
THE
UNIVERSE
Sun
ELECTRIC

navigation and printing

Next page
Click the Next Page button, either in the Acrobat toolbar or in the lower right hand corner, or press the Right Arrow key on your keyboard.

Previous page
Click the Previous Page button, either in the Acrobat toolbar or in the lower left hand corner, or press the Left Arrow key on your keyboard.

Previous view
Press Left Arrow + Alt on the PC or Left Arrow + Opt on the Mac. Like the Back button in a web browser, Previous View will return you to a previous view further back than the physical previous page.

Zoom in and out
Zoom in by clicking the Acrobat Magnify tool (magnifying glass) or click-dragging a marquee selection around the photo using the Magnify tool. To return to viewing the entire two-page spread, press Control + 0 (zero) on the PC or Command + 0 on the Mac.

Links
Besides the table of contents entries, live links to project collaborators' websites, related websites and papers are shown in blue.

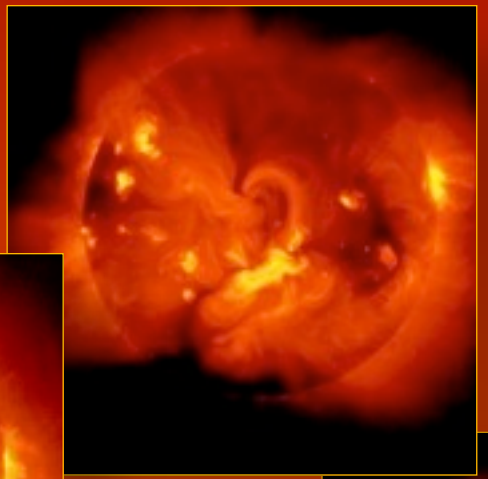
Printing single pages
In the Acrobat print dialog box either click on 'Current page' or type in the page range in the box next to 'Pages'. One page of the ebook with print on each sheet of paper.

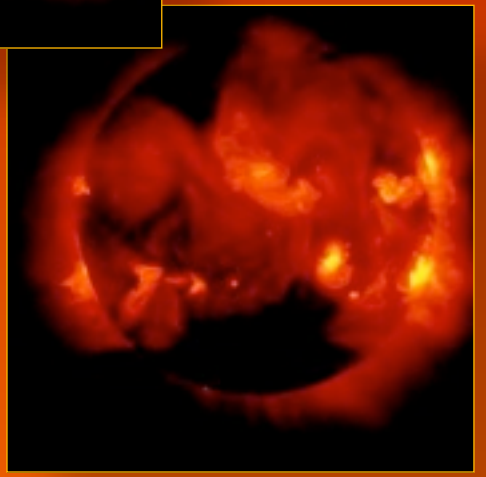
Printing page spreads
You can also print the spreads or double-page layouts that are displayed on your computer monitor. In the Acrobat print dialog box, begin by typing in the page range in the box next to 'Pages'. Come down to 'Page Scaling', and choose the option, 'Multiple pages per sheet'. In the box next to 'Pages per sheet' choose 2, 4 or 16. Finally, choose 'Horizontal' from the list of options next to 'Page Order'.

THE UNIVERSE

SUN

ELECTRIC



written by

Wallace Thornhill

David Talbott

collaborators
(the thunderbolts project)

Stephen J. Crothers

David Drew

Michael Goodspeed

Michael Gmirkin

Kevin Merrell

C. J. Ransom

Donald E. Scott

Dave Smith

Steve Smith

Ian Tresman

editor–in–chief

David Talbott

managing editor, book design, graphics

Ben Ged Low

technical, scientific consultant

Wallace Thornhill

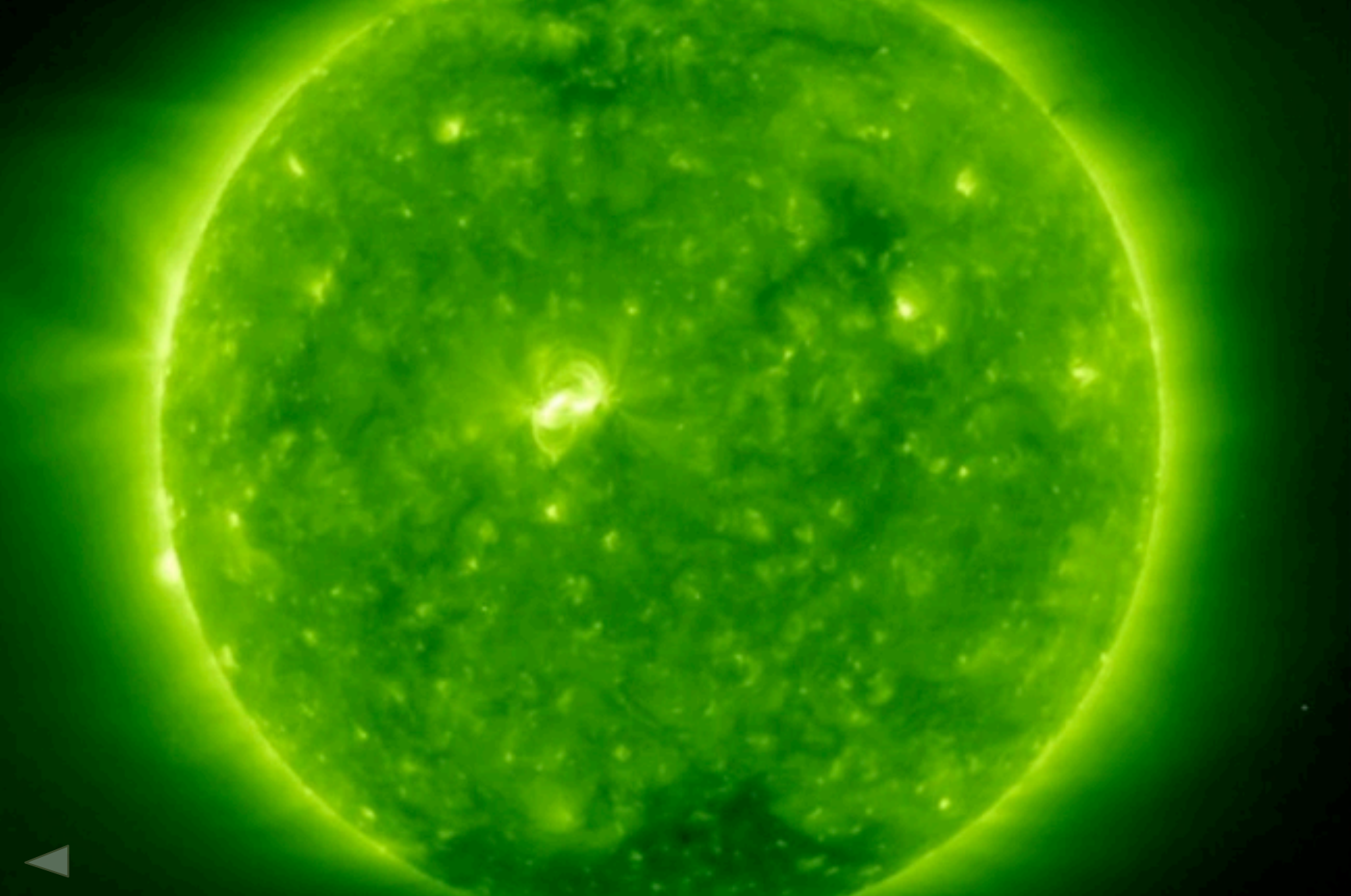
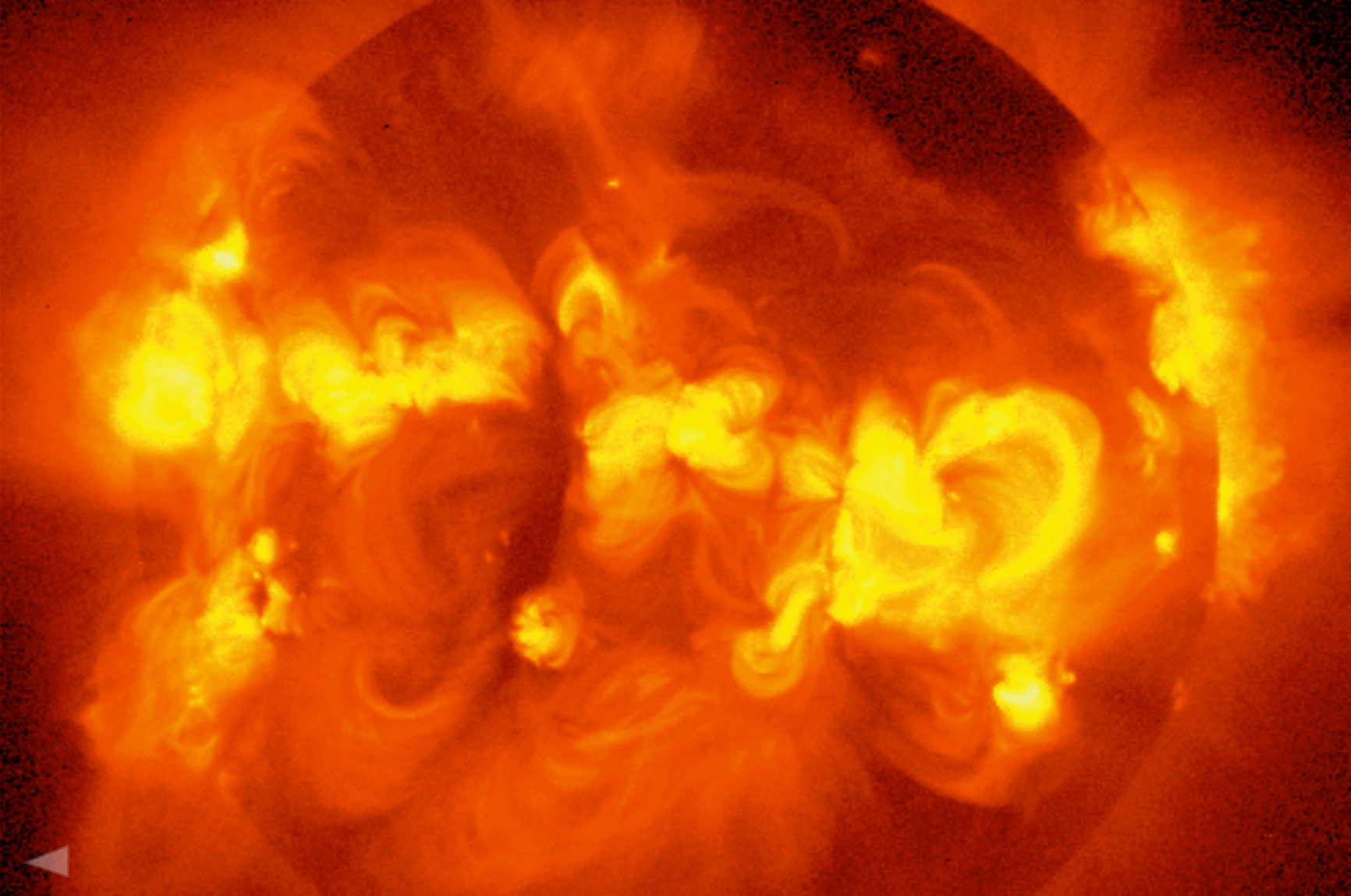
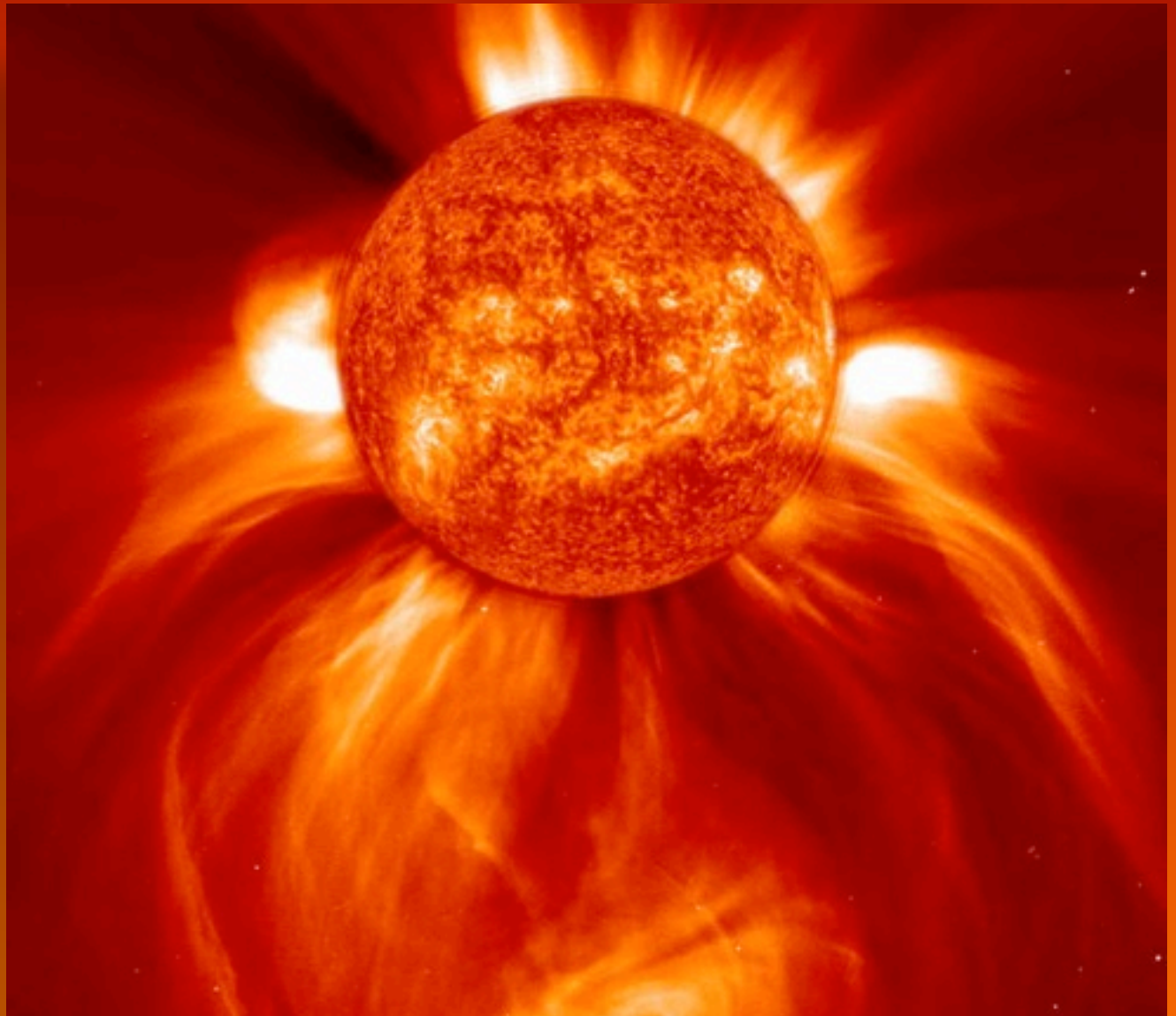


table of contents



THE SUN

Today, most astronomers believe that the fundamental question about the Sun has been answered: *it is a self-consuming thermonuclear furnace*.



