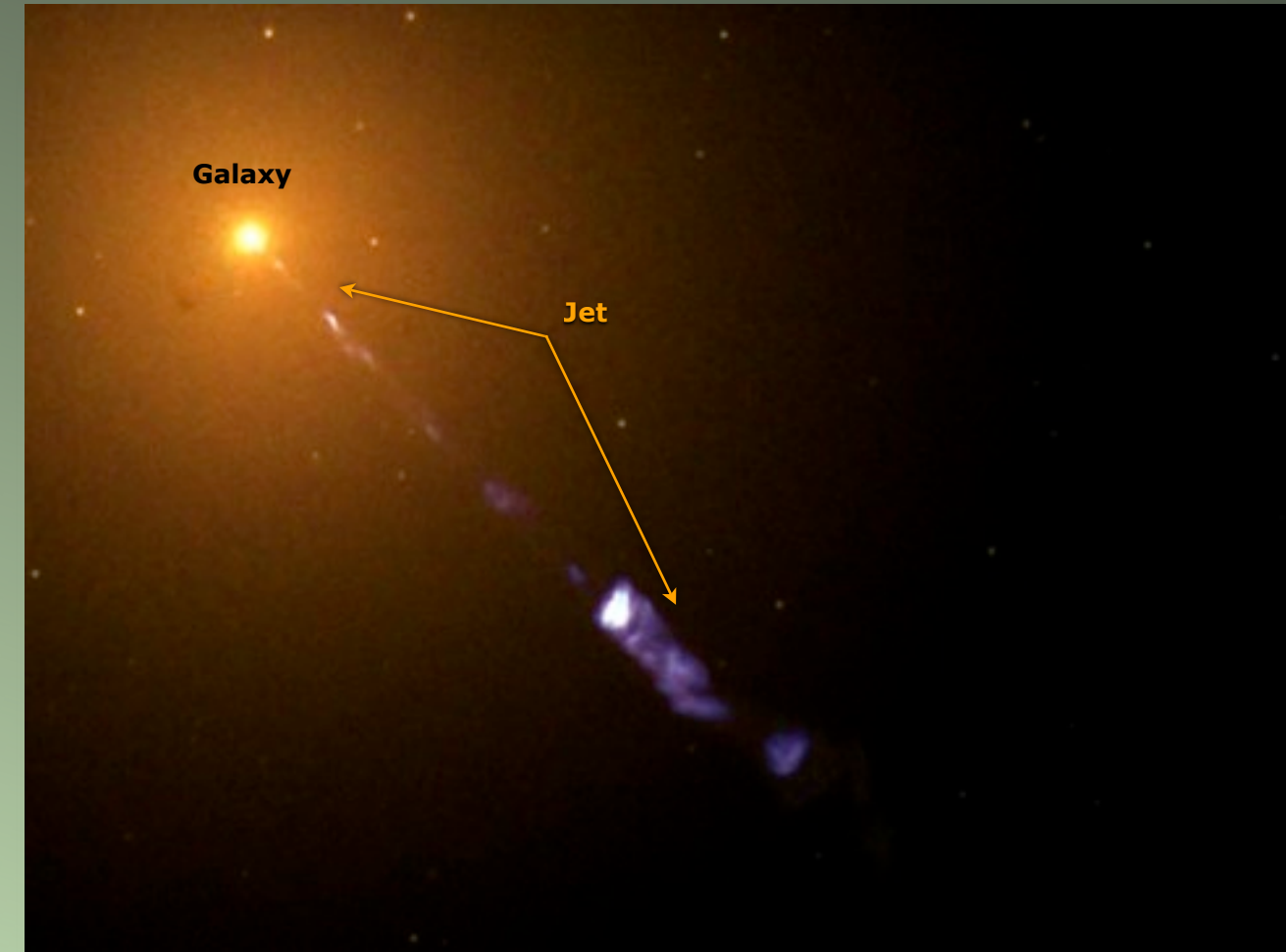


Galaxies now pose an even bigger problem than jetted stars. The confined jets of numerous 'active' galaxies reach up to *hundreds of thousands of light years*.

Few astronomers claim to understand how such jets could be created and maintained across such distances. According to a NASA release, "the most popular hypothesis holds that the jet is created by mysteriously magnetized gas swirling around a massive black hole at the galaxy's center."

But no mechanical process generating "swirling magnetized gases" to produce such an effect has ever been demonstrated.

Hubble Telescope image of a jet from the galaxy M87, spanning thousands of light years





False color image of the nearby radio galaxy, Centaurus A, showing unexpectedly high energy events. Spectacular jets along both axes of the galaxy emit high-energy synchrotron radiation—including radio (red), infrared (green) and X-ray (blue) wavelengths.

Surprising structures in space frequently exhibit extraordinary energies.

One of the most astonishing discoveries was the abundant galactic emission of *synchrotron radiation*. This is radiation at the highest energy levels, requiring an acceleration of electrons on a curved path *in a magnetic field* to nearly the speed of light.

In a gravity-only environment there is no plausible mechanism for creating the magnetic field or radiation of such intensity.

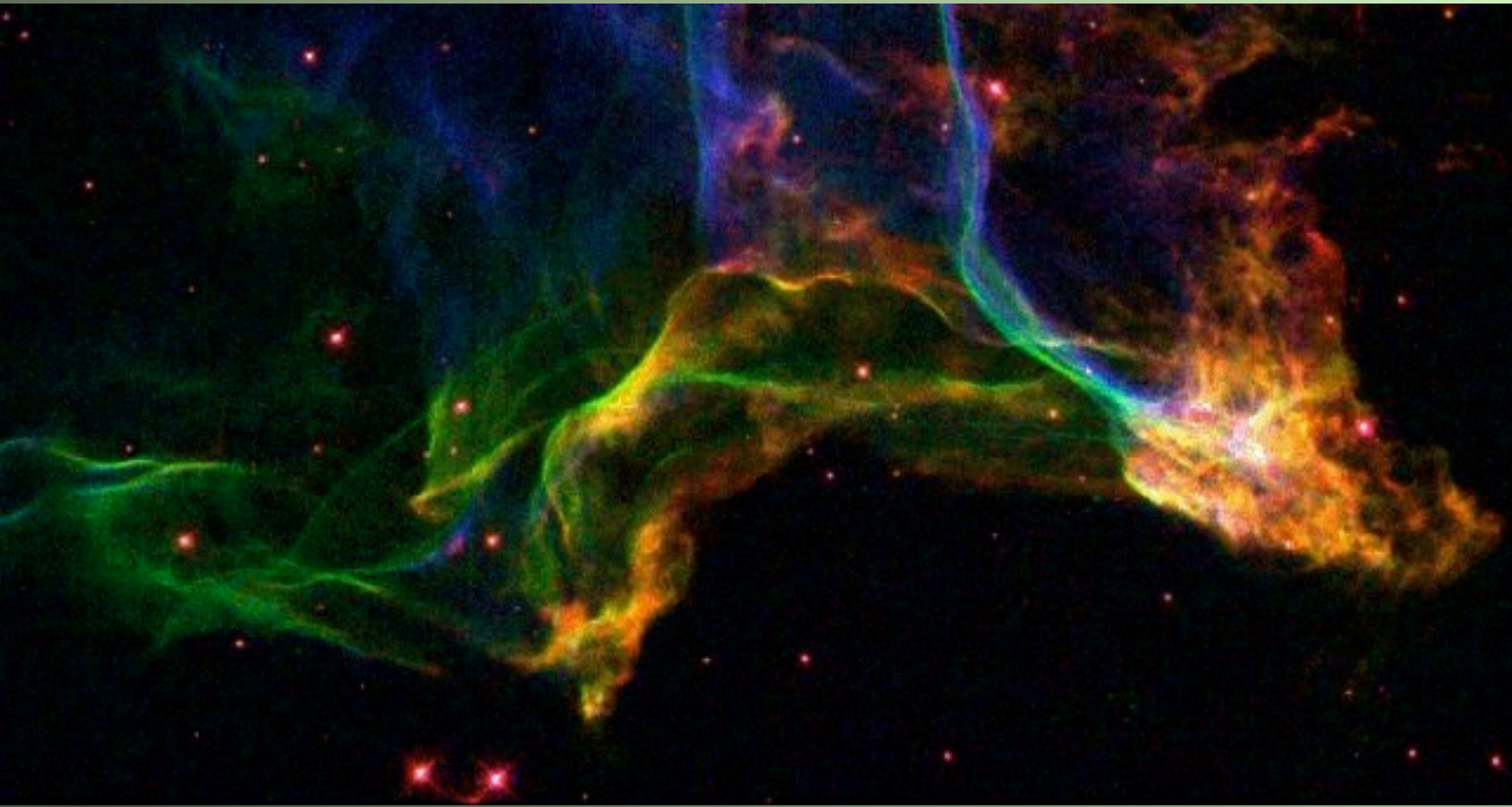


### the 'electric' model:

Electric discharges form jets naturally. In particular, the simple plasma focus gun described earlier shows how prodigious electrical energy can be stored in a tiny plasma donut, or plasmoid.

When the plasmoid breaks down, it forms intense polar jets. The electric current of the jet generates its own magnetic field which maintains the helical, pencil-thin beam over vast distances.





The Cygnus Loop is the remnant of a supernova explosion about 1400 light-years away.

## filamentation

From planetary nebulae to clusters of galaxies, we observe fine *filamentary* structure everywhere in deep space. What force creates and maintains these entwining filaments across cosmic distances?

Astronomers call the filaments of Cygnus Loop [left] “shocked interstellar gas” from a supernova believed to have occurred about 20,000 years ago.

Both the filamentation and the well-defined sorting of elements (oxygen-blue, sulfur-red, and hydrogen-green) remain paradoxical.



### the 'electric' model:

The "shocked gas" model requires cold gas to pre-exist in deep space for a collision to occur. It supposes that we are seeing the edges of a shocked surface.

The electric model does not require an invisible gaseous environment. Each filament glows with electrical energy. The current filament scavenges gas from its vicinity and often exhibits pairing of filaments in a helix — a configuration that cannot be explained by a mechanical collision.

NGC6992 "Veil Nebula"  
Supernova remnant in  
Cygnus





## dynamic interactions between galaxies

In a Big Bang 'expanding' universe it is particularly difficult to account for dynamic interactions *between* galaxies. The space between galaxies is supposed to be increasing.

More powerful telescopes, however, have revealed astonishingly dynamic interactions between galaxies, often called "collisions" or "mergers"—the one thing prohibited by the original Big Bang hypothesis.

NGC 3808 and its  
companion NGC 3808A

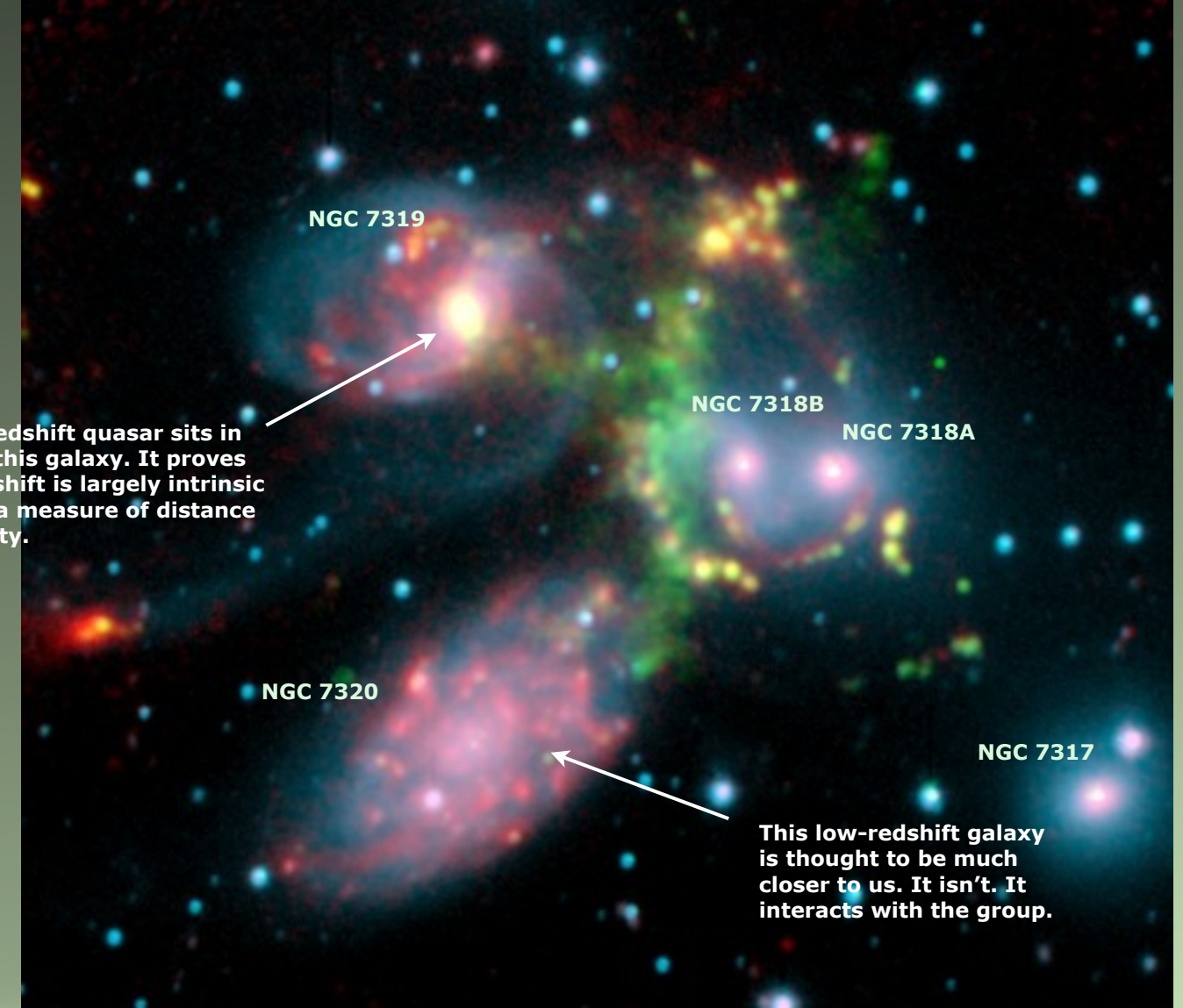


This false-color image [right] of the Stephan's Quintet galaxy cluster supposedly shows a shock wave (green arc), produced by one galaxy falling toward another at over a million miles per hour.