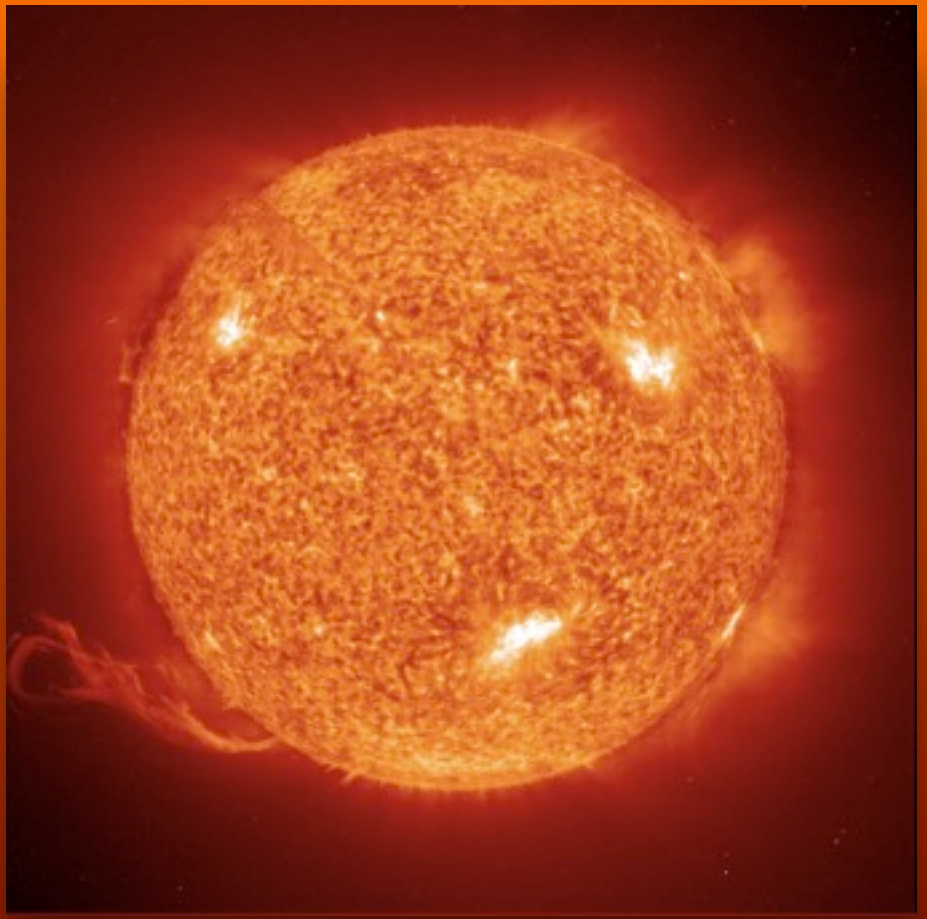
the ‘thermonuclear’ sun

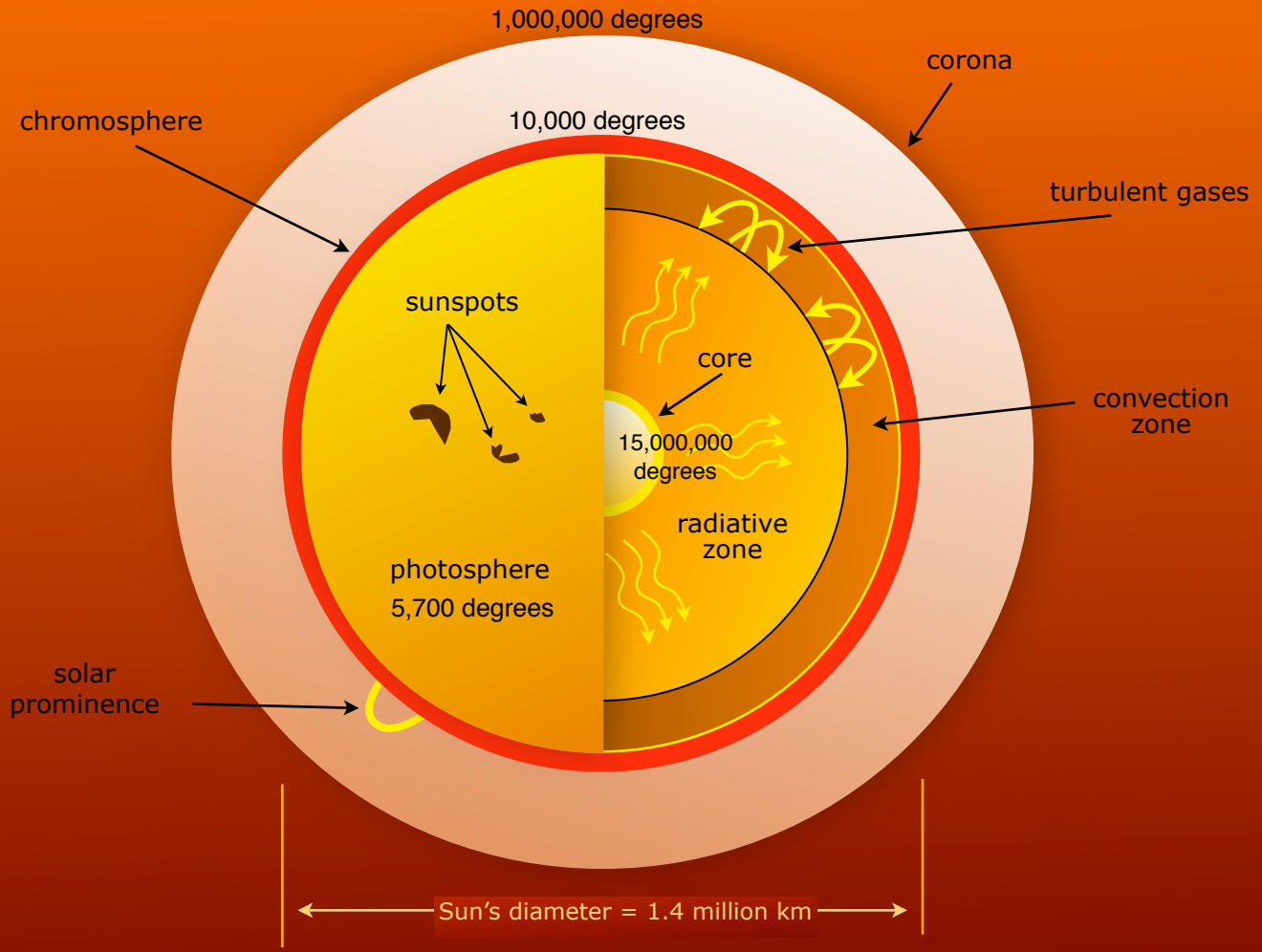
The “thermonuclear” Sun is a ball of gas so large that its internal pressure generates a core temperature of about 15 million°C, enough to produce a continuous thermonuclear reaction.

In this model the Sun’s ‘engine’ is the same as the hydrogen bomb. So how is it that stars show such remarkable stability?

For this thermonuclear reaction to occur, the Sun requires no contribution from the space around it.

The power comes from the sun itself.




1,000,000 degrees
corona
chromosphere
10,000 degrees
turbulent gases
sunspots
core
convection zone
15,000,000 degrees
radiative zone
photosphere
5,700 degrees
solar prominence
Sun's diameter = 1.4 million km

In this model, X-Rays generated in the Sun's thermonuclear core progressively lose energy and 'cool' by collisions as they gradually percolate outwards, taking millions of years to reach the "convection zone."

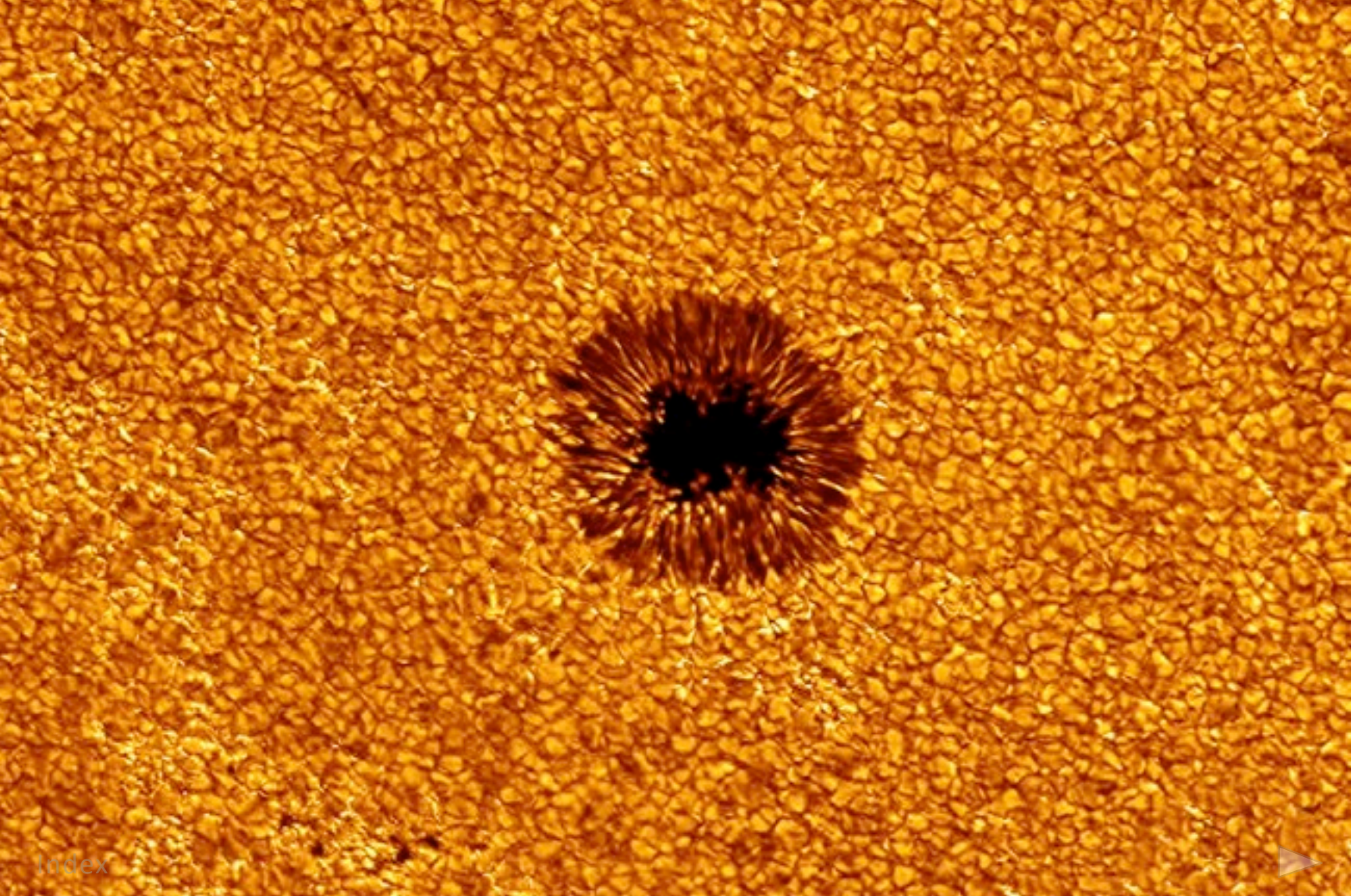
In the convection zone the heated gases become turbulent and – like hot air expanding and rising in the Earth's atmosphere – rush up to the surface as "convection currents," then fall back toward the radiative zone as they cool.

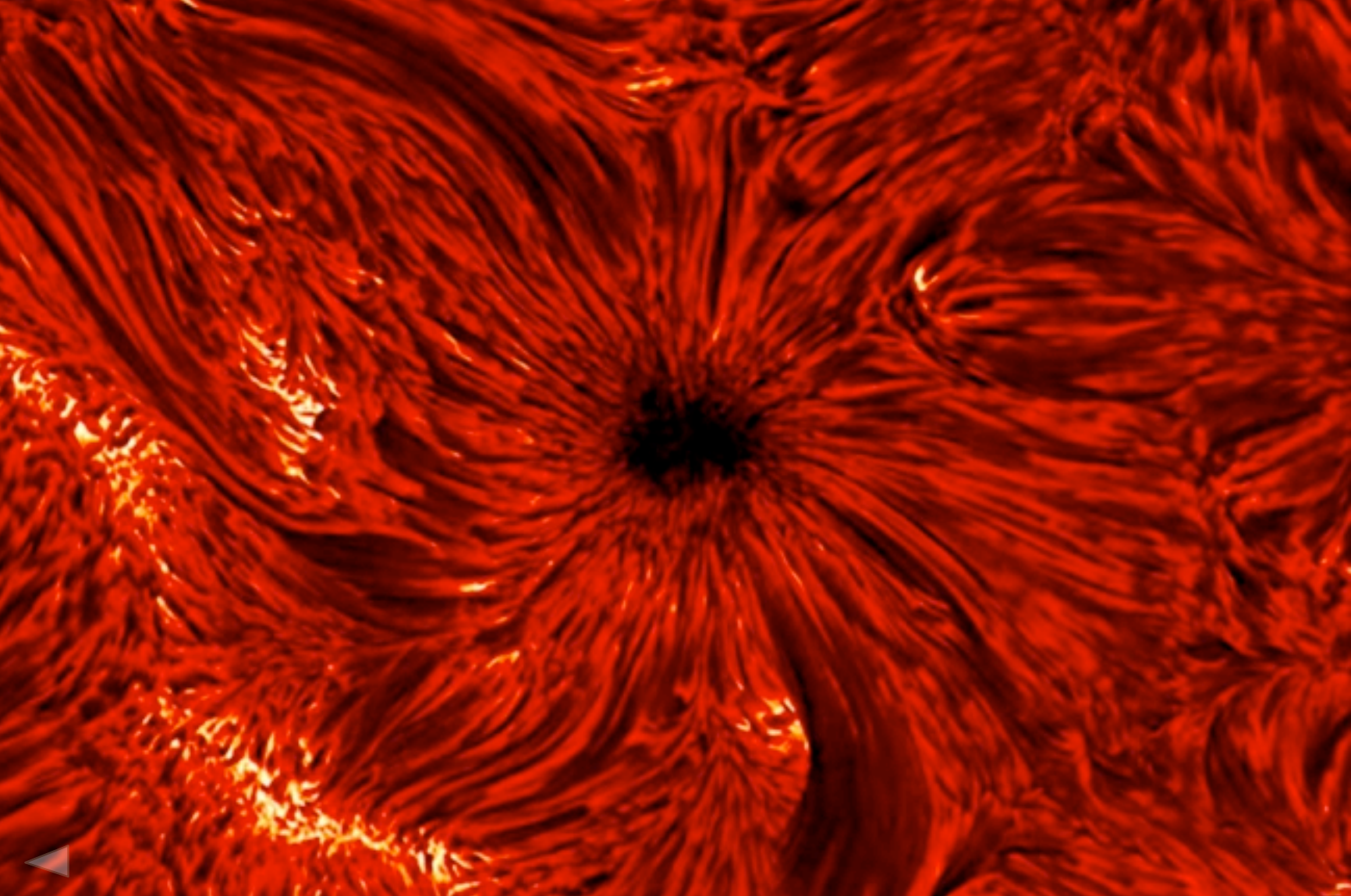
It should be noted that no other known physical body transfers internal heat by radiation.

The visible "granulation" in the photosphere or surface of the Sun is said to be boiling gases as they rise, then cool.

On the margins of the dark regions on the surface, called "sunspots," we see that the granules are the tops of rope-like structures rising from below (right). Solar physicists identify these structures as the “convection currents” that the thermonuclear model calls for.

But the orderly structure and behavior of photosphere "granules" defy any notion of boiling hot gas.

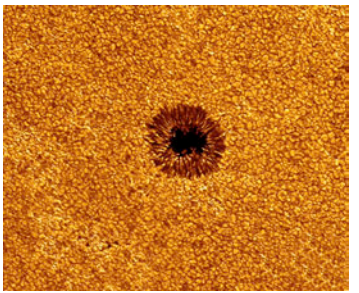


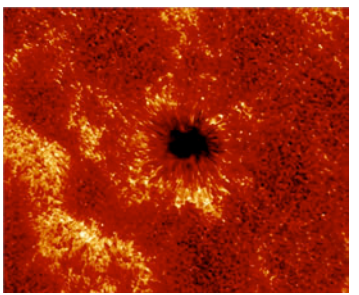


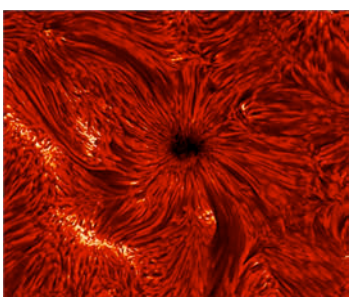
In fact the “ropes” of the sunspot penumbra do not stop at the surface of the photosphere, but extend outward thousands of kilometers into a surrounding maze of filaments, all constrained by complex *magnetic fields*.

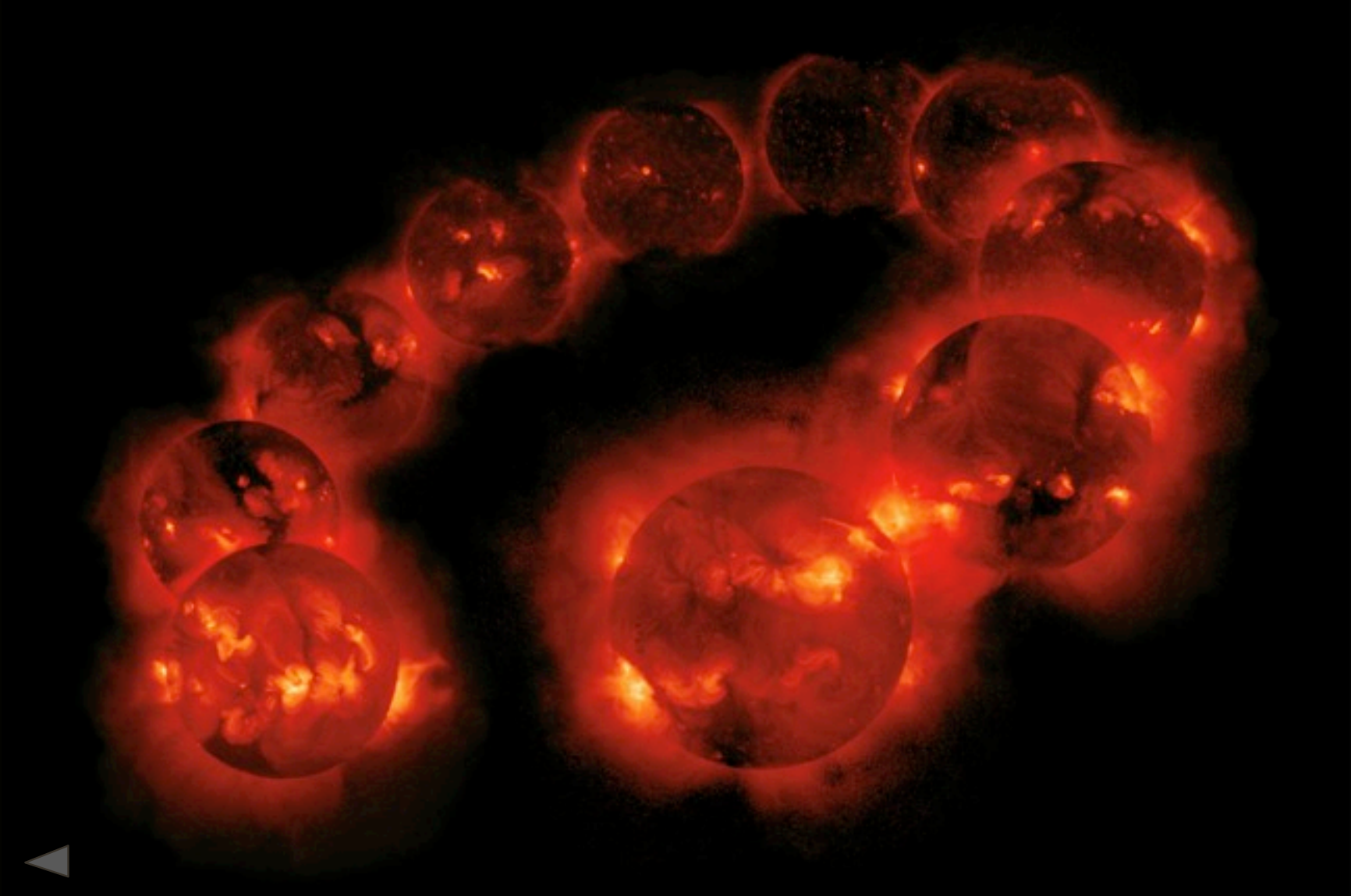
These penumbra filaments bear no resemblance to any known form of convection in a hot gas.

Standard concepts of simple heat transport do not seem to work when applied to sunspot activity.









The above problematic sunspot anomaly is only one of countless anomalies now challenging the traditional concept of the self-powering thermonuclear sun.

The very presence of sunspots is unexpected.

On the right is a list of prominent attributes of the Sun.

Every feature listed poses a problem the thermonuclear model cannot easily explain.

But these features *can* be explained by another model.

the ‘electric’ sun

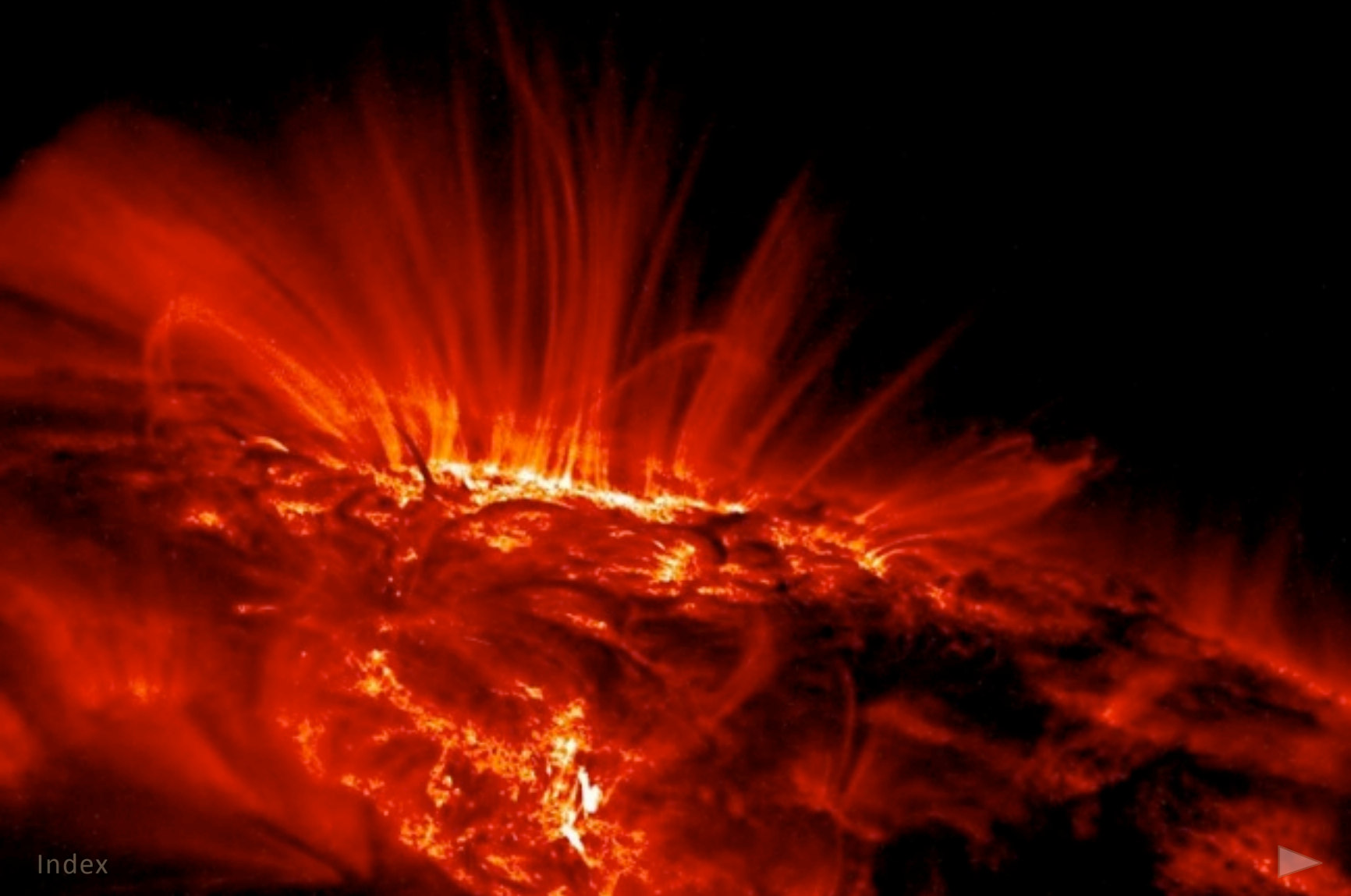
Vast electrical currents stream across interstellar and intergalactic space. These cosmic "power lines" can be detected by the radio "hum" they emit.

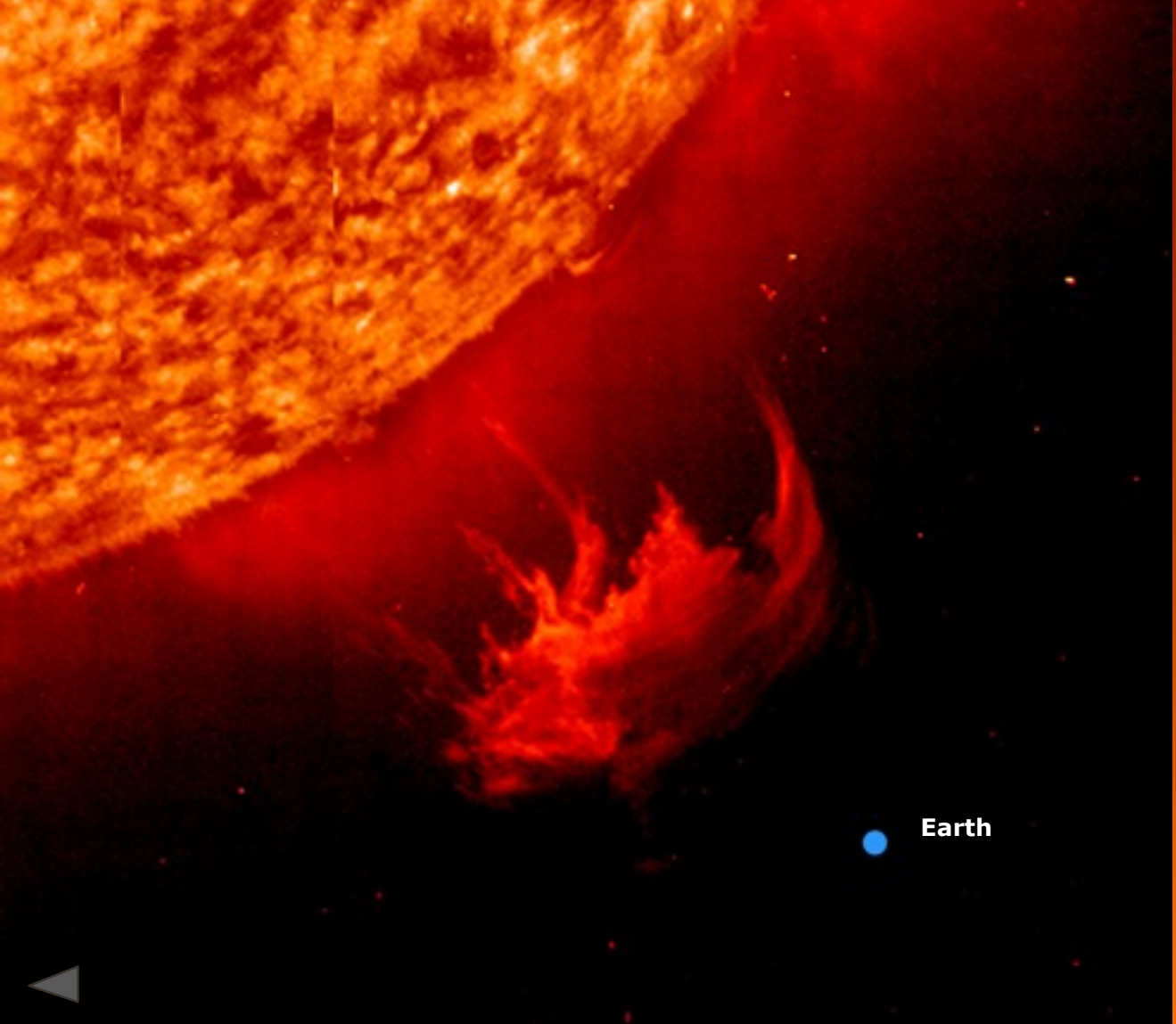
Where two neighboring intergalactic currents cross paths, they draw matter into a spiral vortex to form a spiral galaxy. The galaxy is lit by electric lights — the stars strung along the current streams.

Electric currents in space plasma can provide a new understanding of the Sun.

The Sun’s surface is carpeted with complex magnetic fields. Only electricity can produce magnetic fields. Therefore, the Sun must be understood in terms of electric circuits.

Where are these circuits? What creates them? And what sustains them?





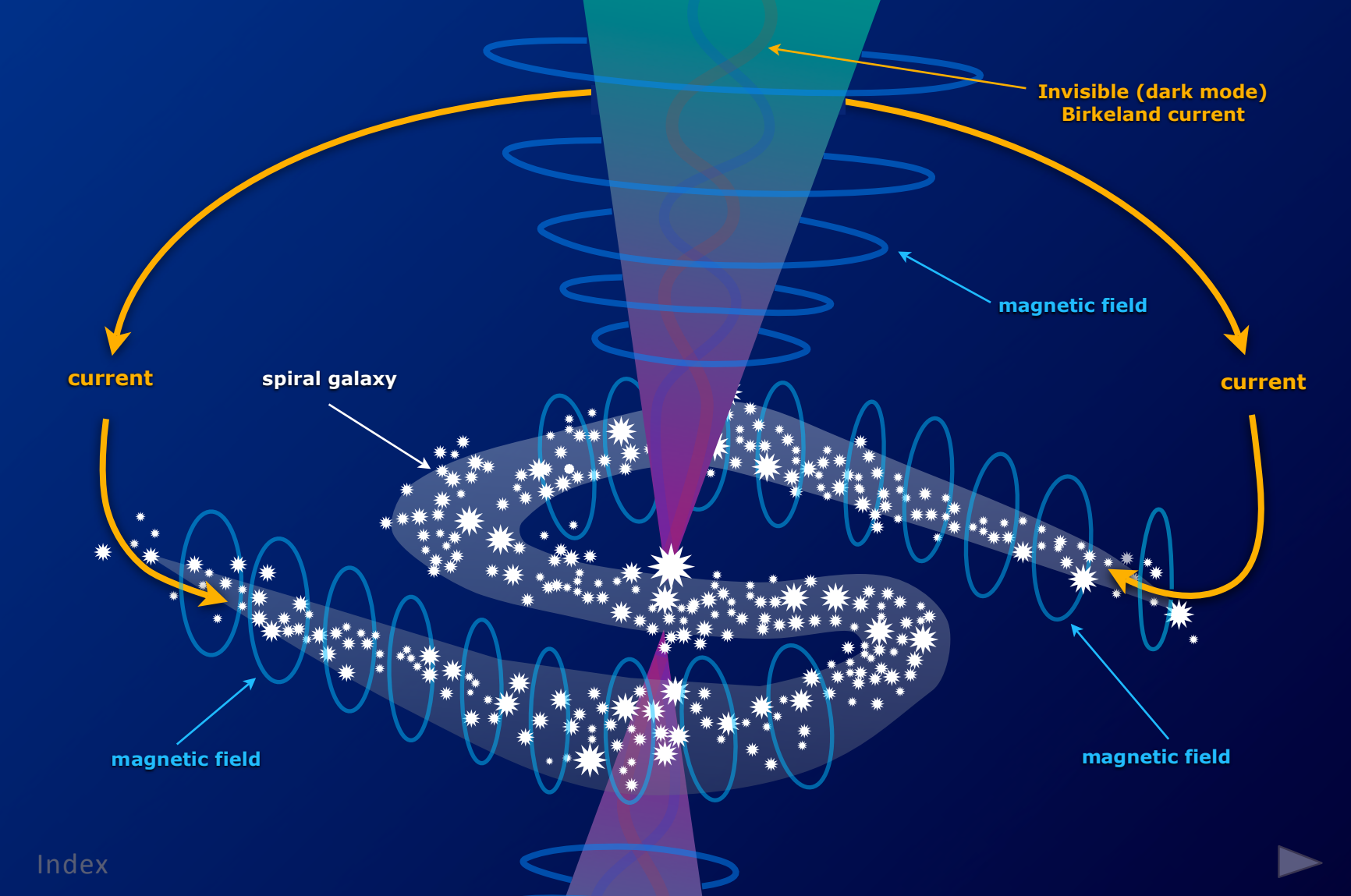
This would be the relative size of Earth next to the sun.

Traditionally, doubts about an electric sun have focused on a simplistic *electrostatic* model. It is well known that electrostatic charge could only sustain the Sun's output for a brief moment.

But Hannes Alfvén pointed out that the Sun and its environment must be understood in terms of *electrodynamics* and *circuit theory*.

Electric current flows inward along the arms of the galaxy, generating an encircling magnetic field.

The magnetic field confines and 'pinches' the galactic plasma into the magnificent spiral arms we see, lit by stars.