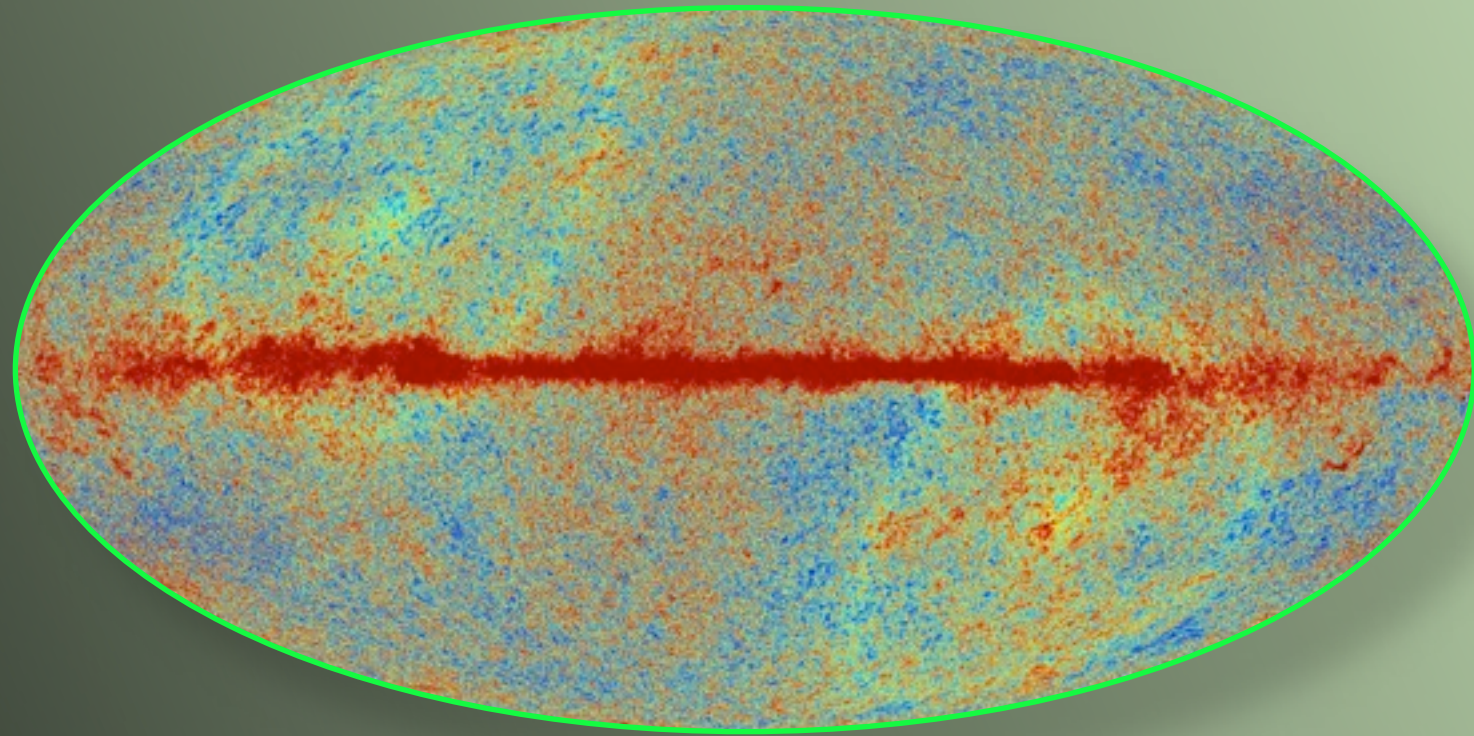
But by the astronomers' own measurement (redshift) the affected galaxies are *not* supposed to be falling toward each other. So no "collision" should be occurring.

Galactic interactions produce high temperatures. In a plasma universe, electrical interactions are to be expected. The green arc in the accompanying image is simply lit by electrical discharge. The high energies radiated by the arc exceed anything that could be plausibly explained by "colliding gases" in a vacuum.

**A high-redshift quasar sits in front of this galaxy. It proves that redshift is largely intrinsic and not a measure of distance or velocity.**



**This low-redshift galaxy is thought to be much closer to us. It isn't. It interacts with the group.**



WMAP (Wilkinson Microwave Anisotropy Probe): the first full-sky, high-resolution map of the microwave sky.

## cosmic microwave background

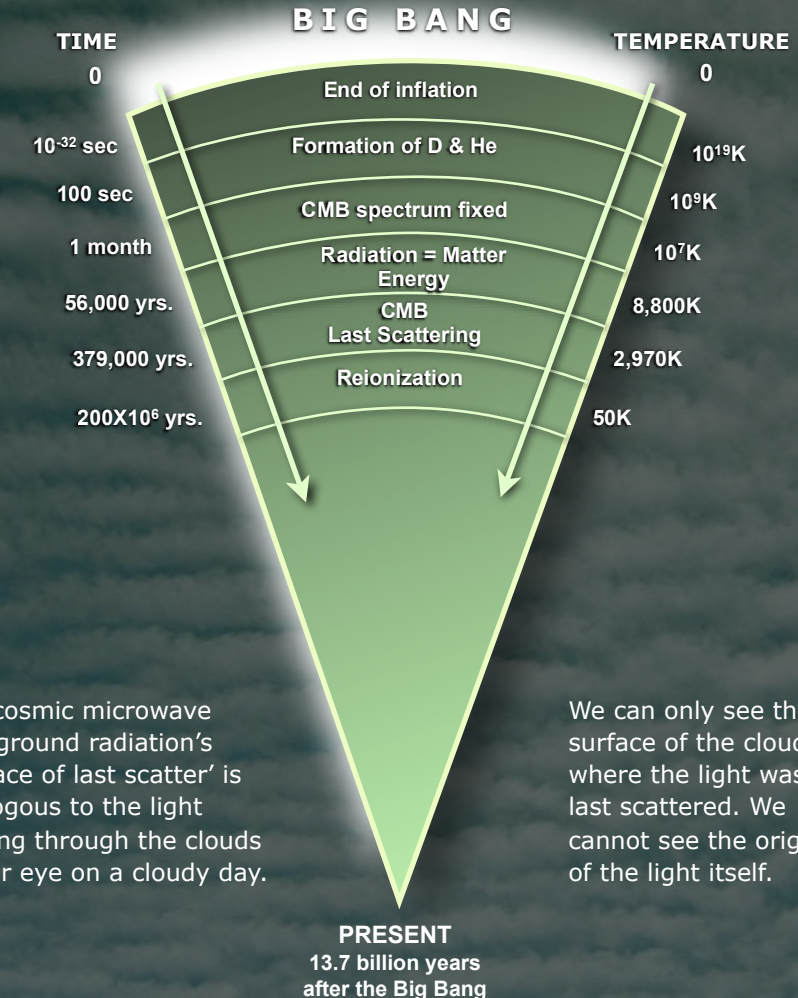
A detectable “background temperature” (electromagnetic radiation) in the heavens is called the *Cosmic Microwave Background* (CMB). It was first measured in 1964, and is now given at 2.75 degrees Kelvin, which is 2.75 degrees above ‘absolute zero’ and very cold.

Proponents of the Big Bang, see this as a residual temperature of an expanding and cooling universe 13.7 billion years after the event. The CMB is often given as the first and “best” evidence for the Big Bang.



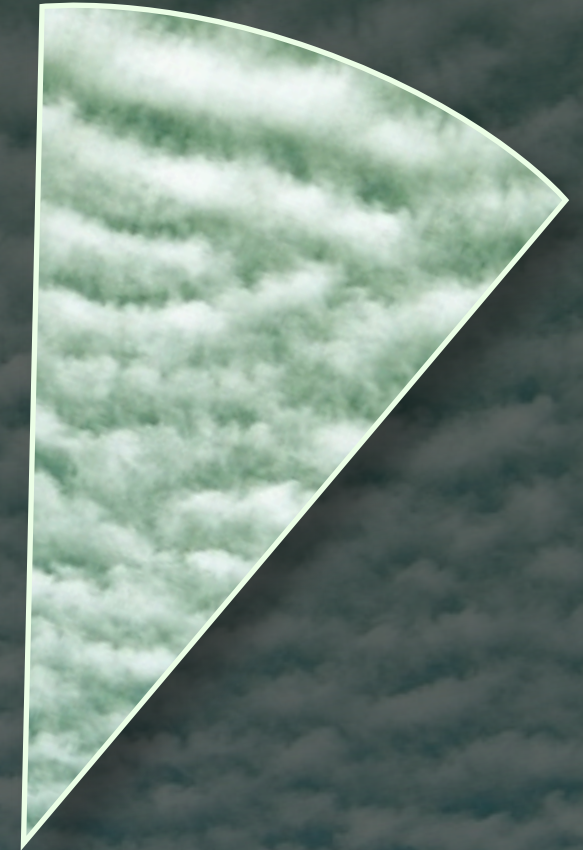
Measurements of cosmic background radiation (CMB) are critical to cosmology, since any proposed model of the universe must explain this observed radiation.

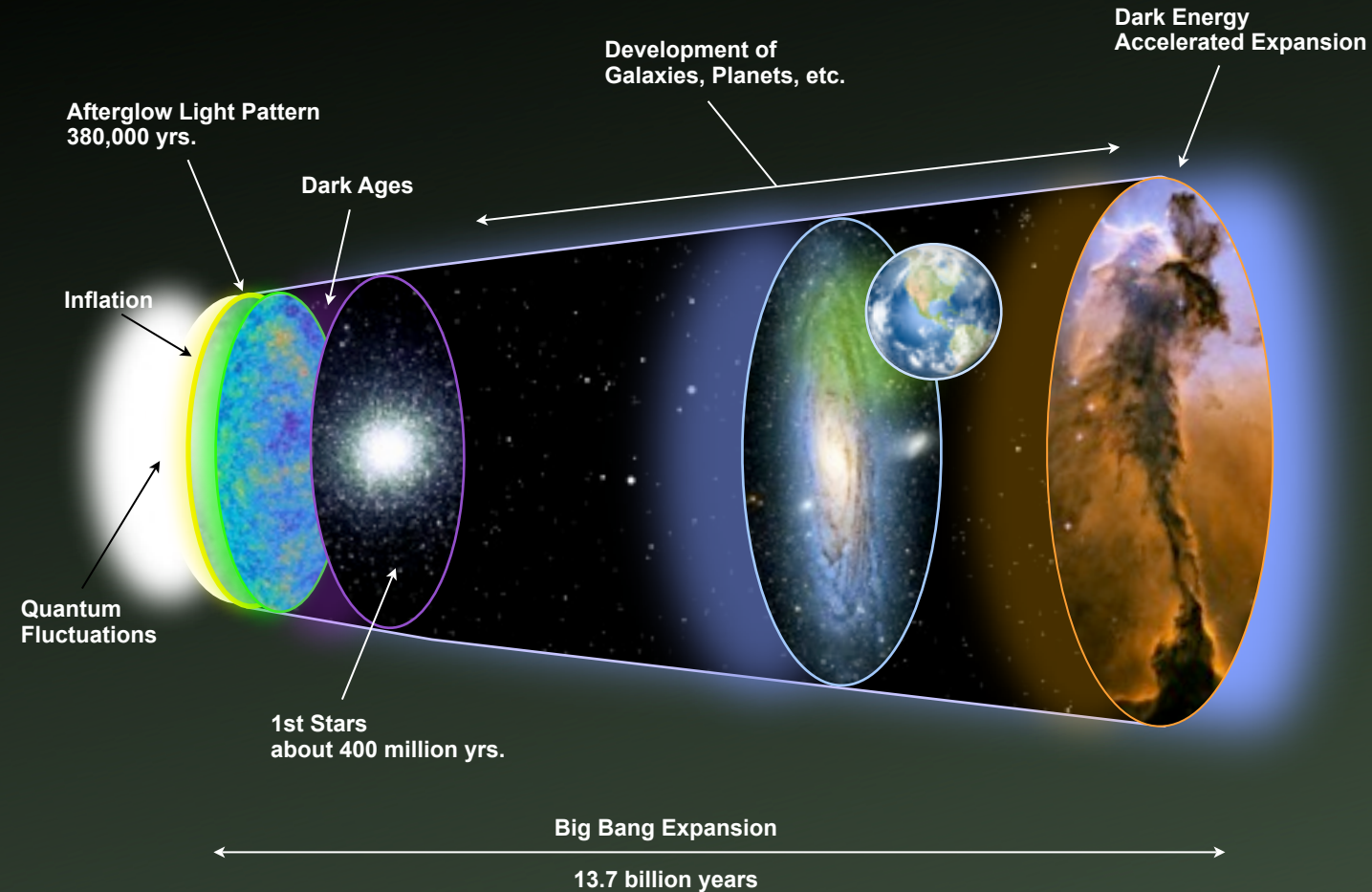
However, critics point out that Big Bang theorists made the most inaccurate predictions of the CMB before its discovery. "In no sense did the Big Bang theory predict the microwave background," wrote noted astronomer, Geoffrey Burbidge.



The cosmic microwave background radiation's 'surface of last scatter' is analogous to the light coming through the clouds to our eye on a cloudy day.

We can only see the surface of the cloud where the light was last scattered. We cannot see the origin of the light itself.





Nonetheless, today's popular folklore advertises the CMB as a "confirmation" of the Big Bang.

This, in turn, has permitted theorists to cover for the apparent failures of the theory by adding wildly speculative notions, ranging from black holes to dark energy, and dark matter.

Yet no evidence has ever confirmed the actual existence of black holes, dark energy, or dark matter. (See chapter to follow.)



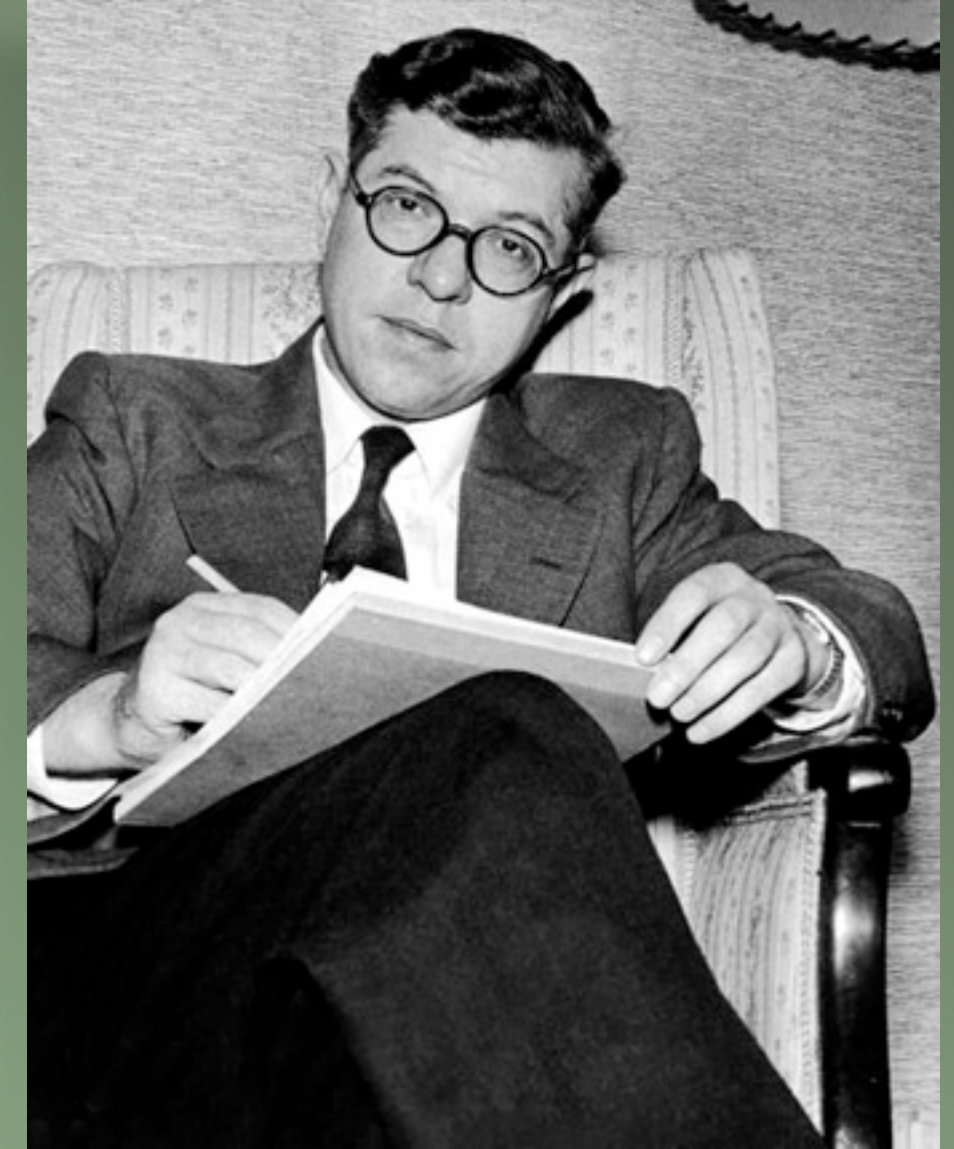
Radio astronomy data now reveals that what astronomers believe they are seeing at the far edges of the visible Universe is actually occurring in our own cosmic neighborhood.

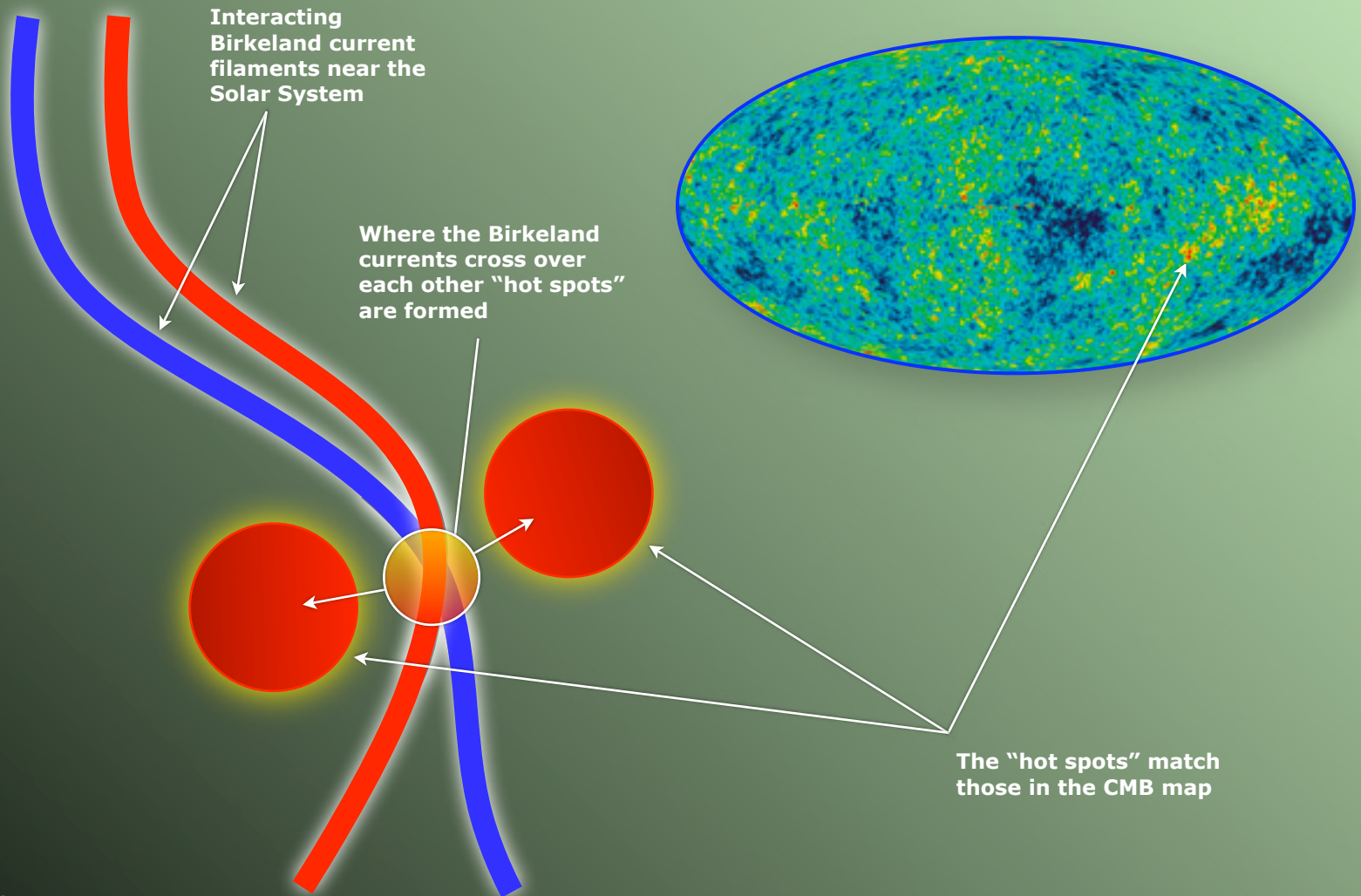
The Cosmic Microwave Background is nothing more than a *foreground* effect – a local electromagnetic 'fog' within the Milky Way.

Fred Hoyle  
1915-2001

Well before the radio astronomy data had been analyzed and published this was, in fact, the interpretation given by Fred Hoyle, one of the 20th Century's most respected astronomers. Hoyle suggested that, in the CMB, astronomers were seeing through a local fog and simply projecting it into the farthest reaches of space.

*"A man who falls asleep on the top of a mountain and who awakes in a fog does not think he is looking at the origin of the Universe. He thinks he is in a fog."*





"Do those [CMB] signals truly reveal the fingerprints of processes that took place shortly after the universe was born? Upon closer inspection, certain features in the WMAP maps look hauntingly familiar to those who have spent their careers studying the HI structure and radio emission from the Milky Way galaxy."

"The role of large-scale currents may be far more important in defining interstellar structure than has generally been recognized within the astronomical community."

radio astronomer  
Gerrit L. Verschuur

### the 'electric' model:

Electric currents flowing in a plasma naturally generate radio noise across a broad spectrum, in other words 'a radio fog.'

Where Birkeland currents intersect in space the 'radio noise' increases, giving the appearance of a relative 'hot spot' to radio astronomers.

That these hot spots match those in the most detailed map of the 'Cosmic Microwave Background' shows that Hoyle was right. The map shows the Cosmic Microwave Foreground Fog. *It has nothing to do with a primordial Big Bang.*





## age of the universe?

Not only the irregular distribution of matter in the universe, but also the *complexity* of structure at the outer regions (the supposed early universe, whose light is only now reaching us) has surprised astronomers.