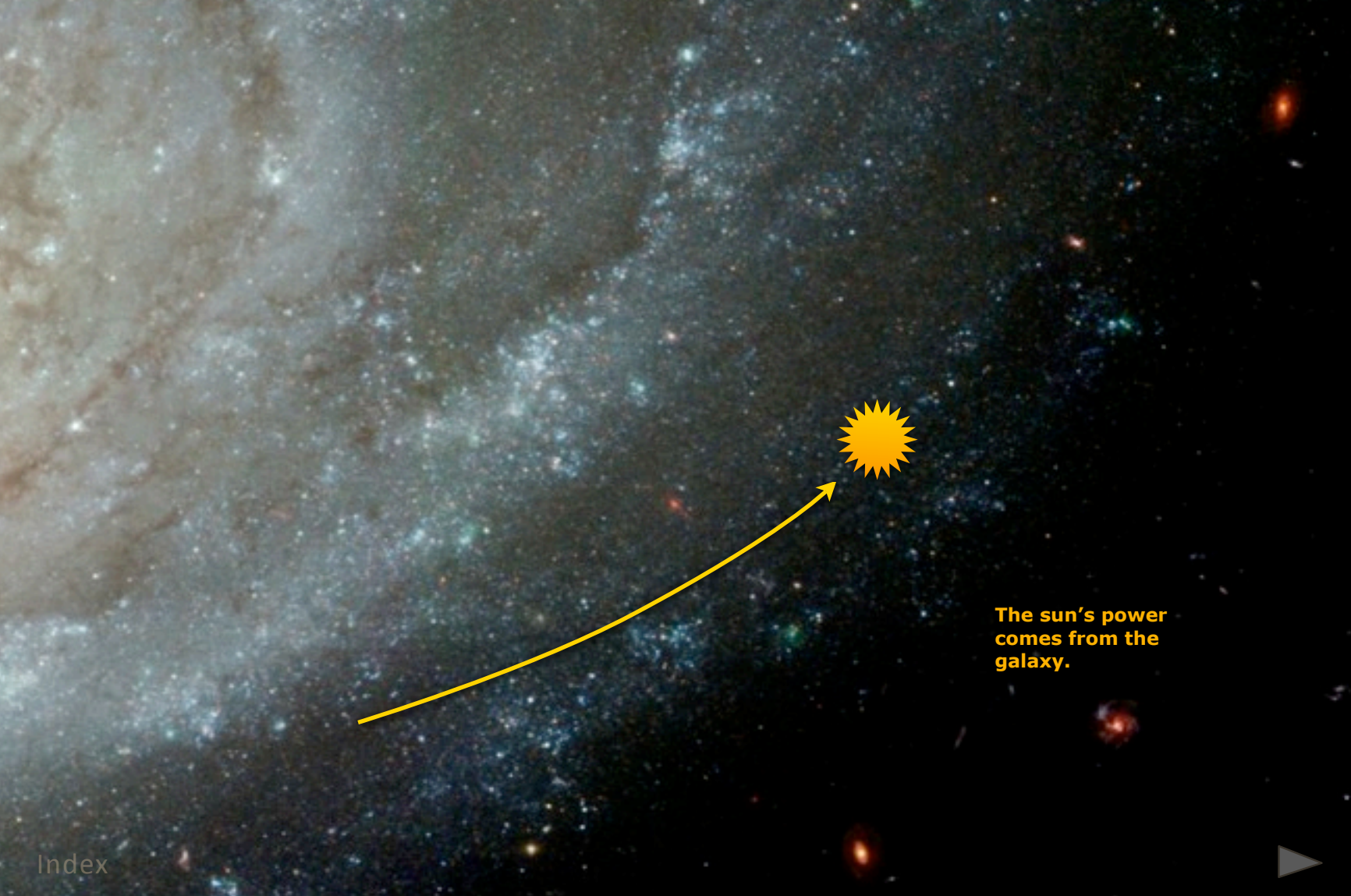

Invisible (dark mode)
Birkeland current
magnetic field
current
spiral galaxy
current
magnetic field
magnetic field

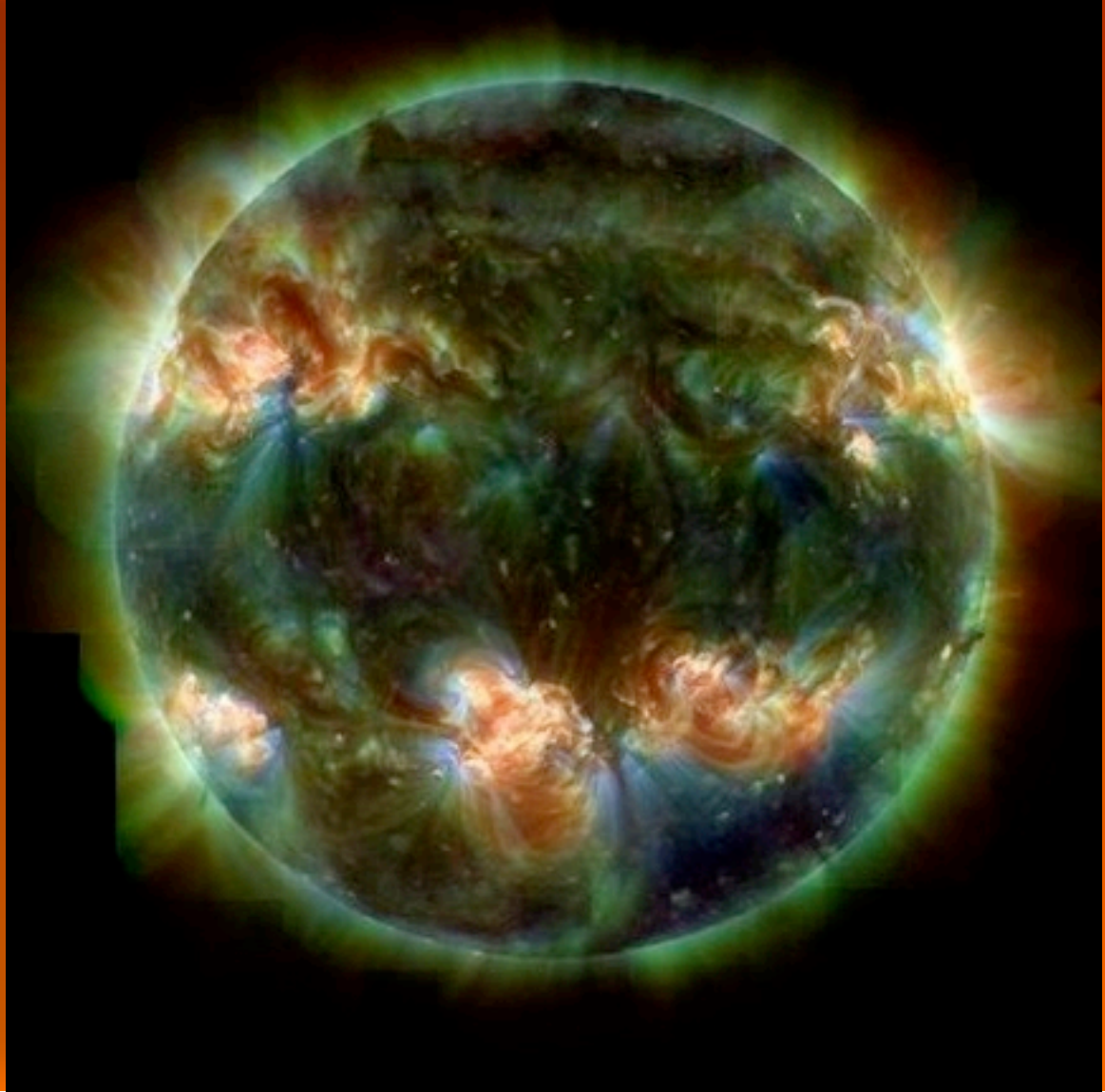
Index

The current, on reaching the galactic center, is stored in a compact *plasmoid* – a donut-shaped electromagnetic plasma structure. The plasmoid occasionally releases its stored energy in jets along the spin axis, at which time it is called an 'active galactic nucleus'.

This plasmoid is typically hidden by surrounding dust.

M82 is an active galaxy spewing jets along the polar axis.


The sun’s power comes from the galaxy.



The thermonuclear model locates nuclear reactions in the core of the Sun.

The electric model sees nuclear reactions occurring in the solar photosphere, where the current density is greatest. Here high-energy plasma discharge takes the form of innumerable tightly packed electrical tornadoes. In the laboratory they are called “anode tufts.”

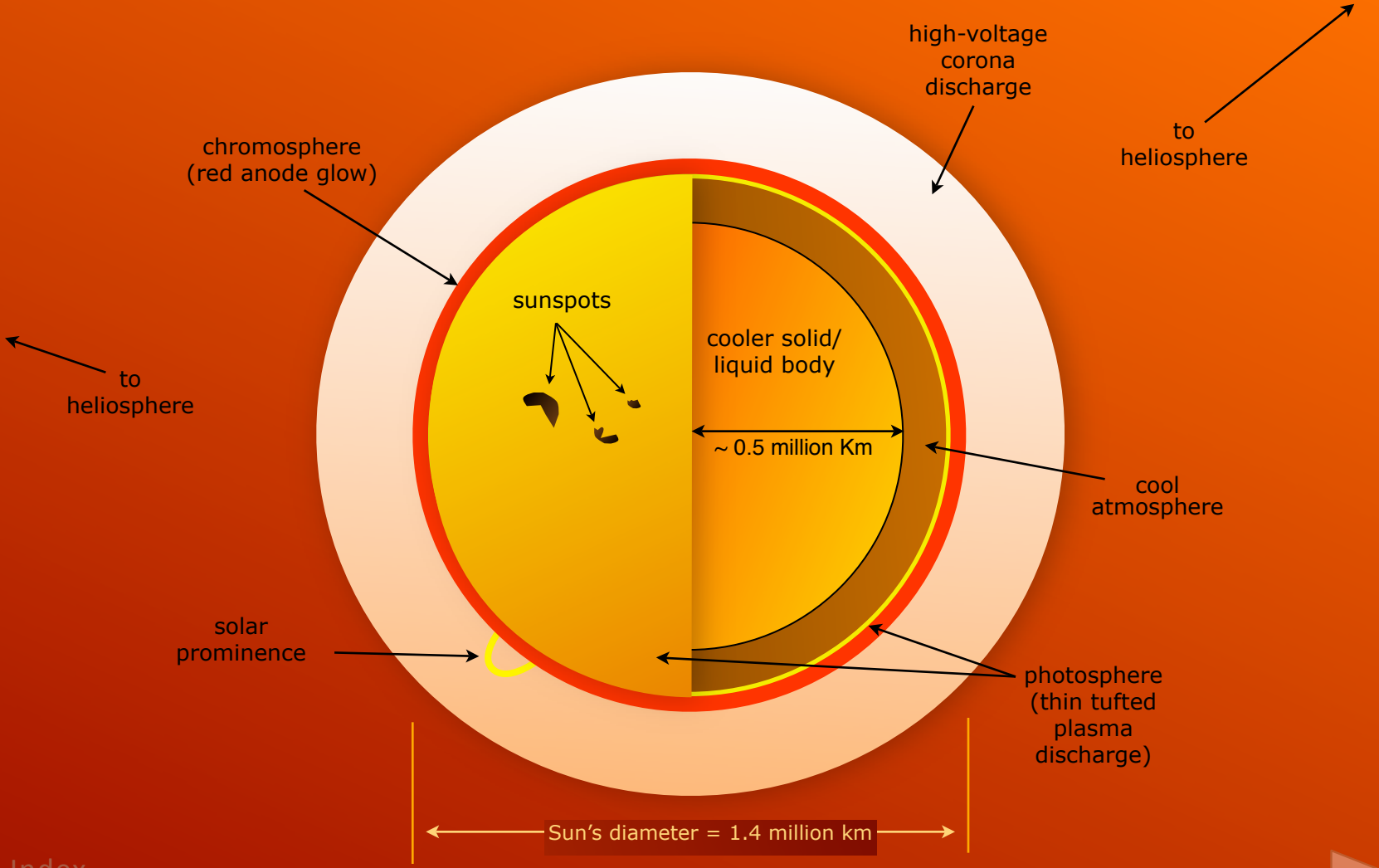
The nuclear reactions are powered by the true source of the Sun’s energy—galactic Birkeland currents.

In its relationship to the galactic environment the Sun is the *anode* or positively charged body.

The cathode in this electric exchange is not a specific object but rather a ‘virtual cathode’ found at the heliosphere—outer limit of the Sun’s influence.

On Earth, when a high-voltage power transmission line discharges into the surrounding air the noisy glow is called a ‘corona discharge.’

Much the same phenomenon occurs in the corona discharge of the sun.


high-voltage
corona
discharge
to
heliosphere
chromosphere
(red anode glow)
sunspots
cooler solid/
liquid body
~ 0.5 million Km
to
heliosphere
cool
atmosphere
solar
prominence
photosphere
(thin tufted
plasma
discharge)
Sun's diameter = 1.4 million km

Index

Magnetic loop created by the secondary current

Main current increasing in strength

Secondary current

Magnetic fields increasing in strength

N

S

Magnetic loop created by the secondary current

Main current increasing in strength

S

N

Magnetic loop created by the secondary current

Secondary current

Main current increasing in strength

There is no generally accepted explanation for sunspots or their strange cyclical behavior in the thermonuclear model.

The electric model proposes that the Sun's 'circuit' would look something like the diagram on the left.

As the main current varies in strength, a transformer action occurs in the Sun to produce secondary currents which generate varying magnetic fields.

In electrical terms this action will explain both the Sun's magnetic field reversal and the enigmatic behavior of sunspots.

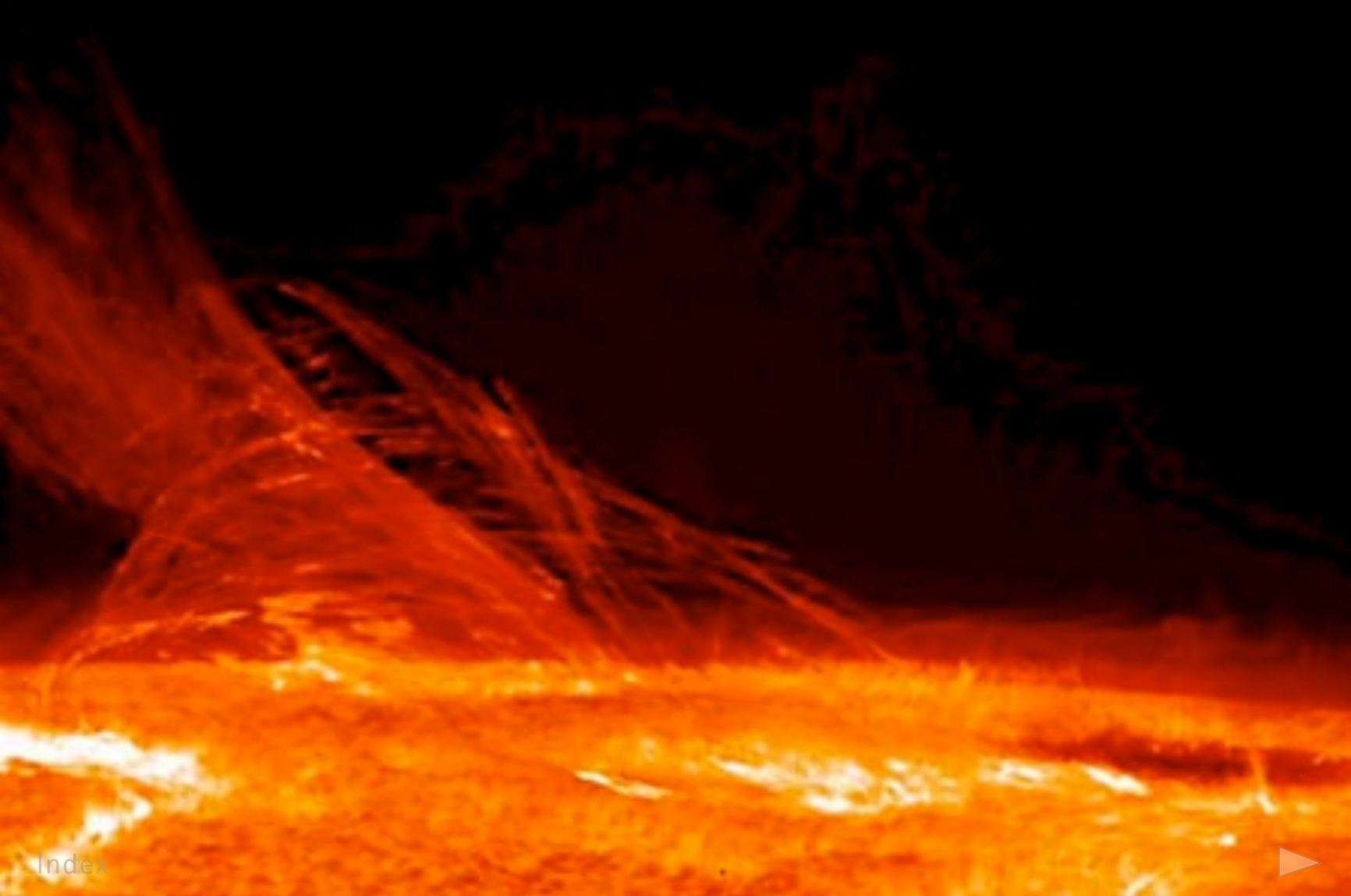
In the following pages we explore 4 key issues currently challenging the 'thermonuclear' model of the Sun. We give an 'electric' model explanation for each.

1. *Temperature*: why the spectacular increase in temperatures from the surface of the Sun outward to the corona?

2. *Solar wind*: why the rapid *acceleration* of the charged particles of the solar wind, up to millions of miles per hour away from the Sun?

3. *Sunspots*: why the mystifying Sunspot behavior?