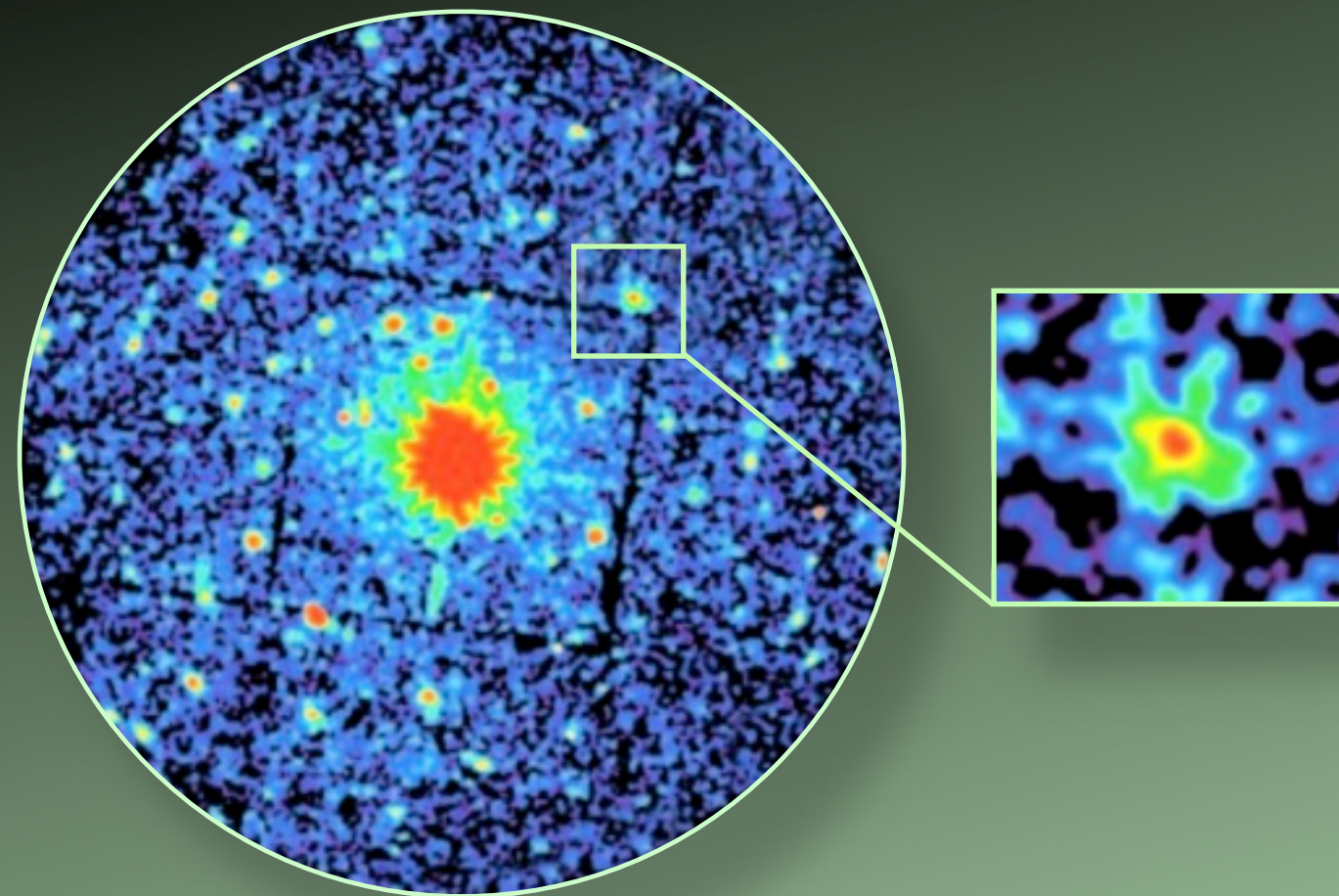
Based on redshift assumptions, the 'maturity' of the inset galaxy cluster [right] shocked investigators.

The light from the structure should have taken almost all of the time since the Big Bang to reach us. So we should be seeing the universe in its supposed infancy.

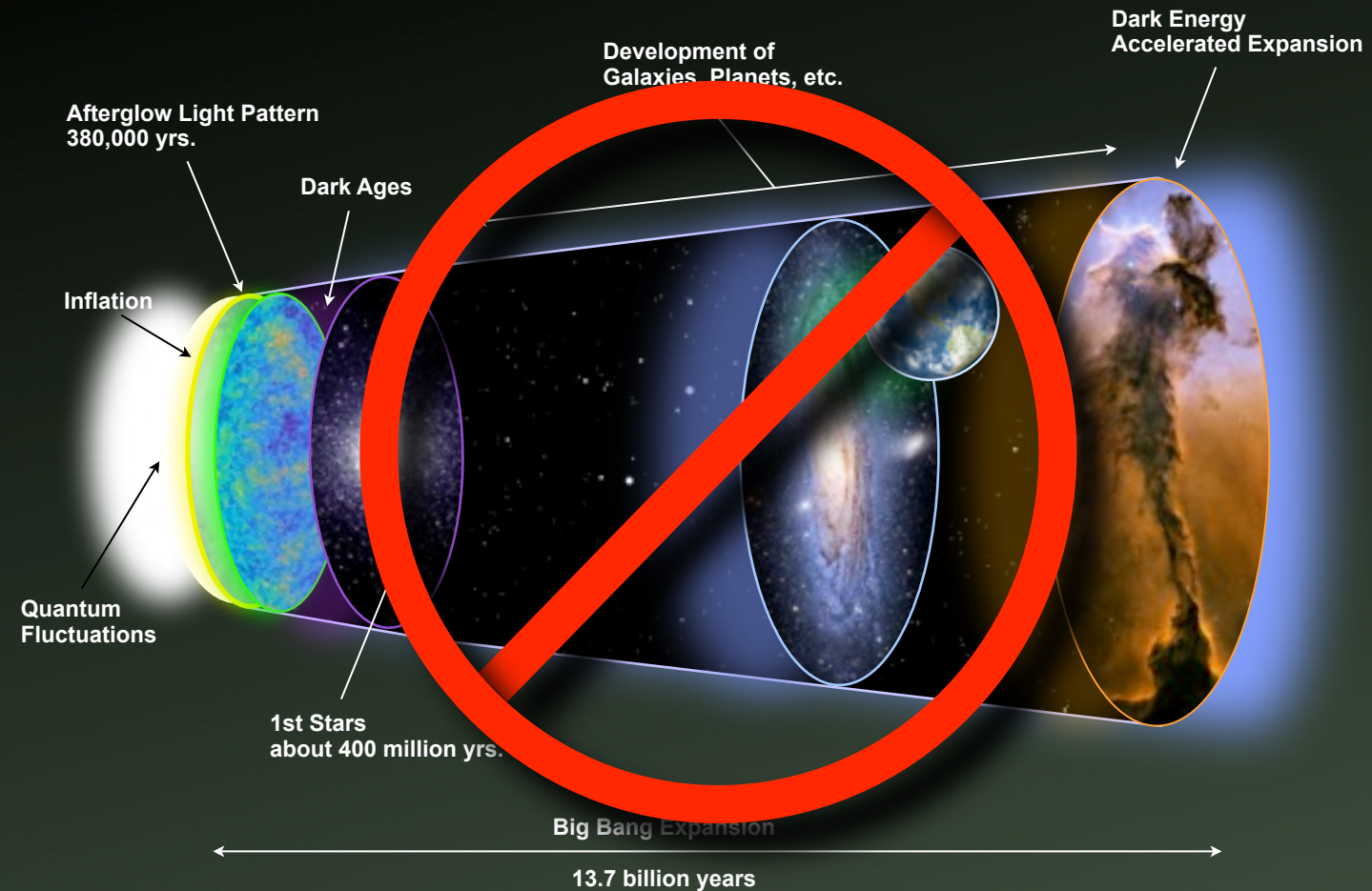
At a time when the universe was not expected to have formed many stars, an overabundance of mature galaxies has been found.

This discovery challenges the theoretical underpinning of the Big Bang hypothesis.

The image on the right combines observations by the Very Large Telescope and the XMM-Newton X-ray Observatory.







### the 'electric' model:

The *electric* model embraces the discoveries of Halton Arp, which show that redshift is not a reliable measure of velocity and distance.

Available evidence does not tell us whether the universe is expanding, contracting, or static. Presently, we can only say that the universe is of unknown extent and unknown age.

Close-up image of  
helical filaments  
in the Veil Nebula.

[Index](#)



## **'black holes' 'dark matter' 'dark energy'**

**'Black Holes', 'Dark Matter' and 'Dark Energy' all have one thing in common.**

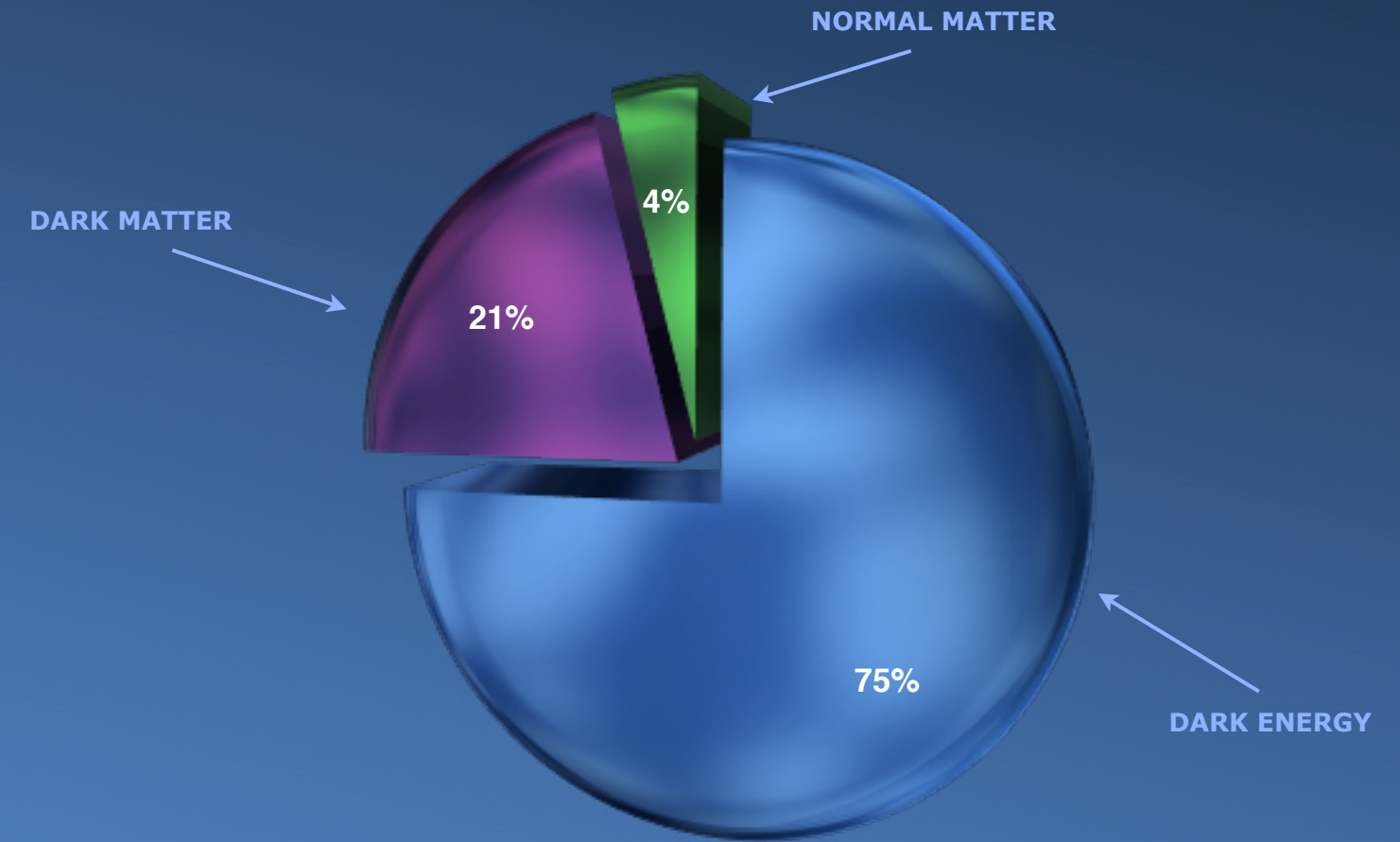
**They are invisible.**

**T**oday a growing number of specialists, coming from many different fields of investigation, warn that purely mathematical "solutions" to the mysteries of space may be deceiving us: the equations used are not describing real events, but arbitrarily filling gaps in an incomplete picture.

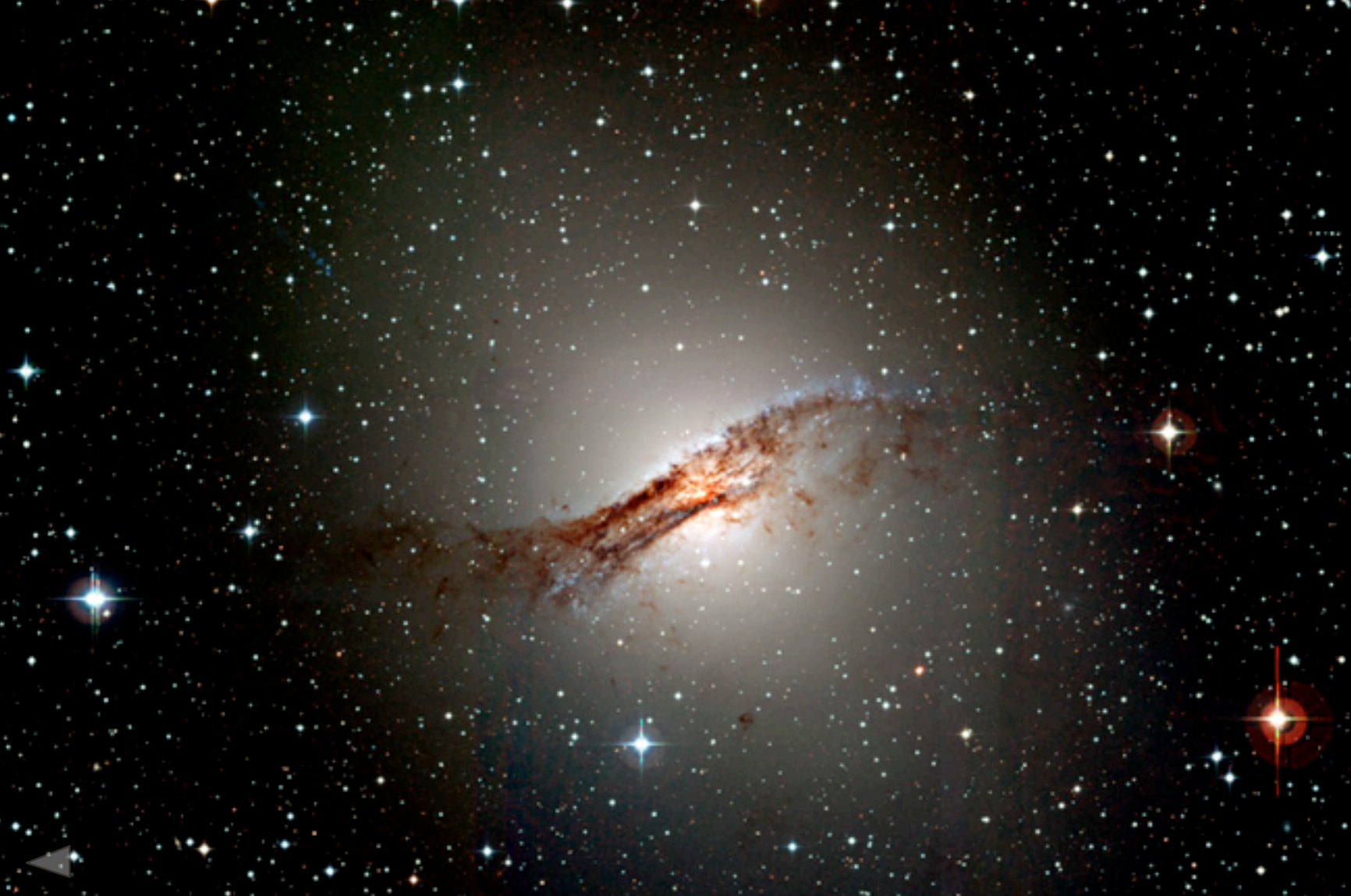
Critics are particularly skeptical when they see answers based on abstractions, or leaps of faith, replacing observational and experimental science.

Suspect 'mathematical fictions' include *black holes, dark matter, dark energy, neutron stars* and a great deal more.

The result is a remarkable picture of the heavens, one in which the familiar (visible) forms of matter make up only about four percent of this *imagined* universe.







## rescued by 'black holes'

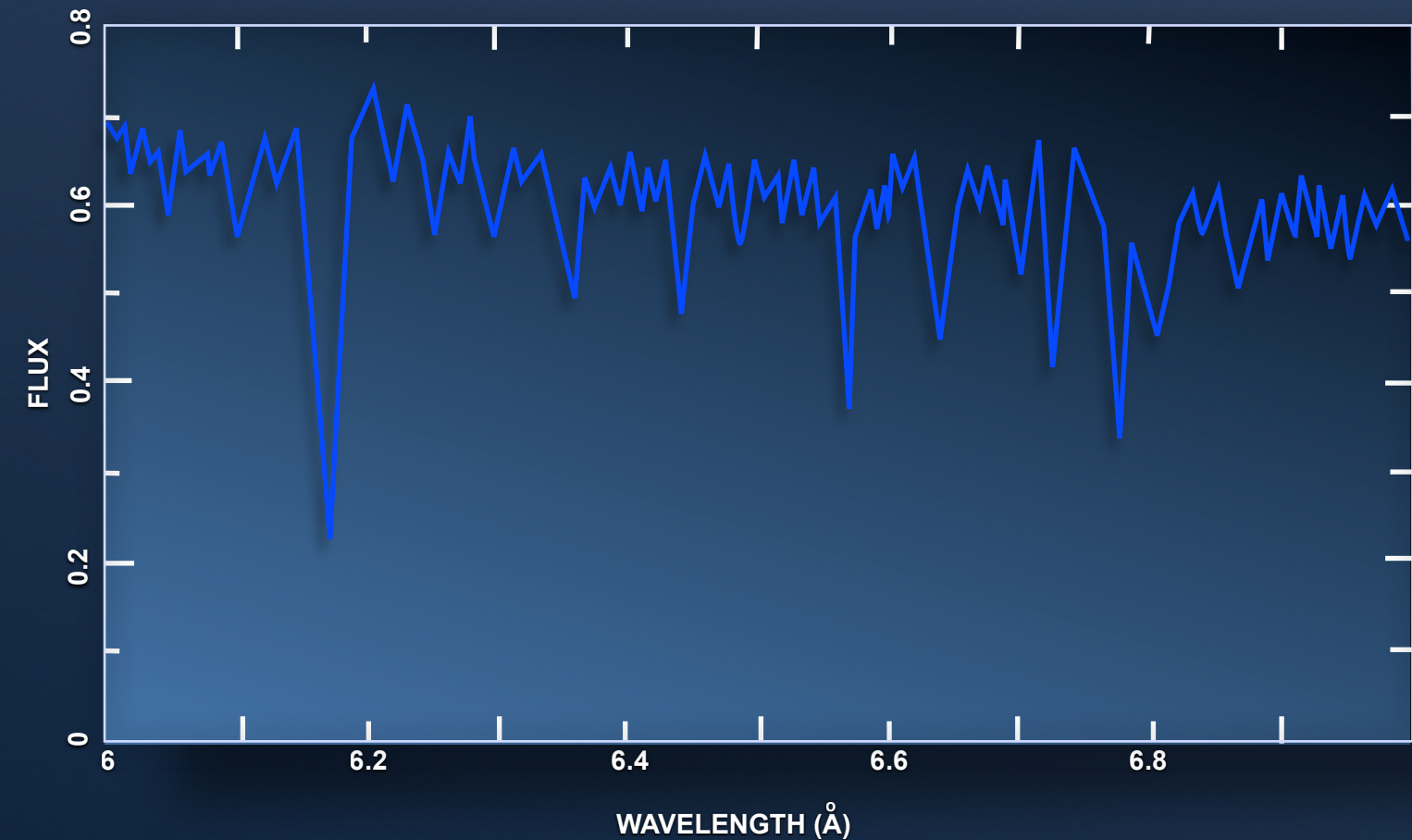
In the twentieth century astronomers observed extraordinary levels of energy emitted by galactic cores and by unusually energetic stars.

The energy levels could not be explained by standard gravitational theory. So cosmologists began to speculate about matter being compressed down to virtually zero volume, creating a gravitational 'Black Hole' *from which nothing, not even light, could escape.*

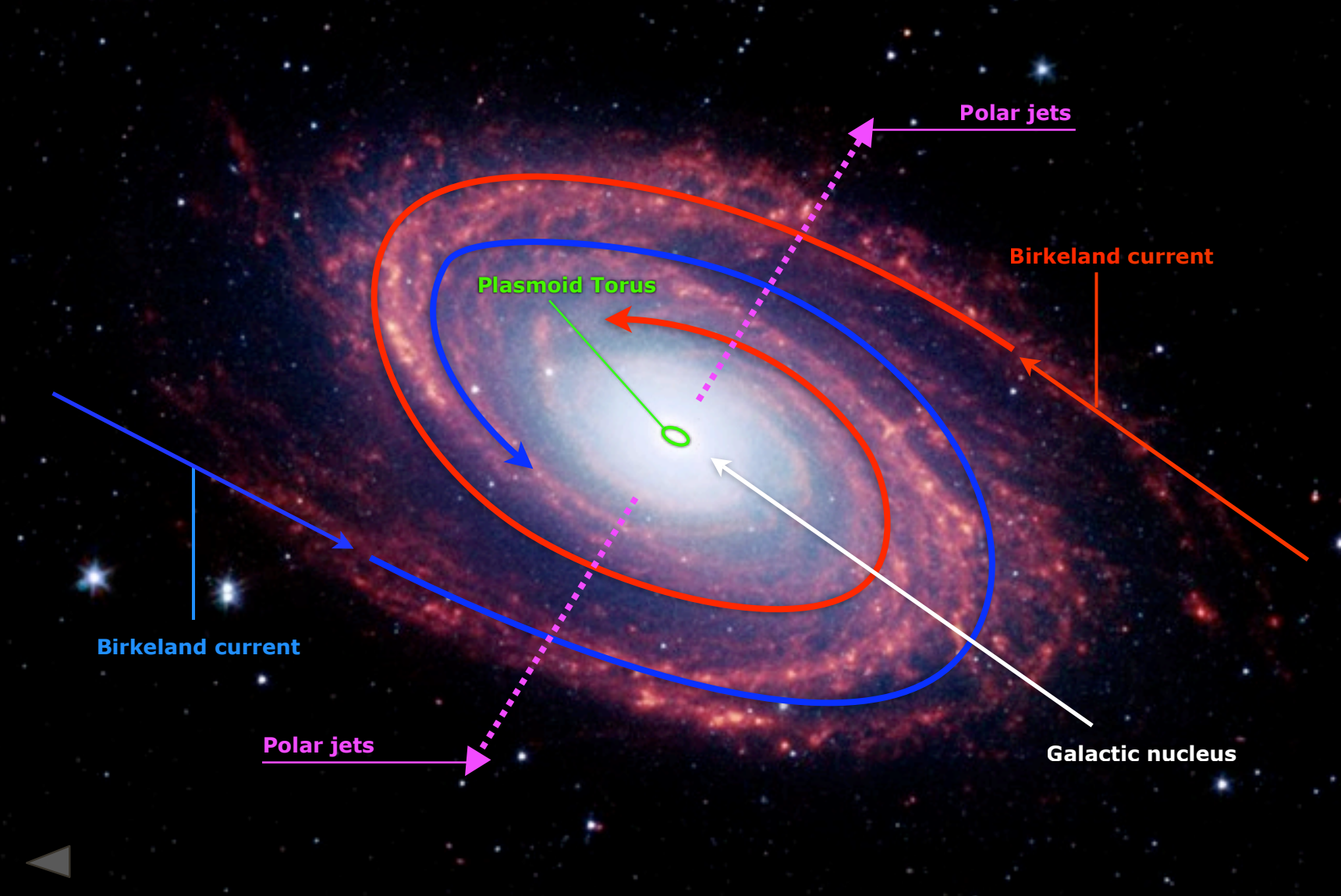
Centaurus A

The behavior of the star “GRO J1655-40” challenges this speculation: first astronomers discovered polar jets of electrically charged particles rushing outward at nearly the speed of light; later they observed electrified winds racing outward from the “black hole” in every direction.

Graphic stylization of the X-ray spectrum of the star “GRO J1655-40”





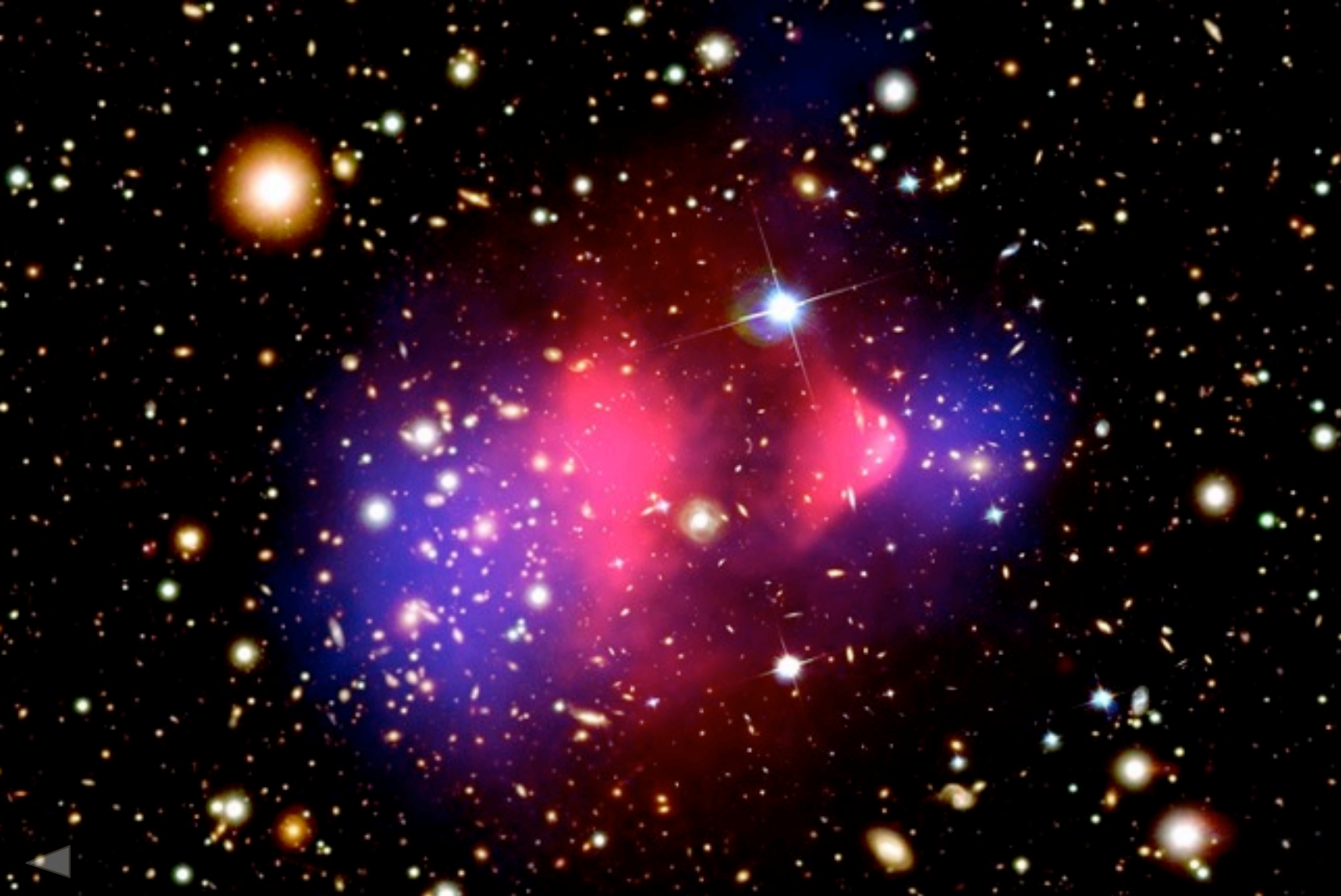


### the 'electric' model:

The concentration of electromagnetic energy in a tiny volume is demonstrated in the simple plasma focus device (page 103). A galaxy acts as the focus of intergalactic Birkeland currents.