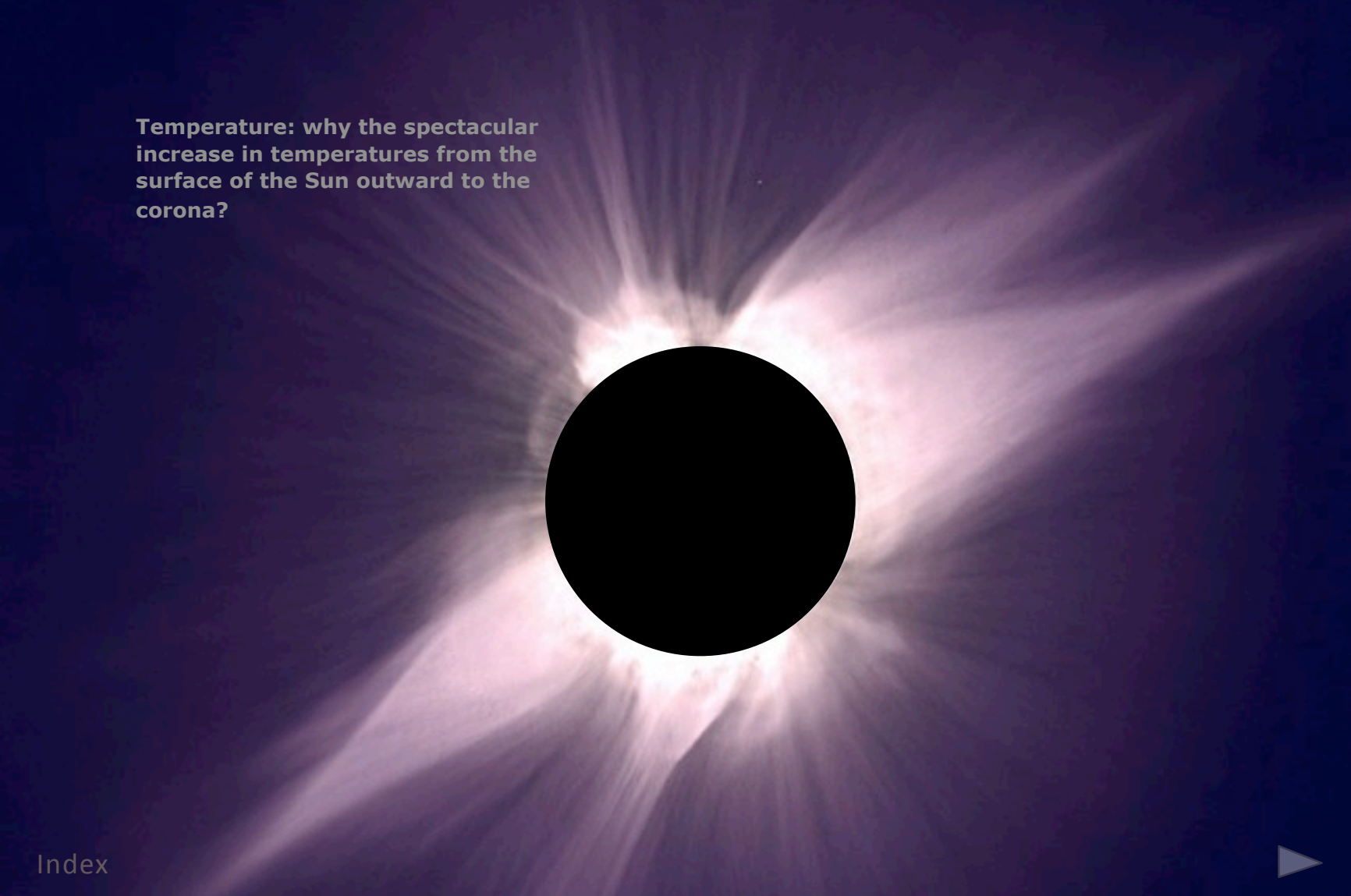
4. *Polar jets:* why the peculiar *polar* jets?



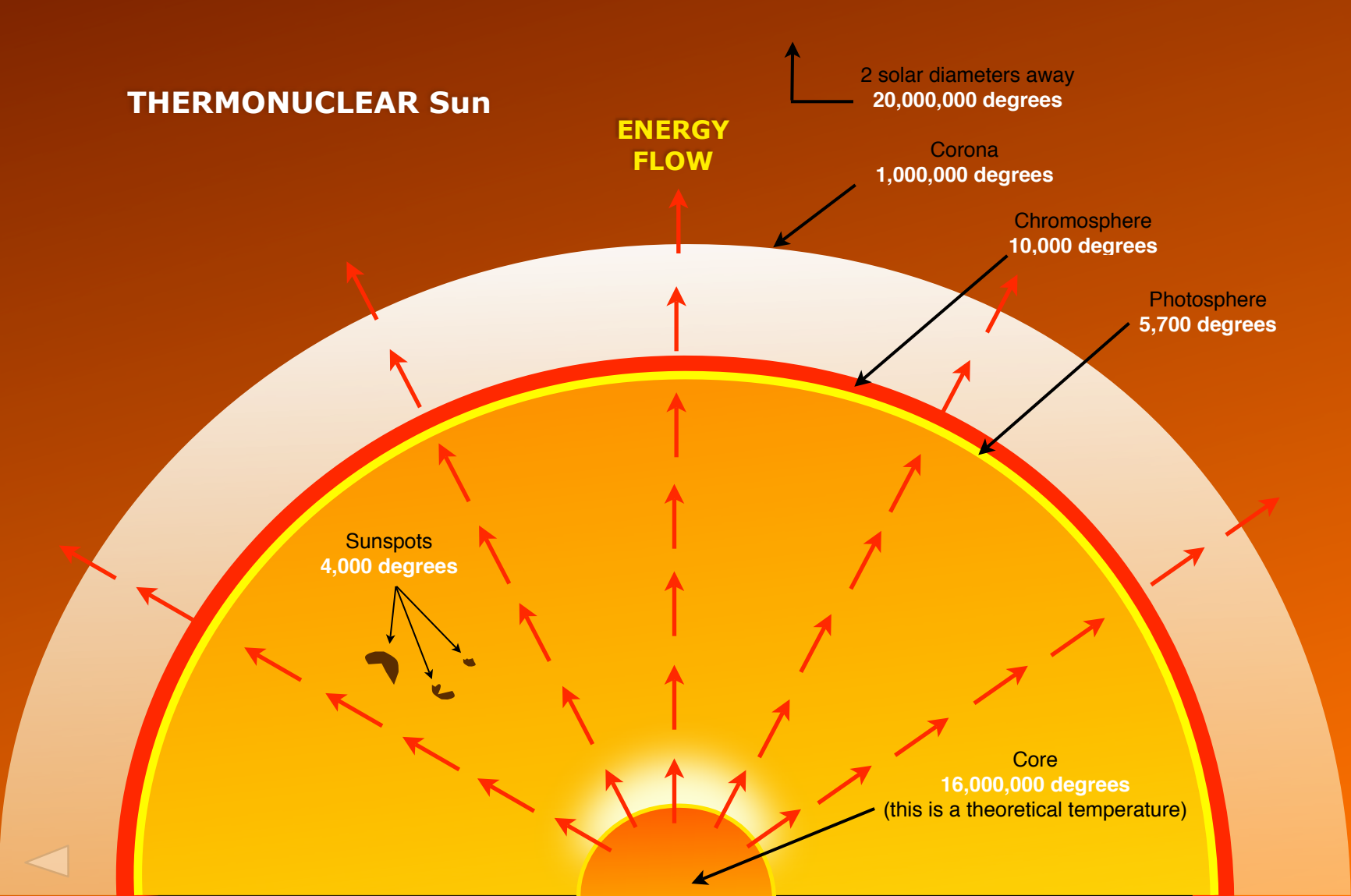
Each of the four unresolved issues noted above came as a great surprise to solar physicists.

But in the electric model these features are *expected*.

Temperature: why the spectacular increase in temperatures from the surface of the Sun outward to the corona?



Index


THERMONUCLEAR Sun
2 solar diameters away
20,000,000 degrees
ENERGY
FLOW
Corona
1,000,000 degrees
Chromosphere
10,000 degrees
Photosphere
5,700 degrees
Sunspots
4,000 degrees
Core
16,000,000 degrees
(this is a theoretical temperature)

Temperature: the thermonuclear model

For a thermonuclear Sun the power comes from the core reaction. The heat moves outwards.

If so, the temperature should decrease as we move away from the source of heat.

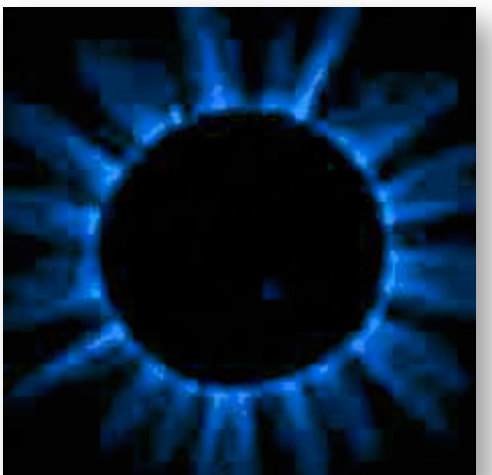
Instead, the temperature is at a minimum just above the photosphere (surface) and rises spectacularly in the corona and beyond.

Temperature: the electric model

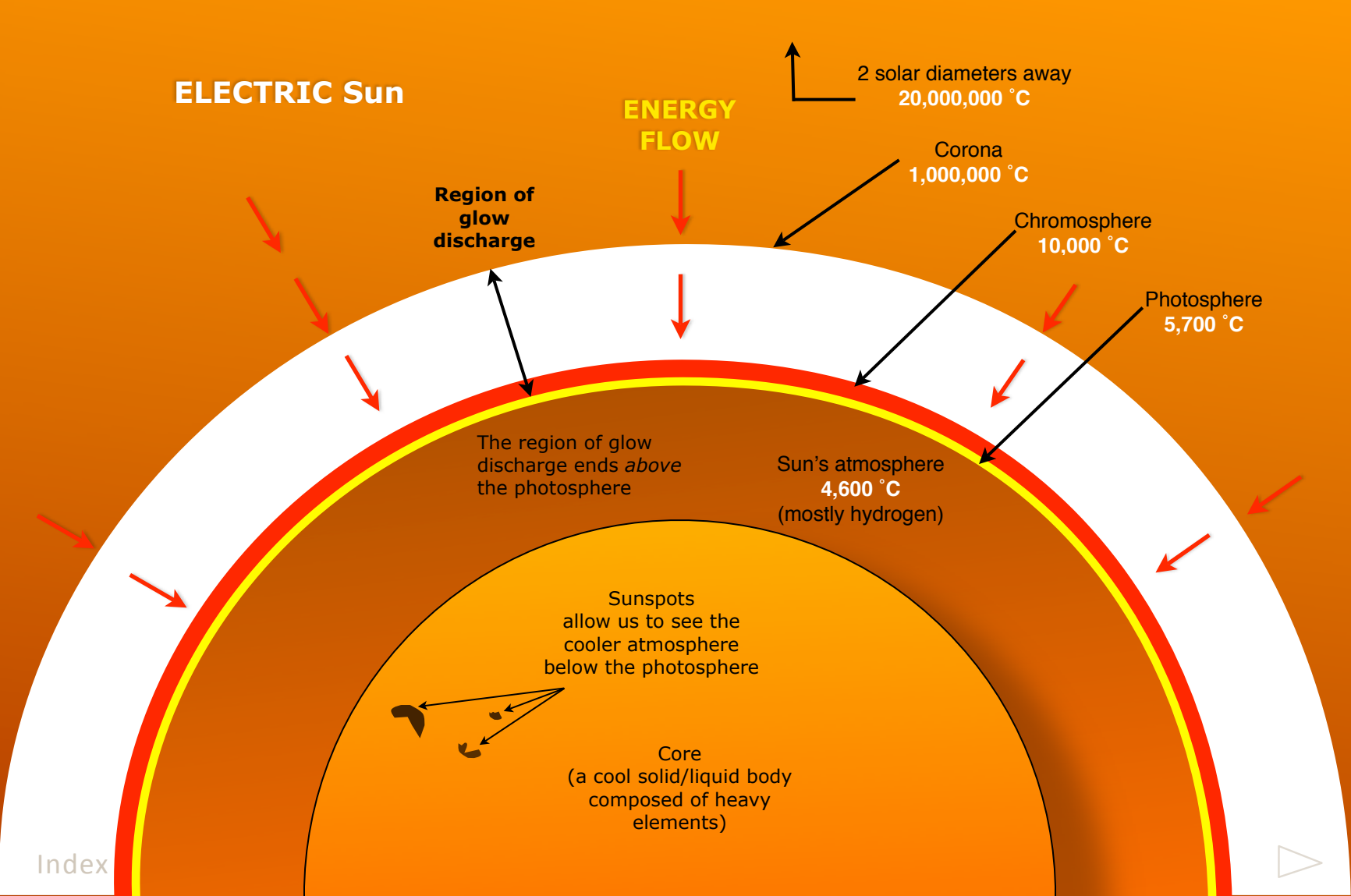
The energy to heat the electric Sun comes *externally* from the galaxy.

The weak electric field in interplanetary space is concentrated most strongly above the surface of the Sun. Protons (positively charged particles) are accelerated away from the photosphere to collide with the thin atmosphere of the corona, heating it to a million degrees or more.

Seen in these terms, the super-heated corona is a familiar glow discharge phenomenon recognized by high-voltage engineers.



Laboratory corona discharge

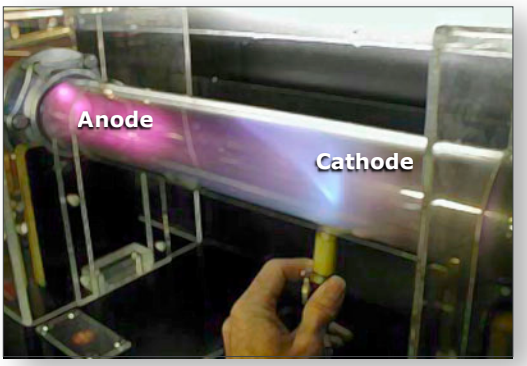

ELECTRIC Sun
ENERGY FLOW
2 solar diameters away
20,000,000 ˚C
Corona
1,000,000 ˚C
Chromosphere
10,000 ˚C
Photosphere
5,700 ˚C
Region of glow discharge
The region of glow discharge ends *above* the photosphere
Sun's atmosphere
4,600 ˚C
(mostly hydrogen)
Sunspots
allow us to see the cooler atmosphere below the photosphere
Core
(a cool solid/liquid body composed of heavy elements)

Index

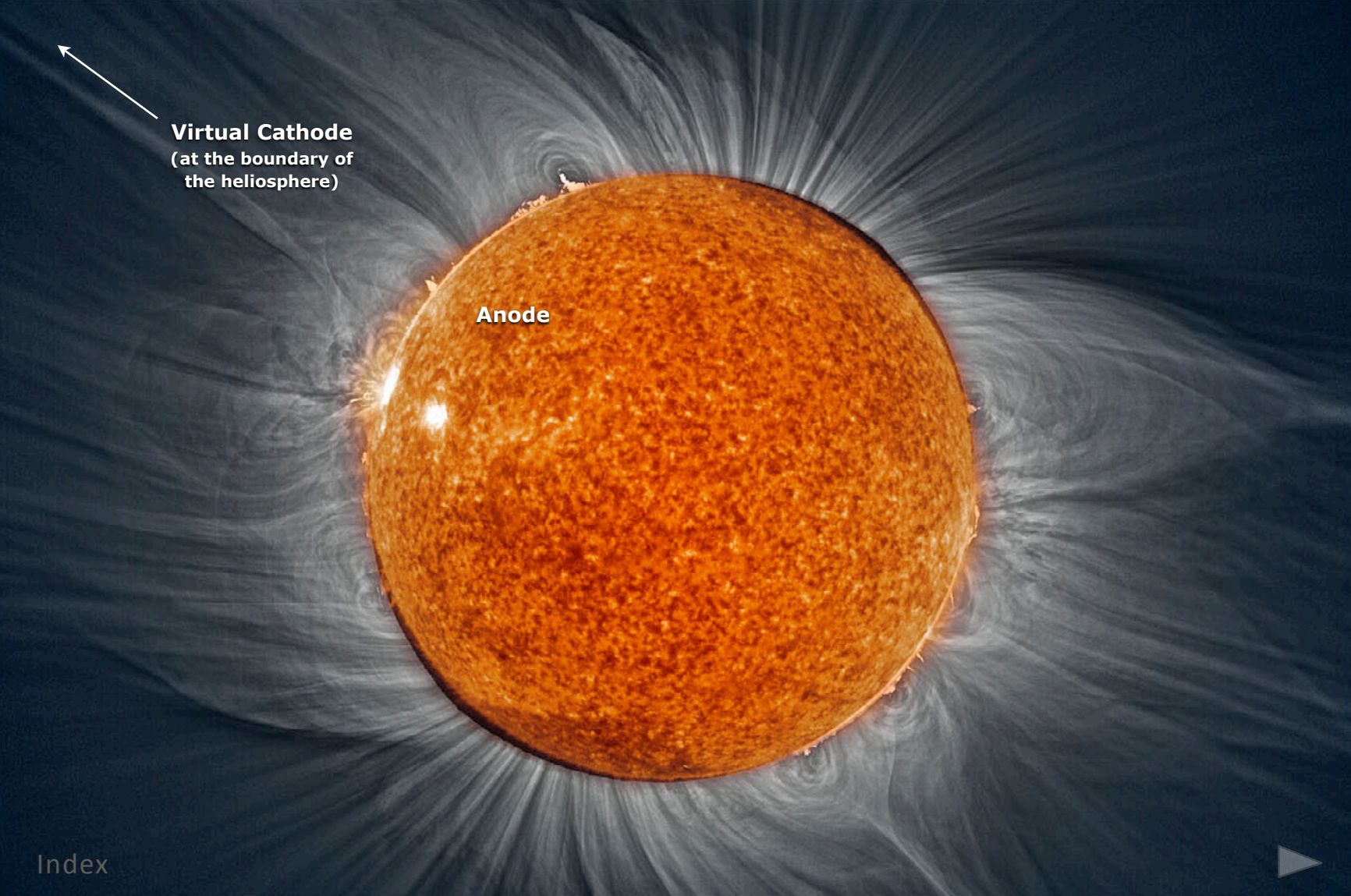
In the laboratory the *glow discharge* tube (near right) demonstrates how distinct plasma regions form between the anode and the cathode.

The high resolution image of the solar corona (far right) highlights the paths of filamentary electric currents flowing between the photosphere and space.

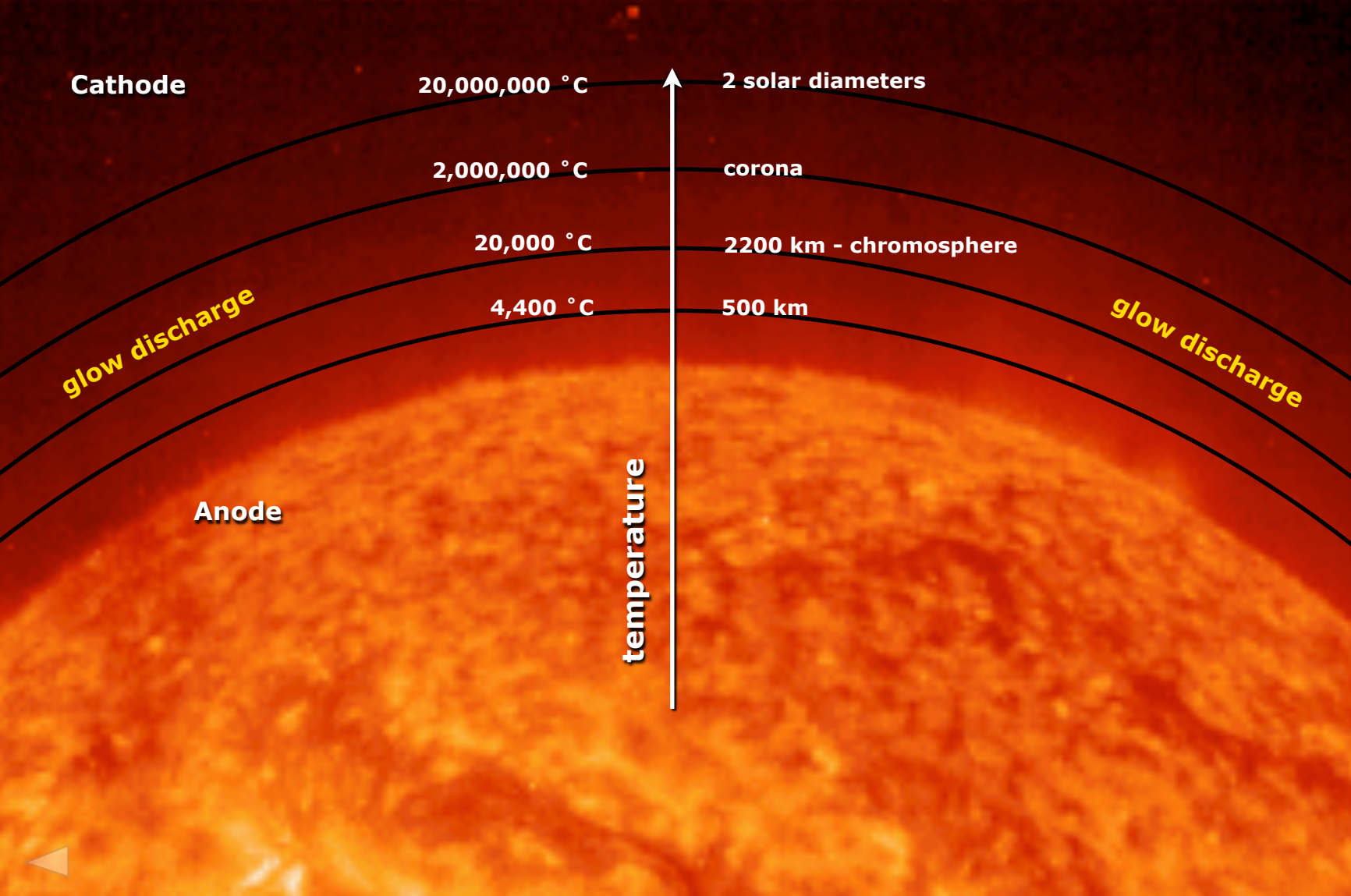
The solar 'wind' does not simply 'boil off' the hot corona.



Lab generated 15,000 volt 'glow discharge.' The magnet held below the tube shows how current in plasma tends to flow along magnetic field lines.



Index


Cathode
20,000,000 °C
2 solar diameters
2,000,000 °C
corona
20,000 °C
2200 km - chromosphere
4,400 °C
500 km
glow discharge
glow discharge
Anode
temperature

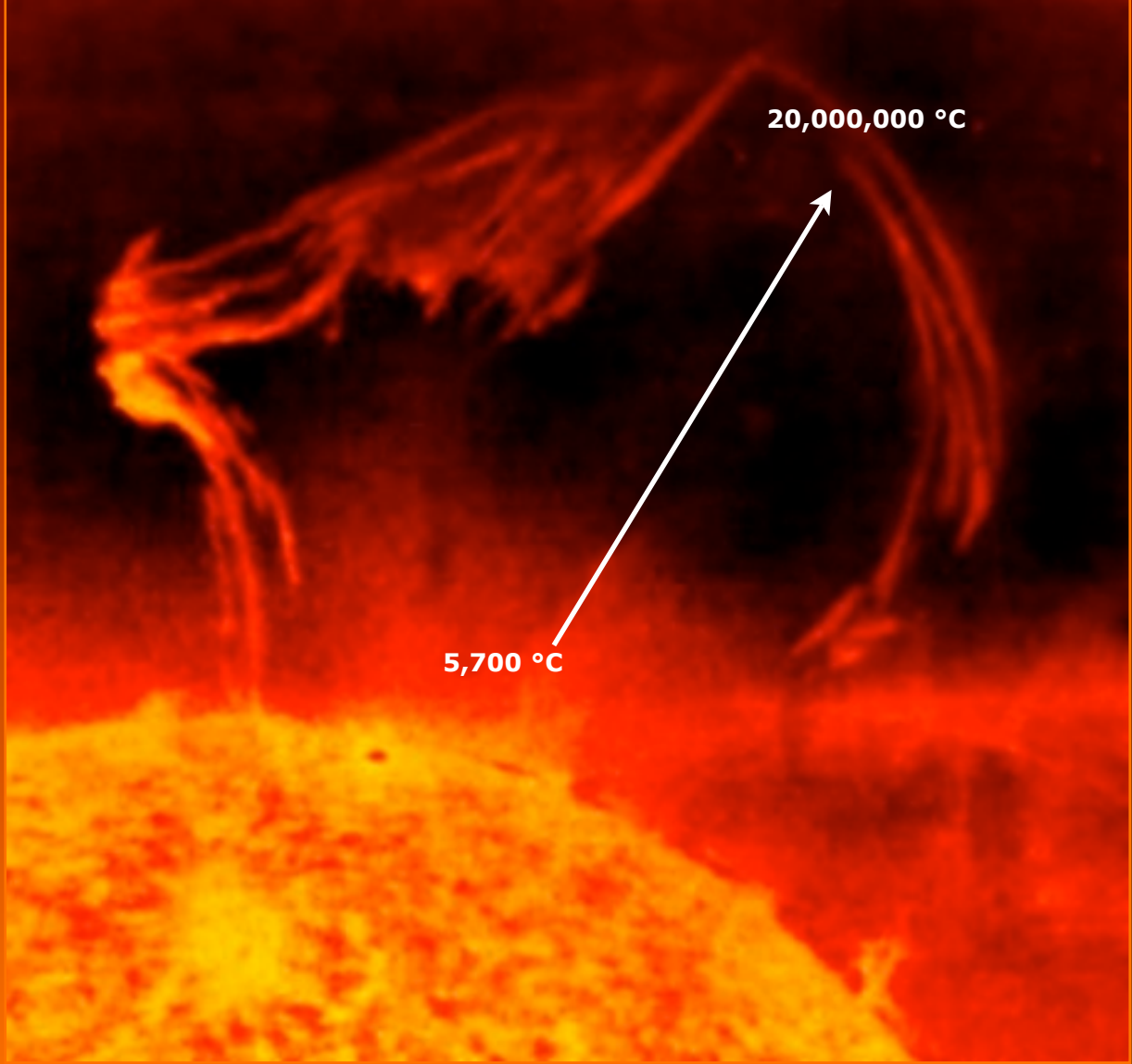
The glow discharge of the electric Sun is visible in the corona and descends into the red ‘anode glow’ of the chromosphere.

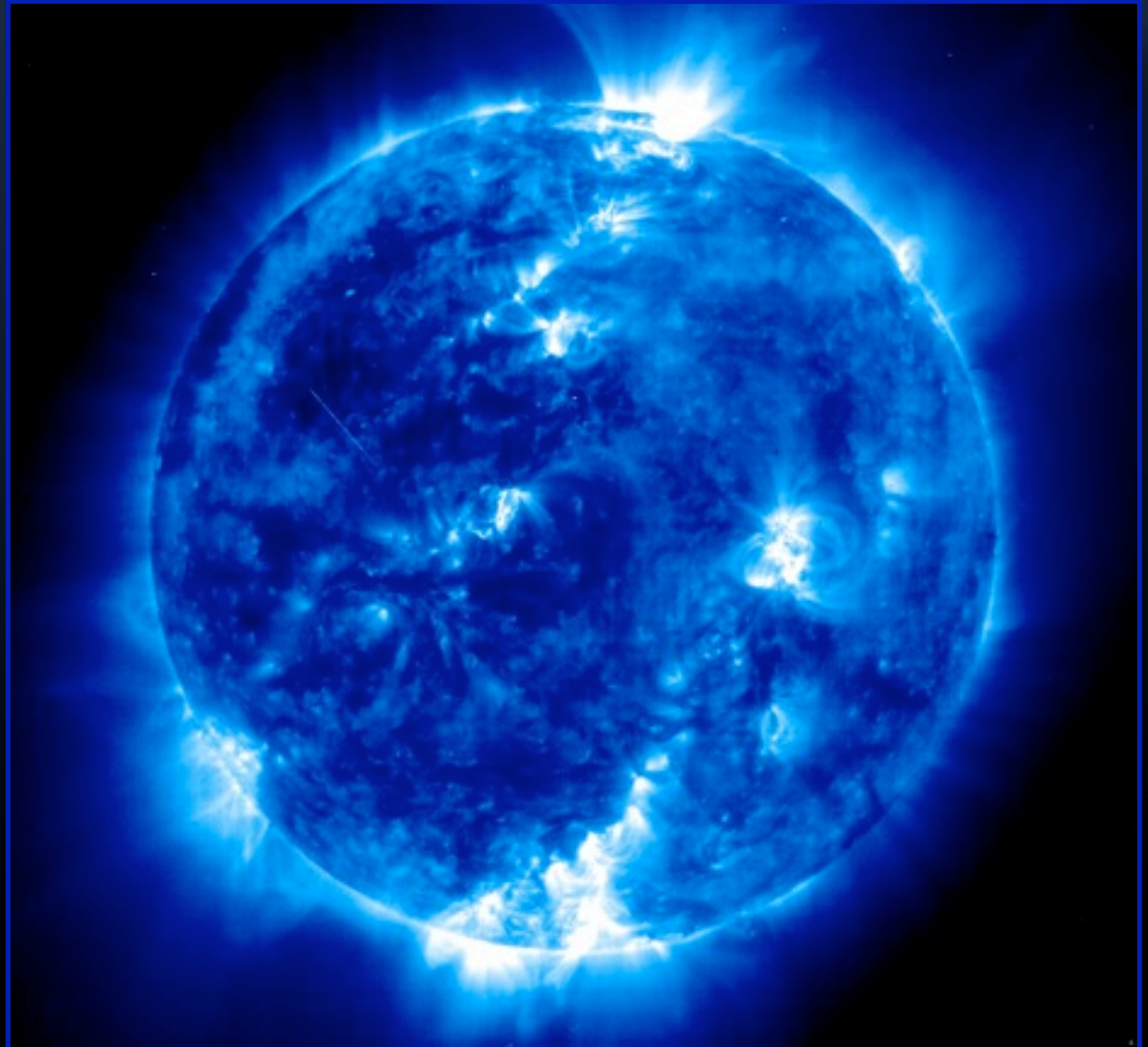
Correspondingly, the highest particle energies are *not* at the photosphere (the Sun’s visible surface) but above it. Far above it.

At 2.8 million kilometers from the sun the ‘temperature’ reaches 100 million degrees.

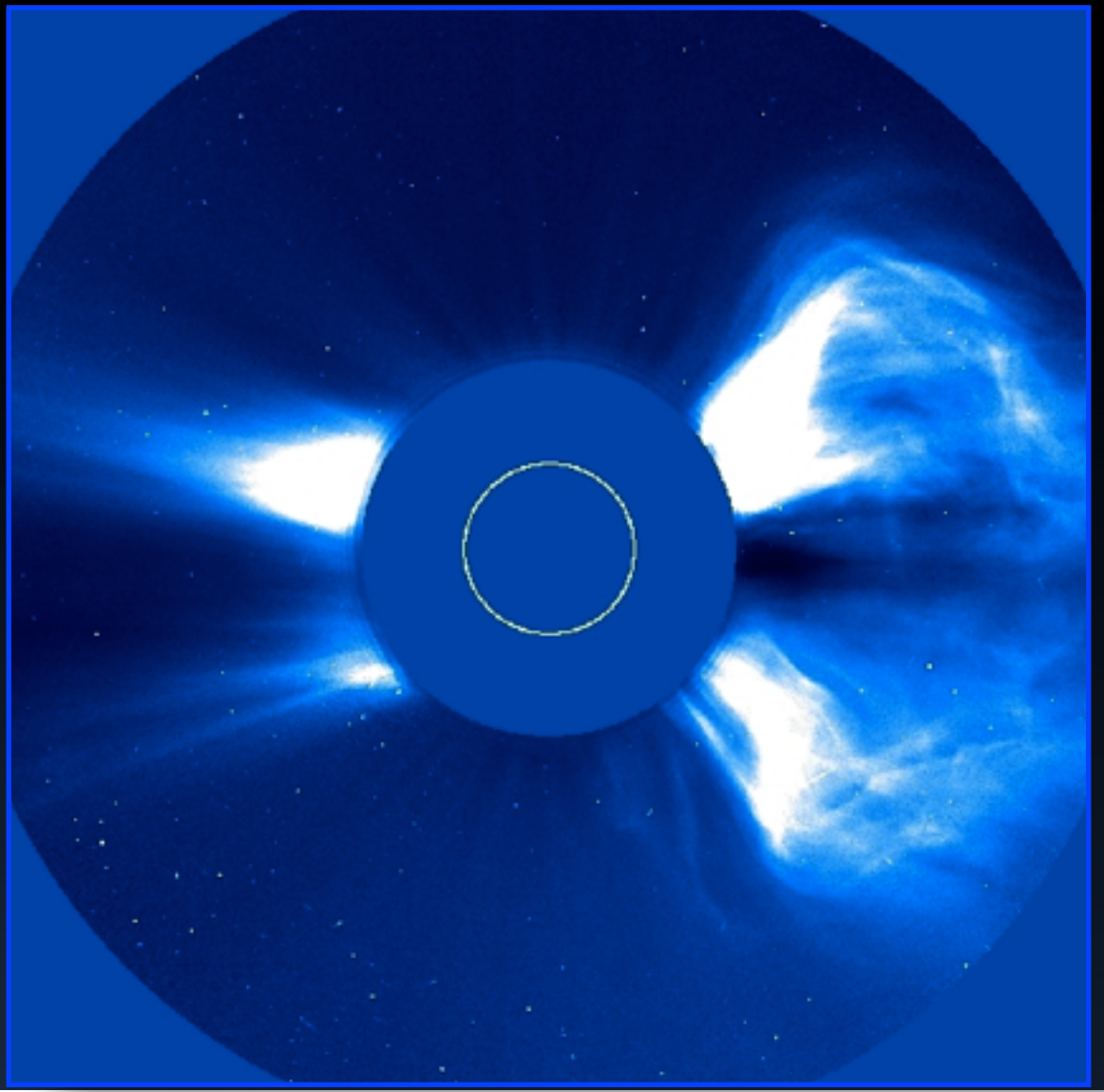
This strange phenomenon of the ‘reverse temperature gradient’ of the sun contradicts every original expectation of the thermonuclear model.