The intergalactic currents, together with those flowing along the spiral arms of a galaxy, give it its distinctive shape and peculiar, rigid rotation. The current flows into the galactic nucleus where it is stored in a donut shaped plasmoid.

The galactic nucleus becomes 'active' when the plasmoid breaks down and produces polar jets, quasars and radio lobes.



## rescued by 'dark matter'

Astrophysicists also faced a growing dilemma posed by the *internal motions* of galaxies. Gravity is not strong enough to contain the rapidly moving outer stars in galaxies. They should be flying apart.

To answer the challenge of galaxies defying the law of gravity, astrophysicists proposed the existence of an invisible form of matter. Then they placed this 'dark matter' wherever needed to make their models work.

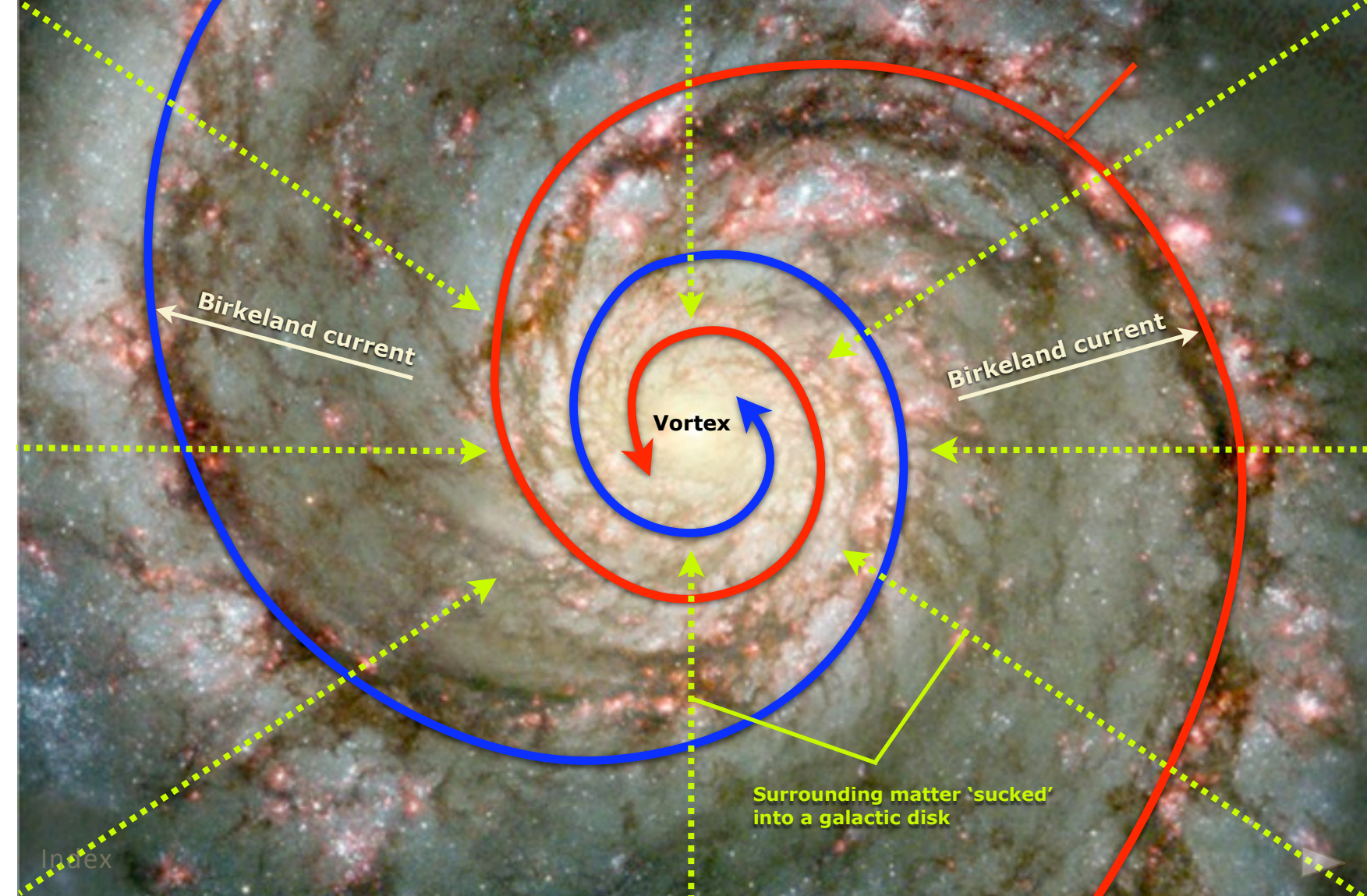
This Chandra X-ray Observatory image is claimed to show the presence of invisible "dark matter" (blue) in the immense Bullet Cluster of galaxies. *The dark matter depicted is a mathematical artifact, not an actual observation.*



### the 'electric' model:

Plasma experts have shown that the rotational behavior of galaxies can be explained electromagnetically: galaxies are *driven* like a simple electric motor.

Where giant intergalactic Birkeland currents intersect they form a vortex, drawing surrounding matter inward to form a rotating galactic disk. The 'anomalous' rotation is a predictable feature of the electric model.



## rescued by 'dark energy'

More recently, gravity-model cosmologists concluded that the universe is not just expanding, but expanding faster and faster—the one thing most obviously impossible in a gravity-only universe. So another invisible influence on matter was needed, something akin to 'gravity that repels.'

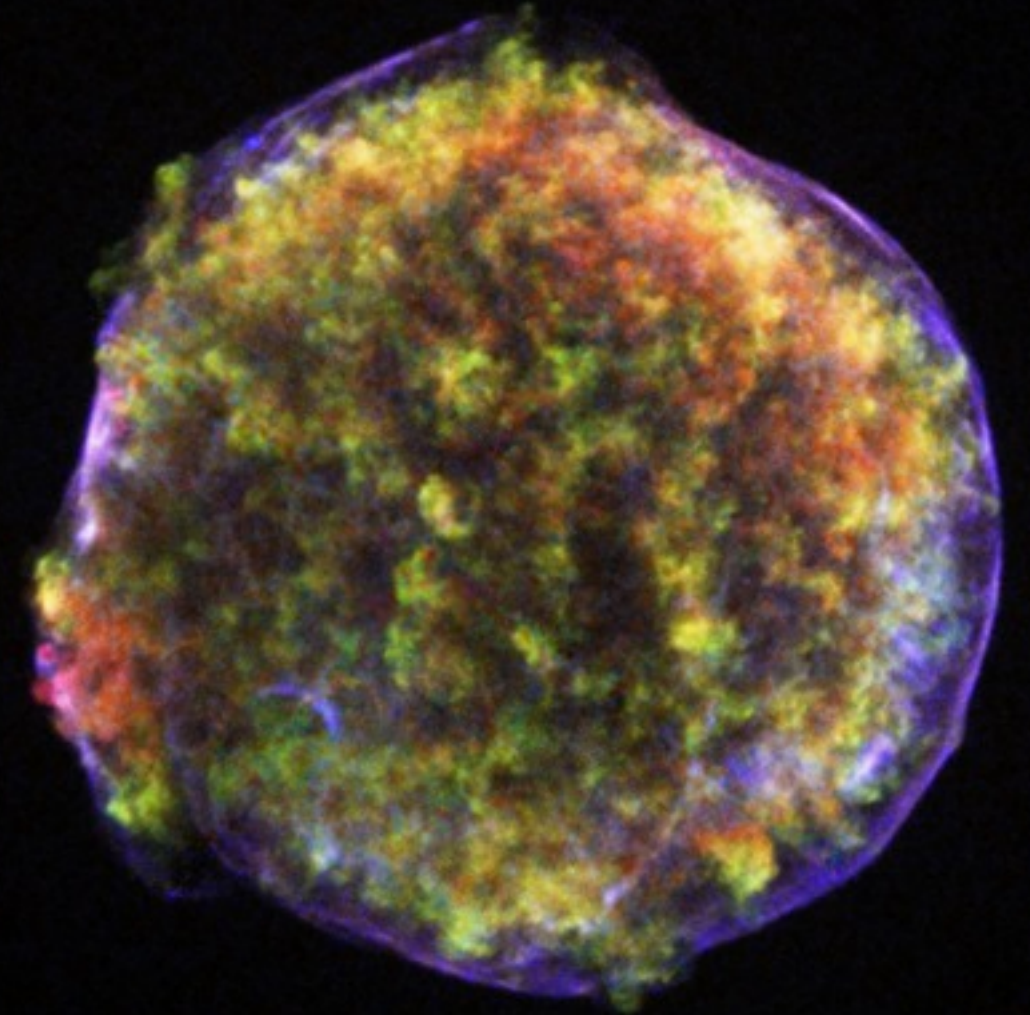
(left) An image described as "co-orbiting supermassive black holes powering the giant radio source 3C 75".

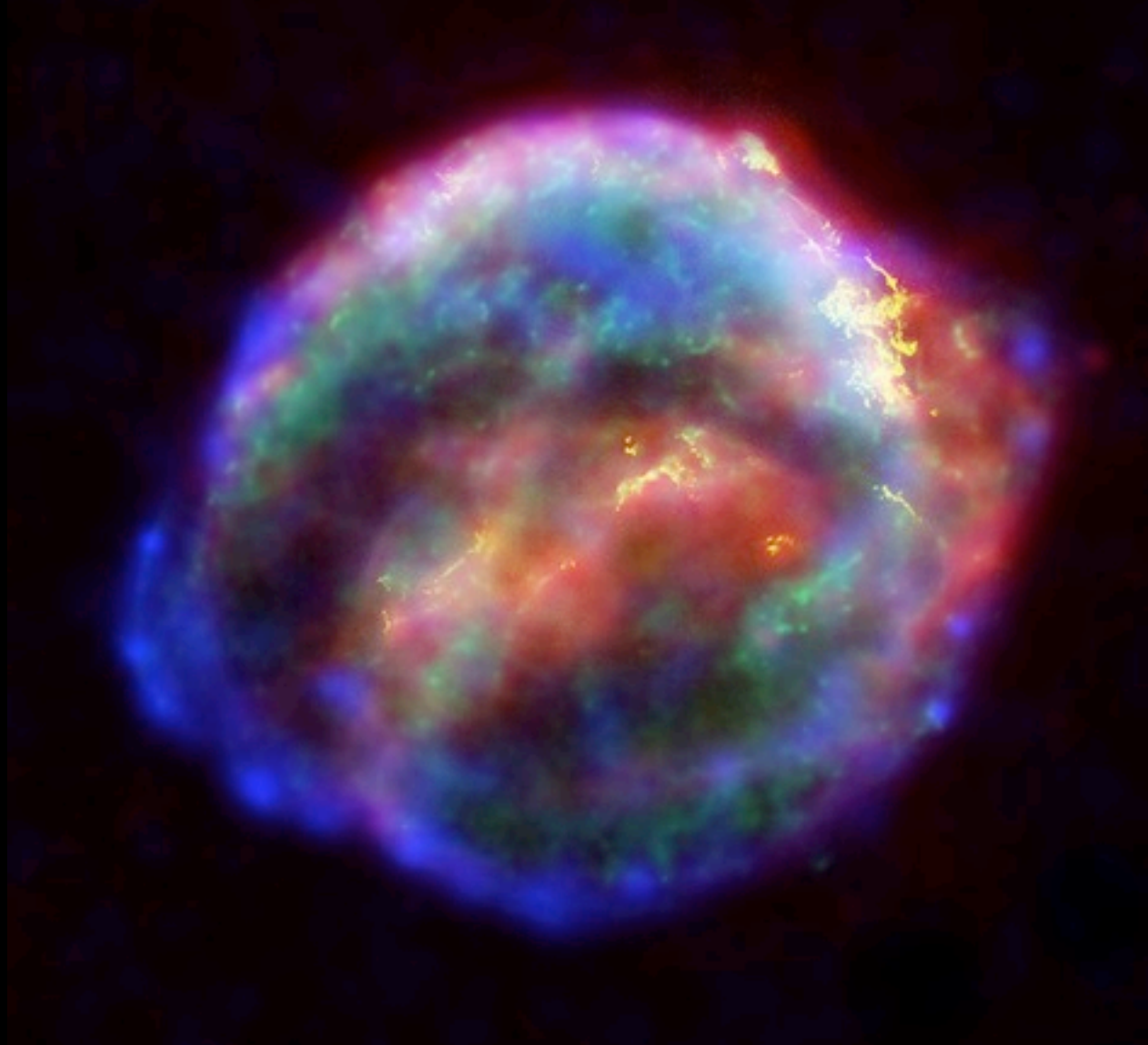


But the 'problem' actually arose from a contradiction between two theoretical speculations —distances calculated by the brightness of supernovae, and distances calculated by redshift.