But it is exactly what is expected in the electric model, and mirrors perfectly the glow discharge phenomenon observed in the laboratory.


20,000,000 °C
5,700 °C



Solar wind: why the rapid acceleration of the charged particles of the solar wind, up to millions of miles per hour?



Solar Wind: the thermonuclear model

If the high temperature of the corona could explain the acceleration of the solar wind we would expect cool ‘red giant’ stars to have the weakest winds. But in fact they have the strongest.

The Sun is not hot enough to ‘boil off’ its atmosphere against its powerful gravitational attraction. Yet the particles of the solar wind defy the Sun's gravity, accelerating past Venus, Earth, and Mars.

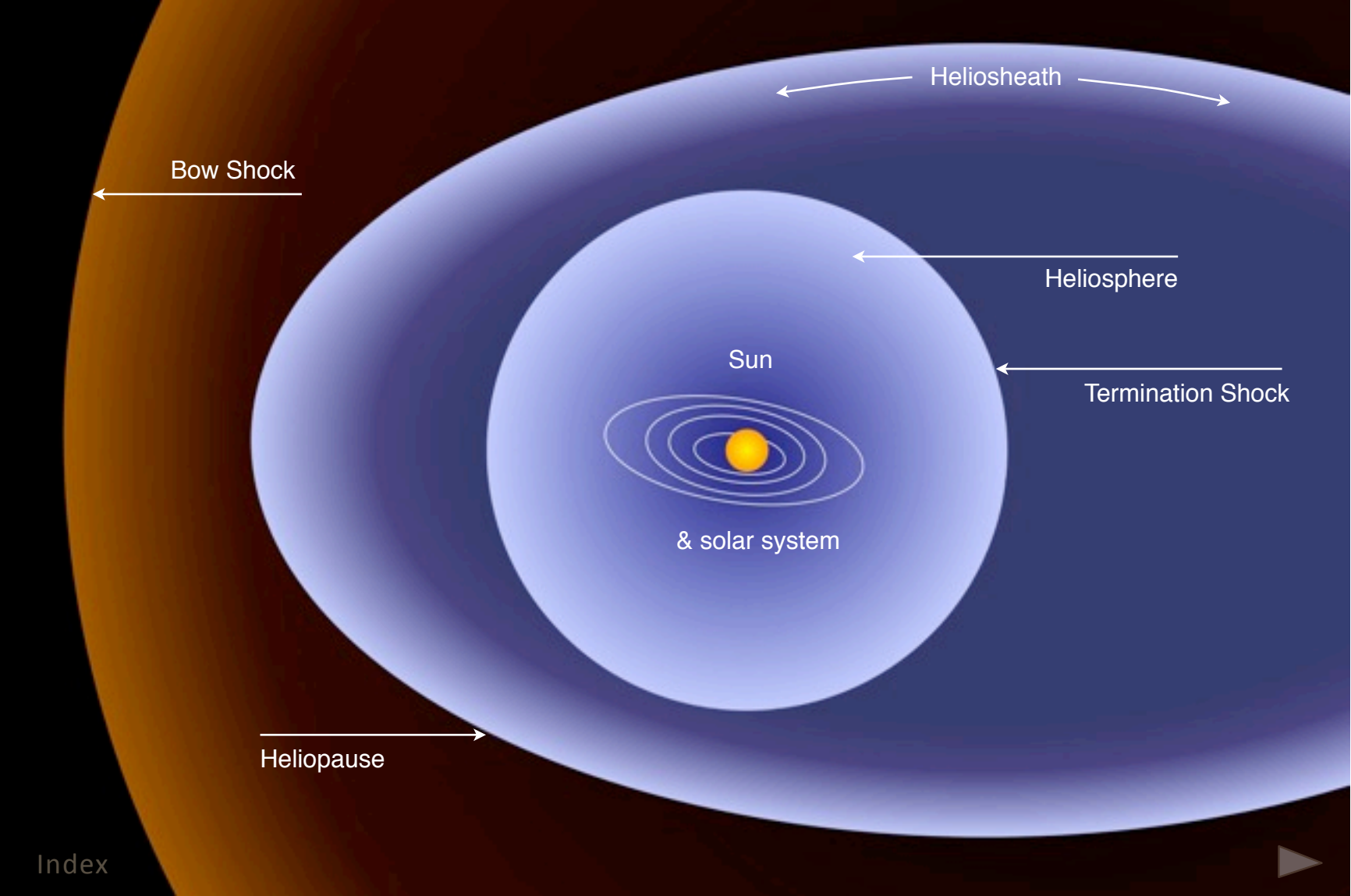
Since these particles are not miniature ‘rocket ships,’ such acceleration is the last thing one should expect from a thermonuclear star.

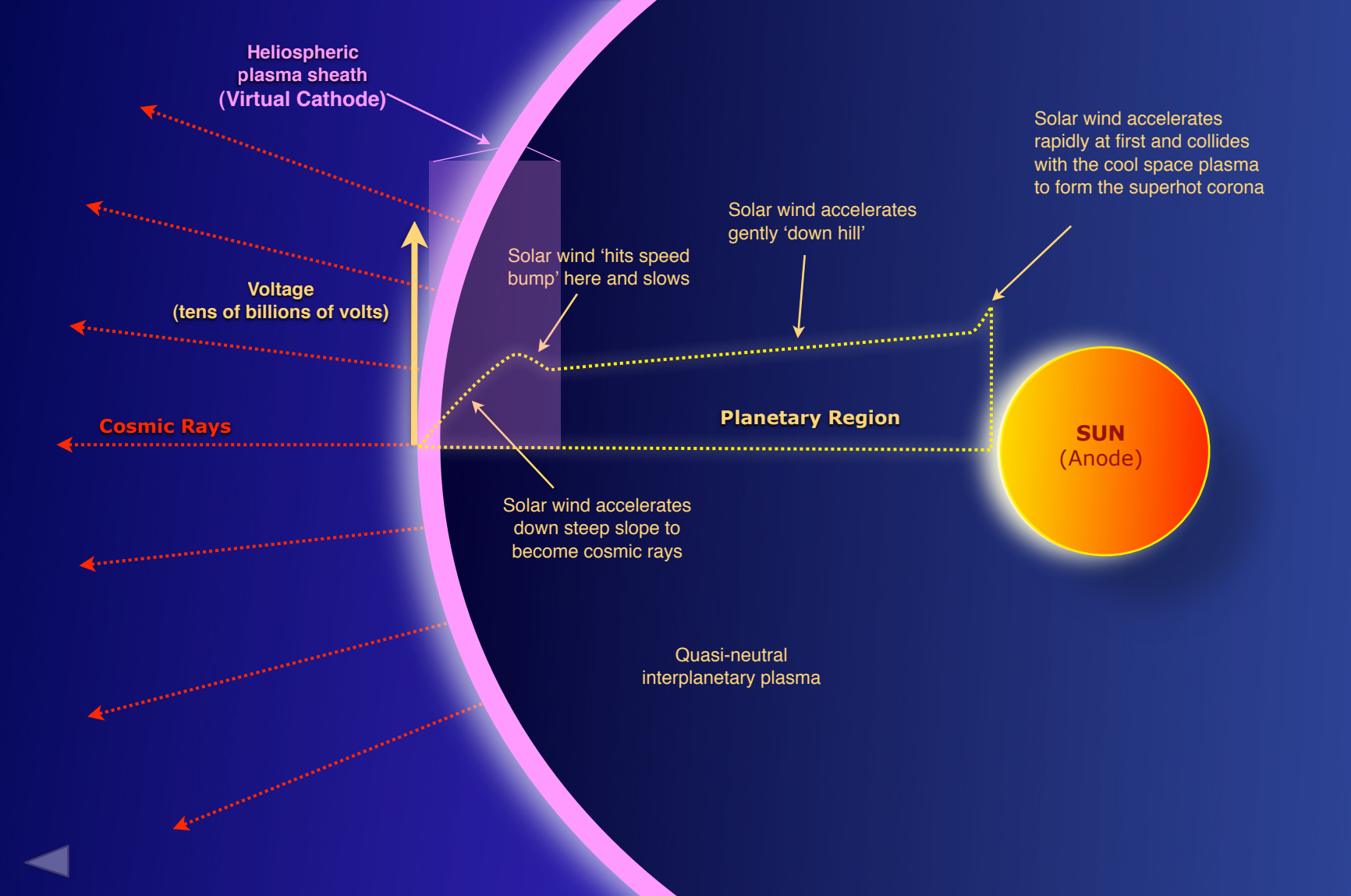
Large coronal mass ejection (CME) from 6 November 1997 as recorded by the LASCO C2 coronagraph at 12:36 UT.

In the thermonuclear model the solar wind rushes out from the Sun, slows through the termination shock and finally halts at the heliopause. The interstellar medium (plasma) backs up to where a ‘bow shock’ occurs. These are features of supersonic objects moving through air.

In the electric model, a simple mechanical analogue does not apply. The Sun is an electrical body moving in an electrified environment.

Graphic representation of the Sun’s domain–the thermonuclear model


Heliosheath
Bow Shock
Heliosphere
Sun
Termination Shock
& solar system
Heliopause


Heliospheric
plasma sheath
(Virtual Cathode)
Voltage
(tens of billions of volts)
Cosmic Rays
Solar wind 'hits speed
bump' here and slows
Solar wind accelerates
gently 'down hill'
Solar wind accelerates
rapidly at first and collides
with the cool space plasma
to form the superhot corona
Planetary Region
SUN
(Anode)
Solar wind accelerates
down steep slope to
become cosmic rays
Quasi-neutral
interplanetary plasma

Solar Wind: the electric model

In the electric model the Sun and its planets are protected within a plasma sheath or cell ('heliosphere'), far beyond the outermost planets.

Across the thin boundary of the heliospheric sheath there is a strong electric field. This field accelerates charged particles to speeds approaching the speed of light—they become *cosmic rays*.

Cosmic rays thus give us a measure of the driving voltage of stars (tens of billions of volts).

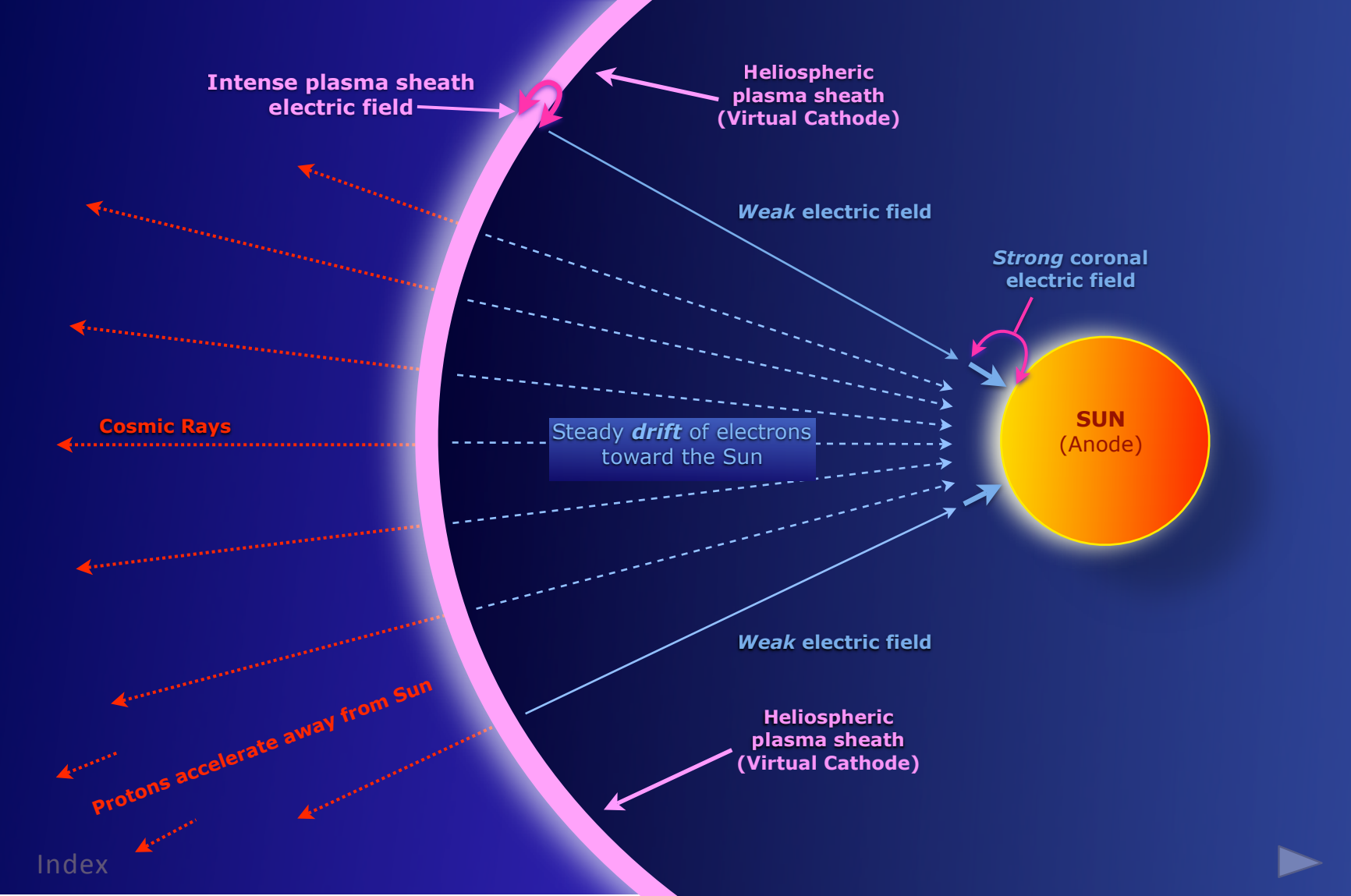
Electrical diagram of the solar environment, with a graph of voltage vs. distance from the anode to the cathode in a glow discharge.

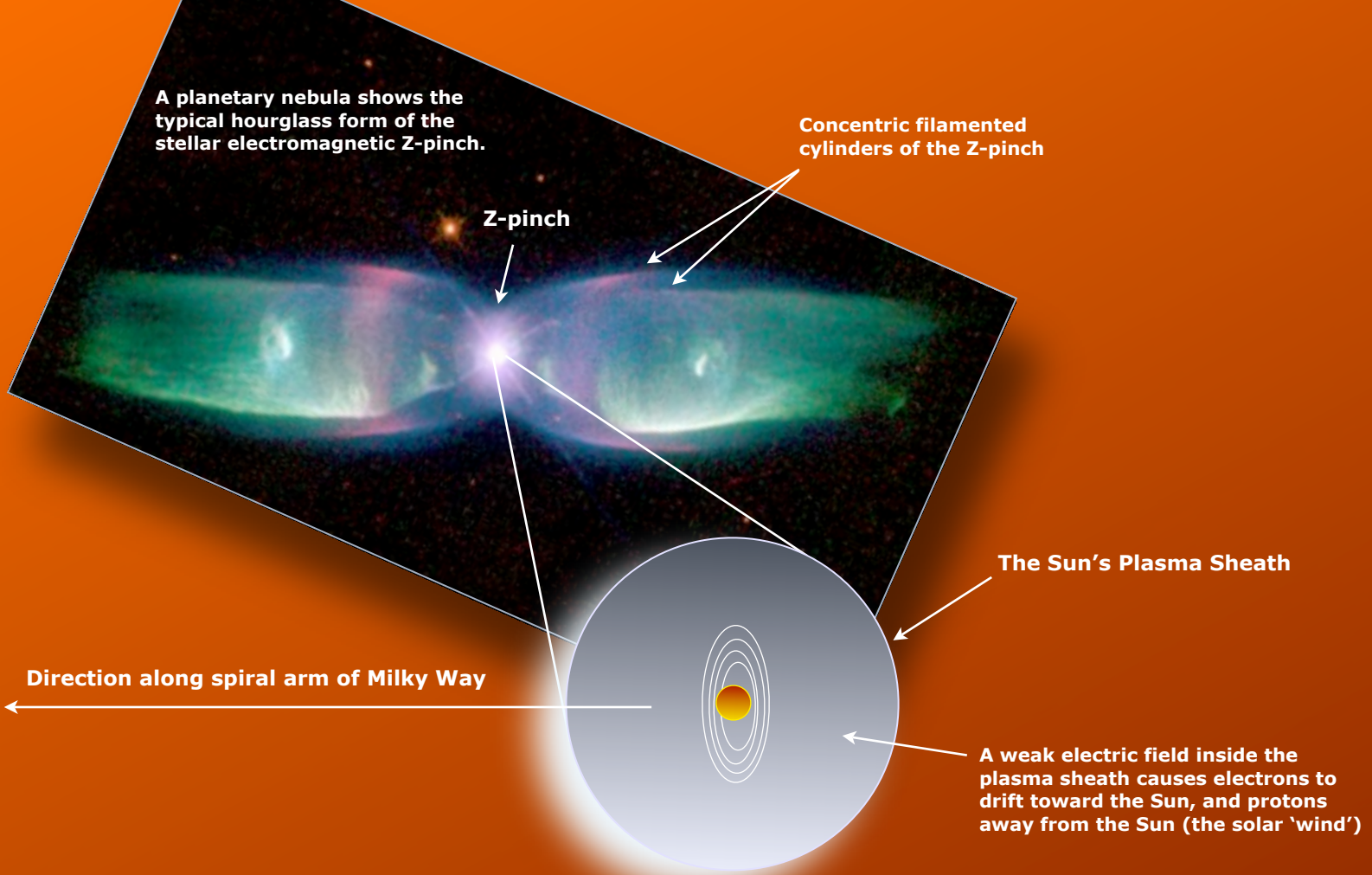
Electrons are caused to *drift toward* the Sun by the electric field.