Two incompatible conjectures required a third: astronomers hit upon 'dark energy,' *invisible, unidentified*, but with the power to overcome gravity everywhere in the universe.

Tycho's super nova remnant.





Kepler's supernova

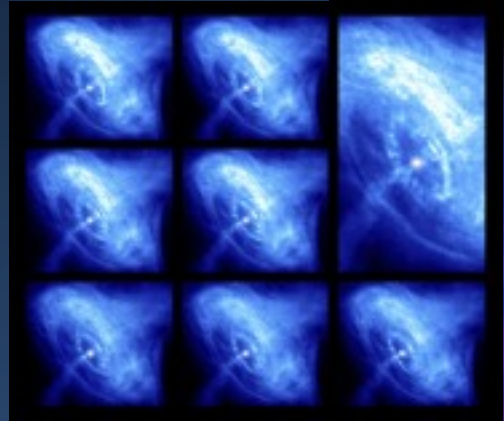
### the 'electric' model:

Most astronomers have no idea why supernovae in faint galaxies fade more rapidly than in bright galaxies. There should be no difference if supernovae depend only upon a stellar explosion.

But if stars are lit by electricity from the galaxy, the power available to a supernova is less in a faint galaxy. There is no need to invent a fantastic solution in the form of 'dark energy.'

The astronomer Halton Arp and others have shown that distances cannot be calculated by redshift, and therefore redshift cannot be used to support the idea of an expanding universe.





## rescued by 'neutron stars'

What happens when a star explodes into a supernova, outshining an entire galaxy?

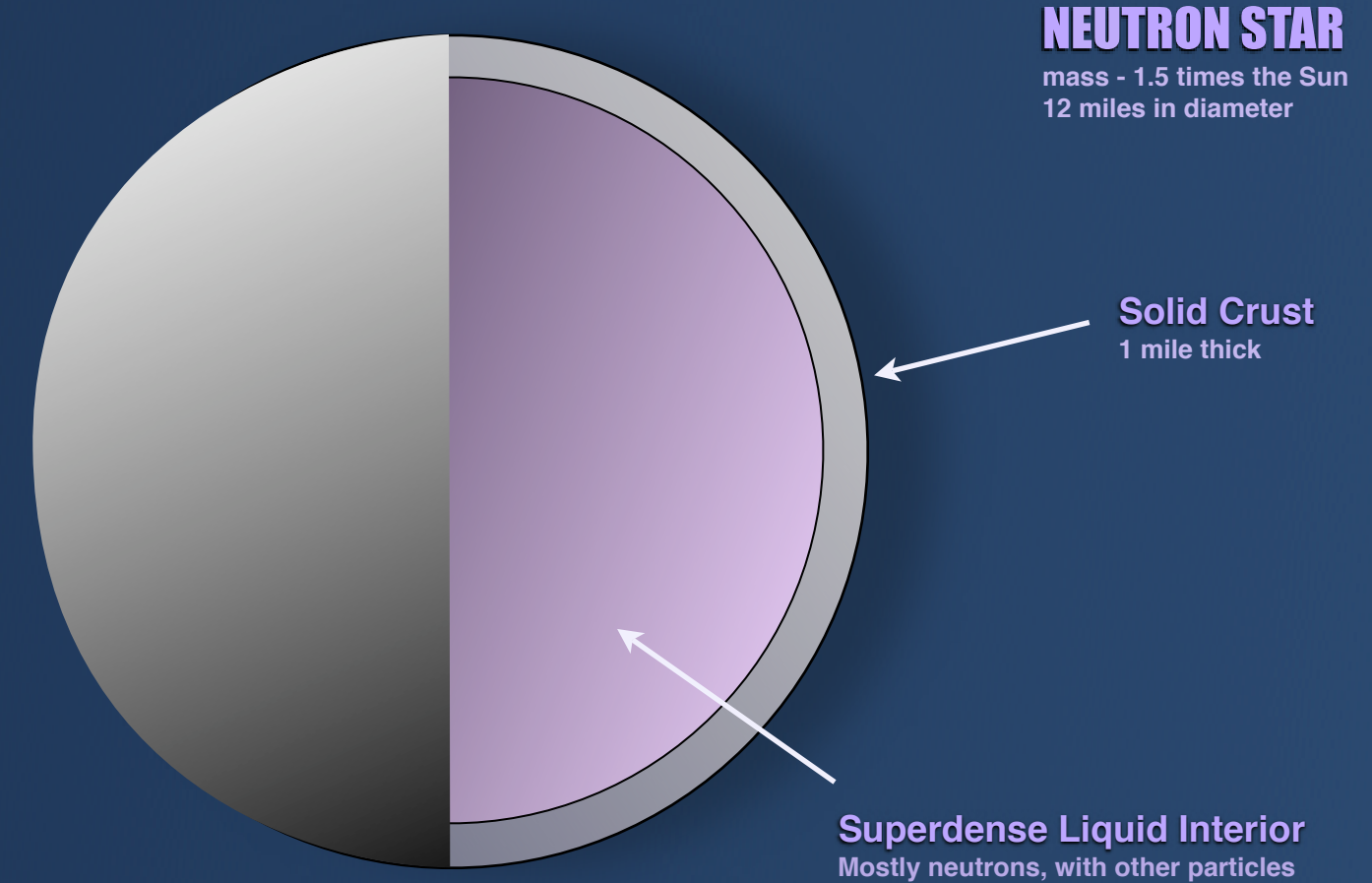
Astronomers have imagined that, if the star does not collapse into a black hole, the remnant of the explosion could be a 'neutron star,' composed largely of neutrons—normally only found packed tightly in combination with protons in atomic nuclei.

Crab Nebula  
pulsar

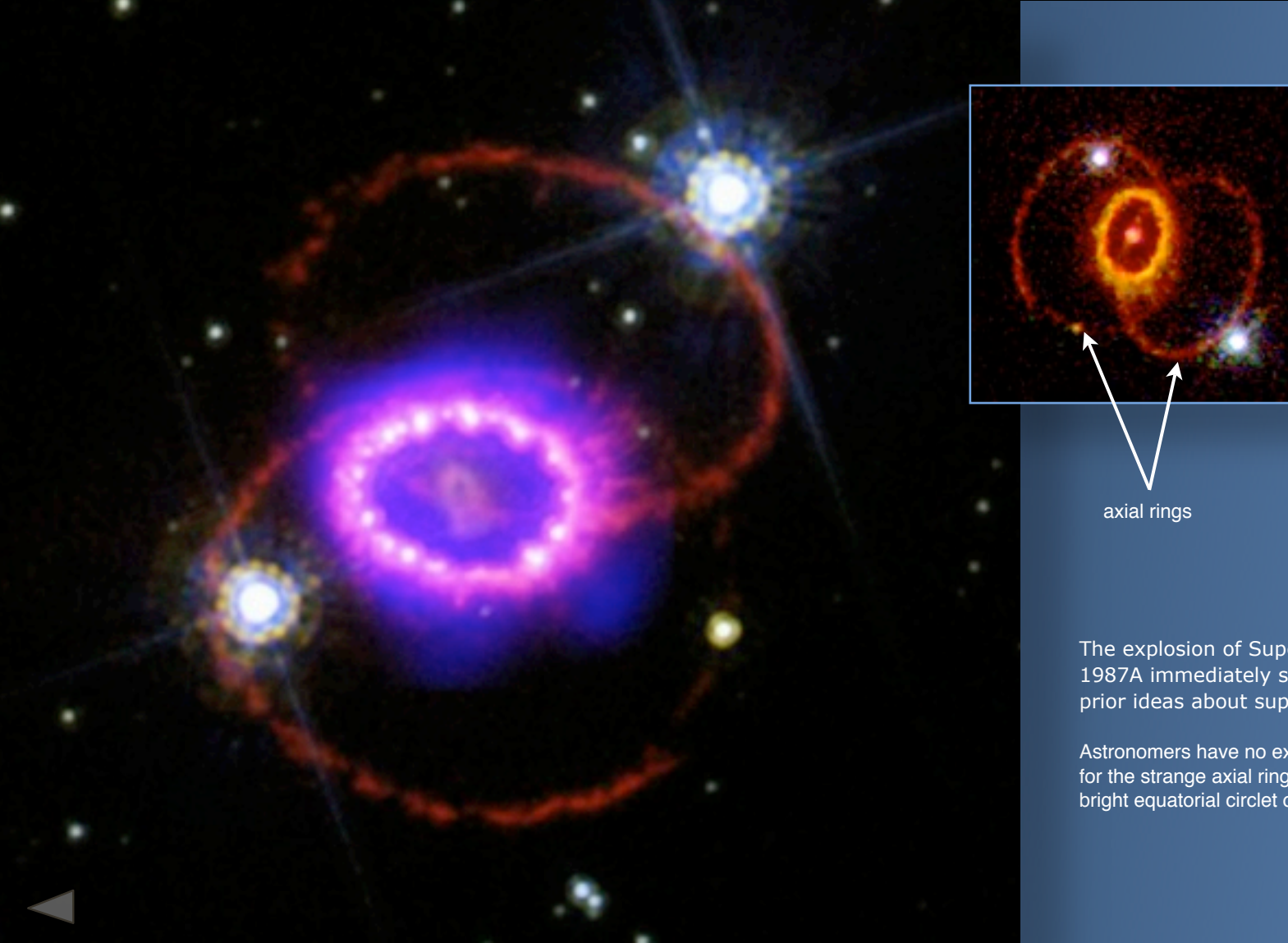
Atoms are mostly empty space. So it is thought that the orbiting electrons in atoms collapse into the nucleus to combine with the protons to form neutrons. The density of such a 'neutron' star would approximate that of an atom's nucleus.

A star with a mass 1.5 times that of the Sun would be left with a diameter of perhaps 12 miles. This would be like packing the state of Iowa into a Volkswagen.

But do 'neutron' stars really exist outside the computer models describing them?







The explosion of Supernova 1987A immediately shattered prior ideas about supernovas.

Astronomers have no explanation for the strange axial rings and the bright equatorial circlet of beads.

axial rings

On February 23, 1987 astronomers discovered a star exploding with the brilliance of a hundred million suns. The event occurred only 163,000 light-years away, and it provided the best opportunity to examine a supernova. For more than two decades astronomers looked for the 'neutron star' that theory demanded. It was never found.

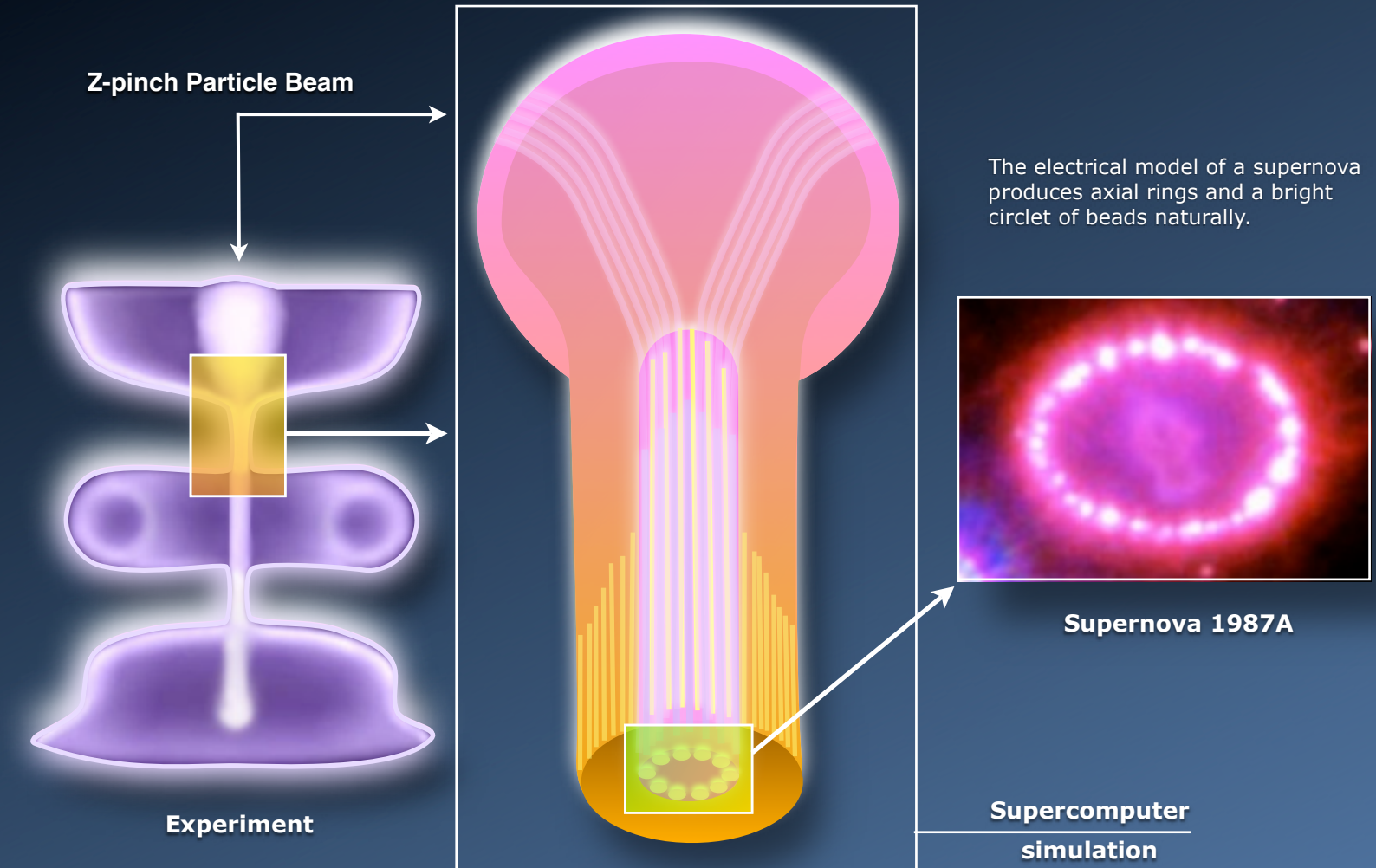
In fact, neither the type of star that exploded, nor the structure created in the explosion fit the theoretical models.

The gravitational model of a supernova explosion, based on matter falling inwards, finds no support in observed gravitational events. It requires an implausible *implosion*, which must then produce an even more implausible **explosion** of such magnitude that gases escape the gravitational 'well' created by the first event.

### the 'electric' model:

If there is a break in a galactic circuit, the energy in the entire circuit may be momentarily concentrated explosively at the circuit breaker. It is that galactic energy that can make a hapless star briefly outshine the rest of the galaxy.

The discharge 'pinches down' in a form known to plasma researchers as a 'Z-pinch.' The result is a cylindrical particle beam with a characteristic number of filaments. Where those filaments strike matter ejected equatorially by the star they produce bright spots, or 'beads,' like those seen in SN 1987A.







Demise of a  
sun-like star

The discovery of electrical events in space is moving the theoretical sciences in promising new directions.

Acceleration of high-energy particles, pervasive magnetic fields at all scales of observation, and the structure and evolution of galaxies all find their explanation at the frontier of plasma science.

The observations and experiments that have led to this new view of space can now be applied to our own cosmic neighborhood: to the behavior of our Sun, to planets, moons, asteroids, comets, and meteorites—and even to weather on Earth.



the end

Index



## collaborators

*(alphabetically)*

**Stephen J. Crothers** [www.sjcrothers.PlasmaResources.com](http://www.sjcrothers.PlasmaResources.com)

**David Drew** [www.PlasmaCosmology.net](http://www.PlasmaCosmology.net)

**Michael Goodspeed** [www.thunderbolts.info](http://www.thunderbolts.info) (thunderblogs)

**Michael Gmirkin** [www.thunderbolts.info](http://www.thunderbolts.info) (thunderblogs)

**Ben Ged Low** [www.bengedlow.com](http://www.bengedlow.com)

**Kevin Merrell** [historysaver@gmail.com](mailto:historysaver@gmail.com)

**C. J. Ransom** [www.vemasat.com](http://www.vemasat.com)

**Donald E. Scott** [www.electric-cosmos.org](http://www.electric-cosmos.org)

**Dave Smith** [www.PlasmaResources.com](http://www.PlasmaResources.com) (thunderblogs)

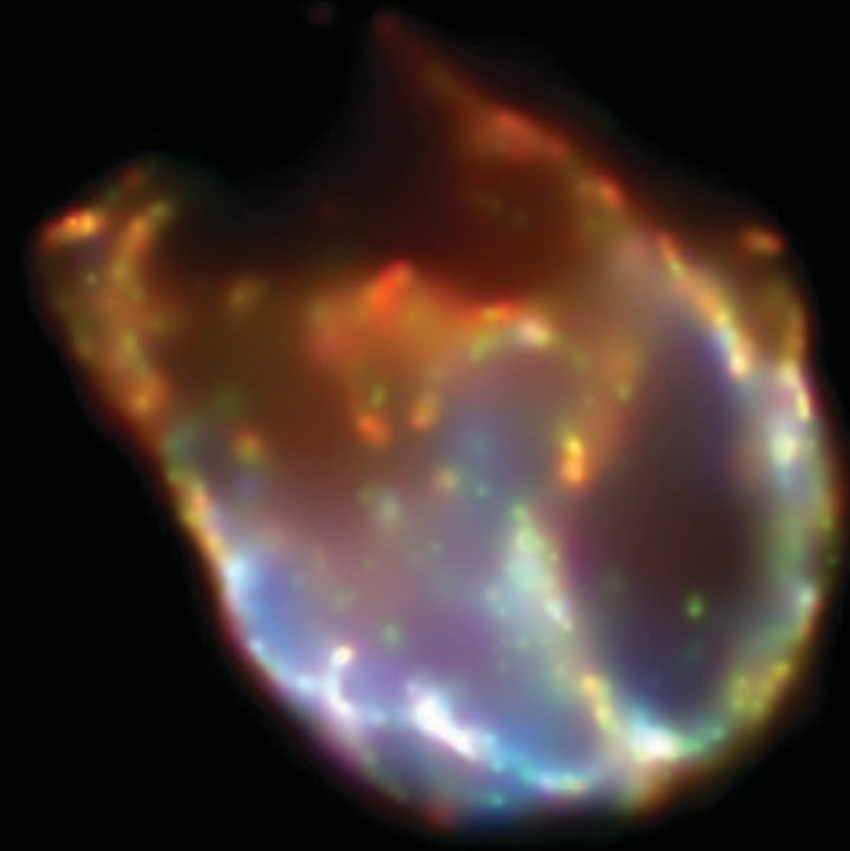
**Steve Smith** [www.thunderbolts.info](http://www.thunderbolts.info) (picture of the day)

**David Talbott** [www.thunderbolts.info](http://www.thunderbolts.info)

**Wallace Thornhill** [www.holoscience.com](http://www.holoscience.com)

**Ian Tresman** [www.plasma-universe.com](http://www.plasma-universe.com)

N132D—remnant  
of the explosion of  
a massive star



## references

This book was designed for simplicity. It represents an overview of the ideas being explored by **The Thunderbolts Project**. The themes and issues presented here have been dealt with much more extensively in the three books below, all of which contain detailed reference notes.

### **THUNDERBOLTS OF THE GODS**

Talbott / Thornhill, 2005

### **THE ELECTRIC UNIVERSE**

Thornhill / Talbott, 2007

### **THE ELECTRIC SKY**

Donald E. Scott, 2007

see: [www.ThunderboltsProject.com](http://www.ThunderboltsProject.com)

## related web links

**Holoscience**: One of the premiere sites dedicated to the Electric Universe and plasma cosmology. Developed and managed by Wallace Thornhill, the site contains all of his Holoscience articles over the past eight years

**Electric Cosmos**: Donald E. Scott's site. Don is the author of **THE ELECTRIC SKY**.

**The Universe**: The nature of space plasma according to Anthony Peratt. A long-time proponent of plasma cosmology, Peratt is an associate director of Los Alamos National Laboratories and one of the leading experts on high-energy plasma discharge.

**Plasma Resources**: Your one-stop-non-shop for exploring plasma cosmology, our electric universe and almost anything else even remotely related to the electrical nature of space, climatology and our Earth.

**Plasma Cosmology**: This site offers a straightforward introduction to the Plasma Universe. An excellent source for newcomers.

**Society for Interdisciplinary Studies**: The SIS was formed in 1974 to consider the role global cosmic catastrophes may have played in our history, and even recorded by cultures worldwide in their oral and written ancient traditions.

**Aeon Journal**: The official site of AEON, a Journal of Myth, Science and Ancient History. AEON specializes in archaeoastronomy and comparative mythology, with an emphasis on ancient planetary catastrophe. And the site contains a variety of articles and a complete list of back issues.



## related reading materials

Thunderbolts of the Gods, Talbott / Thornhill, 2005

The Electric Universe, Thornhill / Talbott, 2007

The Electric Sky; Don Scott, 2007

The Big Bang Never Happened; Lerner, 1992

Bye Bye Big Bang: Hello Reality; William C. Mitchell, 2002

The Virtue of Heresy; Hilton Ratcliffe, 2007

The Fourth State of Matter: an Introduction to Plasma Science; Shalom Eliezer, 2001

Fundamentals of Plasma Physics; Paul M. Bellan, 2004

Physics of Fully Ionized Gases; L. Spitzer, *Jr.*, 1956

Birkeland: "The Norwegian Aurora Polaris Expedition 1902-1903" [http://www.plasma-universe.com/index.php/The\\_Norwegian\\_Aurora\\_Polaris\\_Expedition\\_1902-1903\\_\(Book\)](http://www.plasma-universe.com/index.php/The_Norwegian_Aurora_Polaris_Expedition_1902-1903_(Book))  
<http://www.archive.org/details/norwegianaurorap01chririch>

### General astrophysical electric fields and currents

"Electric Space" at the Space Weather Center, sponsored by the Space Science Institute, National Science Foundation.

[http://www.spaceweathercenter.org/our\\_protective\\_shield/03/03.html](http://www.spaceweathercenter.org/our_protective_shield/03/03.html)

"A Virtual Tour of Electric Space", a virtual exhibit at the Space Science Institute.

<http://wwwold.spacescience.org/ExploringSpace/VirtualExhibit/1.html>

"Electric Space, Exploring Our Plasma Universe" Museum: National Science Foundation; National Oceanographic and Atmospheric Administration

<http://plasmascience.net/tpu/Museum.Exhibits/NOAA.html>

[http://www.plasma-universe.com/index.php/Electric\\_Space](http://www.plasma-universe.com/index.php/Electric_Space)

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<http://www.plasmacoalition.org/>

<http://www.plasmas.com/>

<http://www.plasmas.org/>

<http://ippex.pppl.gov/>

<http://plasmadictionary.llnl.gov/>

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- 48. NGC 4319 and Markarian 205. Credit: Nasa and The Hubble Heritage Team (STScI/AURA) Hubble Space Telescope WFPC2 STScI-PRC02-23
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159. Reproduction of the XMM-Newton observations of the nearby active galaxy NGC7314 (bright object in the centre) from which the newly found distant cluster (white box) was serendipitously identified.

162-163. Cygnus Loop. Credit: William P. Blair and Ravi Sankrit (Johns Hopkins University), NASA

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174. Dark Matter. Credit: X-ray: NASA/CXC/CfA/M.Markevitch et al.; Optical: NASA/STScI; Magellan/U.Arizona/D.Clowe et al.; Lensing Map: NASA/STScI; ESO WFI; Magellan/U.Arizona/D.Clowe et al.

177. m51 The Whirlpool Galaxy. Credit: S. Beckwith (STScI), Hubble Heritage Team, (STScI/AURA), ESA, NASA

178. Caption:: "Composite X-ray/radio image of Abell 400 shows radio jets (pink), immersed in a vast cloud of multimillion degree X-ray emitting gas (blue) that pervades the cluster." Credit: NRAO/VLA/NRL/NASA/CXC/AIfA/D.Hudson & T.Reiprich et al.

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## the thunderbolts project

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