The intense electric field across the boundary sheath contrasts sharply with the electrical environment inside the sheath.

Shielded within this cocoon the planets are subject only to a weak electric field, causing a steady drift of electrons toward the Sun.

Across spacecraft dimensions of a few meters, the electric field is immeasurably weak. But in the immense *volume* of the heliosphere, it causes a drift of electrons that becomes a focused electric current sufficient to power the Sun.


Intense plasma sheath electric field
Heliospheric plasma sheath (Virtual Cathode)
Weak electric field
Strong coronal electric field
Cosmic Rays
Steady drift of electrons toward the Sun
SUN (Anode)
Weak electric field
Heliospheric plasma sheath (Virtual Cathode)
Protons accelerate away from Sun
Index


A planetary nebula shows the typical hourglass form of the stellar electromagnetic Z-pinch.
Z-pinch
Concentric filamented cylinders of the Z-pinch
The Sun's Plasma Sheath
Direction along spiral arm of Milky Way
A weak electric field inside the plasma sheath causes electrons to drift toward the Sun, and protons away from the Sun (the solar 'wind')

The sun’s environment in space

The Sun’s plasma environment is shaped by powerful electromagnetic forces within a spiral arm of the Milky Way. Colliding gases play no more than a minor role.

In the electric model the entire heliosphere lies at the core of an invisible hourglass shape, formed by the ‘pinching’ of galactic currents.

This feature of the Sun’s larger plasma domain is well illustrated in the laboratory by the ‘Z-pinch,’ typical of high-energy electric discharge. The best visible example in space is provided by dusty planetary nebulae (left).

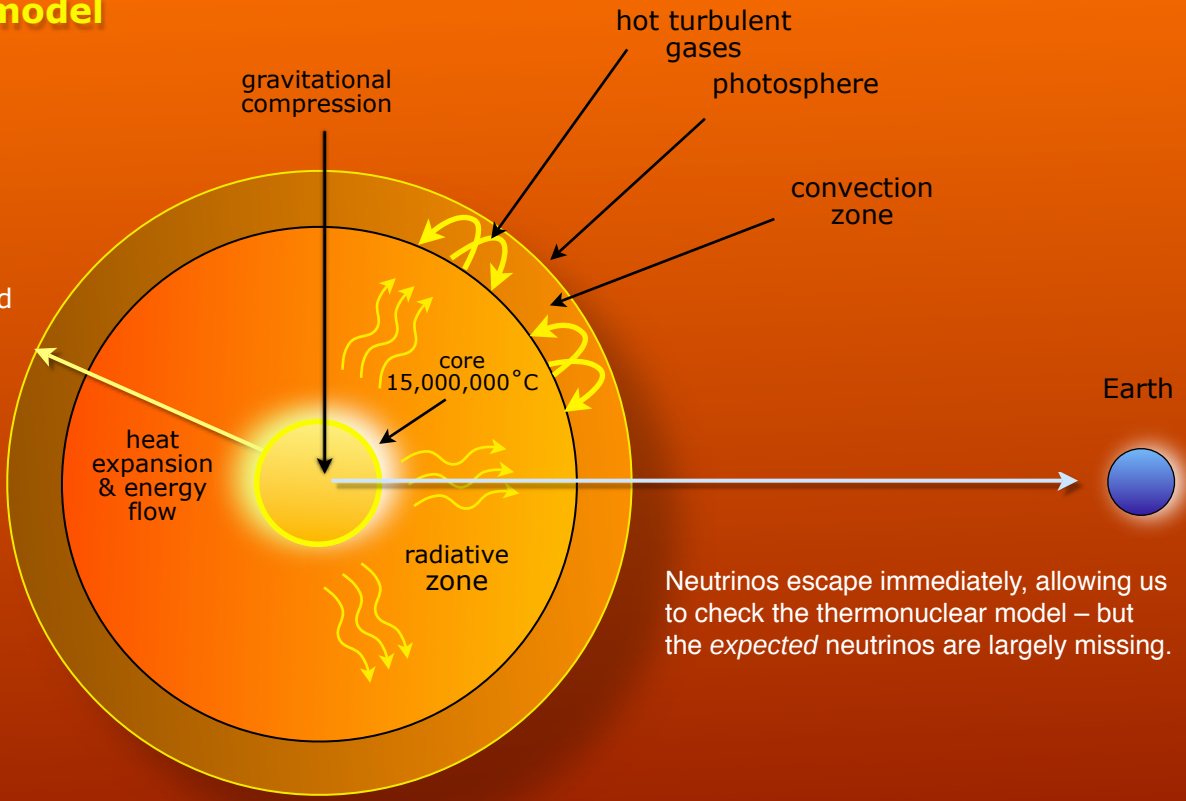
Inside the sun: thermonuclear model

Without a source of internal heat to ‘blow it up like a balloon’ the Sun would collapse under its own weight. The only long-lived source of heat is nuclear power. It must release extremely slowly or the Sun would explode. No experiment has tested the complex and unlikely theory. And the 15,000,000 ^{0}C temperature cannot be measured.

The thermonuclear model predicts ghostly neutrinos that can escape the Sun’s core and swiftly reach the Earth. The expected neutrinos are largely missing.

Rather than considering the thermonuclear model seriously threatened by this contradictory discovery, it was assumed that the problem had to lie with the neutrinos.

thermonuclear model

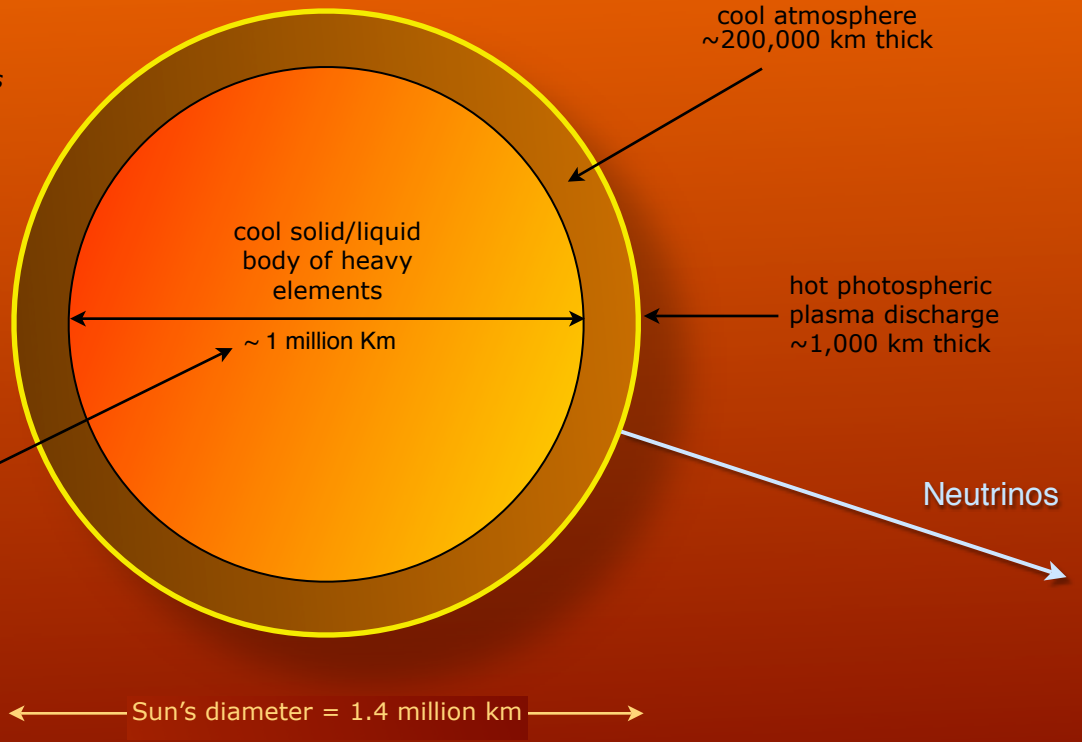


The energy released in the core takes millions of years to reach the surface.

Neutrinos escape immediately, allowing us to check the thermonuclear model – but the *expected* neutrinos are largely missing.

electric model

Heavy elements are concentrated at the center of a star-forming Z-pinch. So the Sun must have a heavy element body that *precludes* a thermonuclear core.



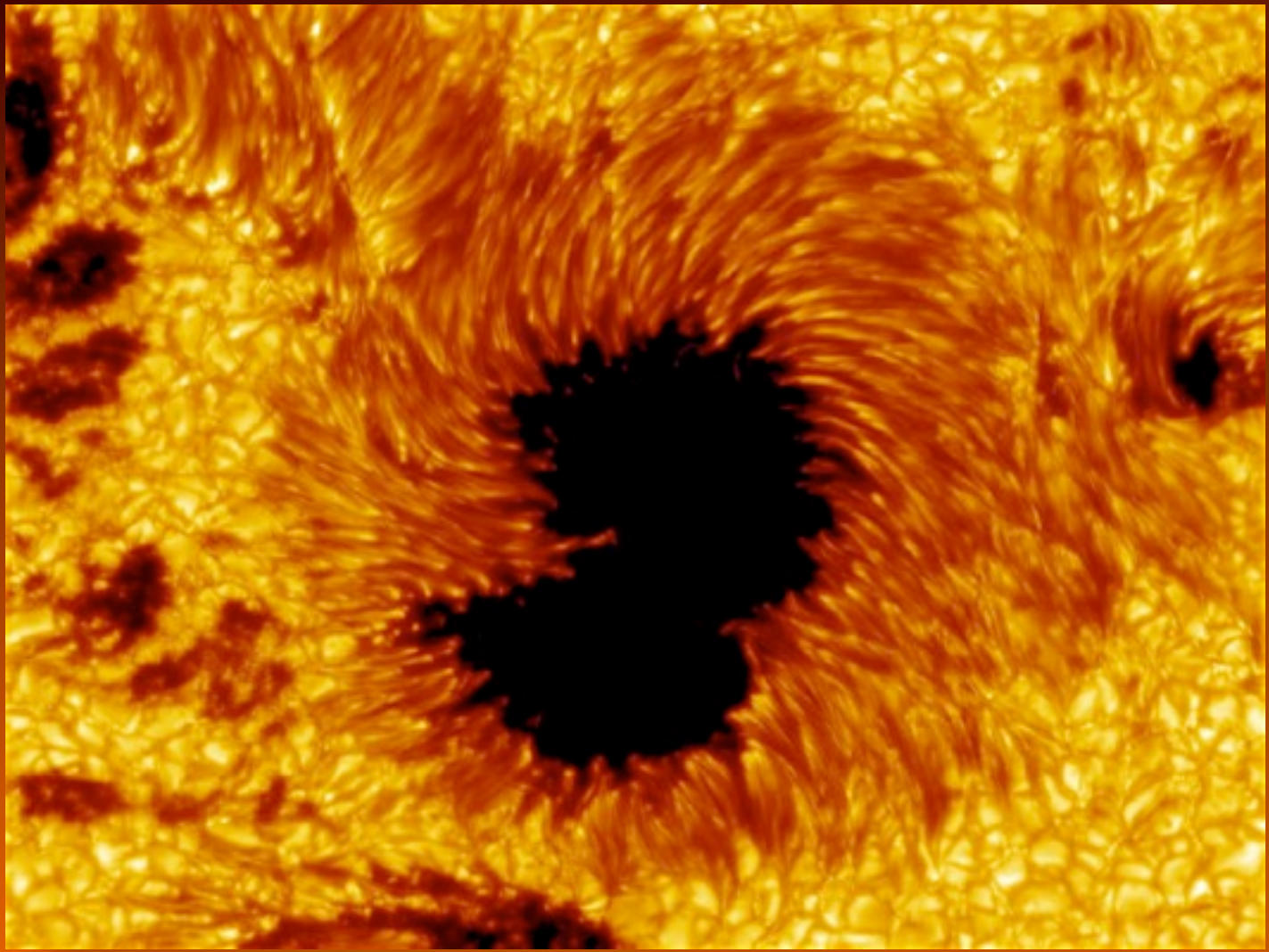
The Sun has a mass of 330,000 Earths. The volume of that many Earths would give a diameter of about 1 million km.

Inside the sun: electric model

In the ‘electric’ model of the Sun, simple laboratory gas laws do not apply. The visible ‘surface’ (photosphere) is a thin electrical discharge layer at the *top* of a plasma ‘atmosphere’—the continuous ‘lightning’ that produces the shining sphere of the Sun.

We do not know what the Sun is made from by simply measuring its gravity and volume, because the volume we measure is an electrical display and not the true size of the Sun. The Sun is much more than a neutral ball of hydrogen gas. Within its vast hydrogen atmosphere, there is a smaller, more dense body.

The electric sun does not require the lethal radiation of an unstable internal hydrogen bomb. And it doesn’t require internal heat to prevent gravitational collapse. All kinds of neutrinos come from the nuclear reactions in the photosphere.

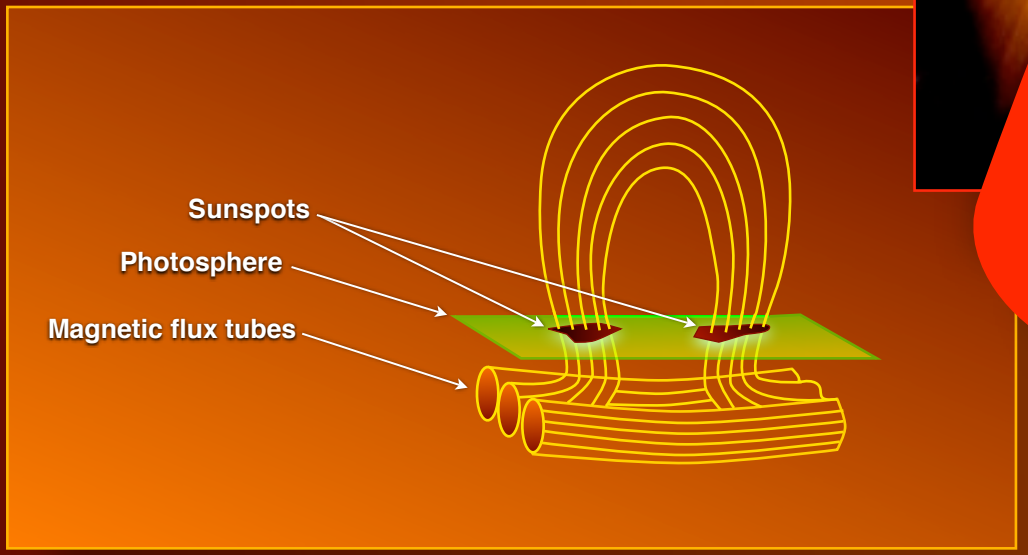


Sunspots: why the mystifying Sunspot behavior?

Sunspots are a problem in the thermonuclear model.

Their darkness, structure and behavior have required great ingenuity in attempts to explain them. Yet they remain mysterious.

‘Thermonuclear’ Sunspot Model



Sunspots: the thermonuclear model

The strong magnetic fields of sunspots have long puzzled solar physicists.

Theorists suggest that convection drives an internal dynamo, and that the Sun's higher speed of rotation at the equator "winds up" a magnetic field, forming 'flux tubes' or tubular concentrations of the magnetic field. Occasionally a buoyant flux tube breaks through the photosphere to form a leading and trailing sunspot of opposite magnetic polarities.

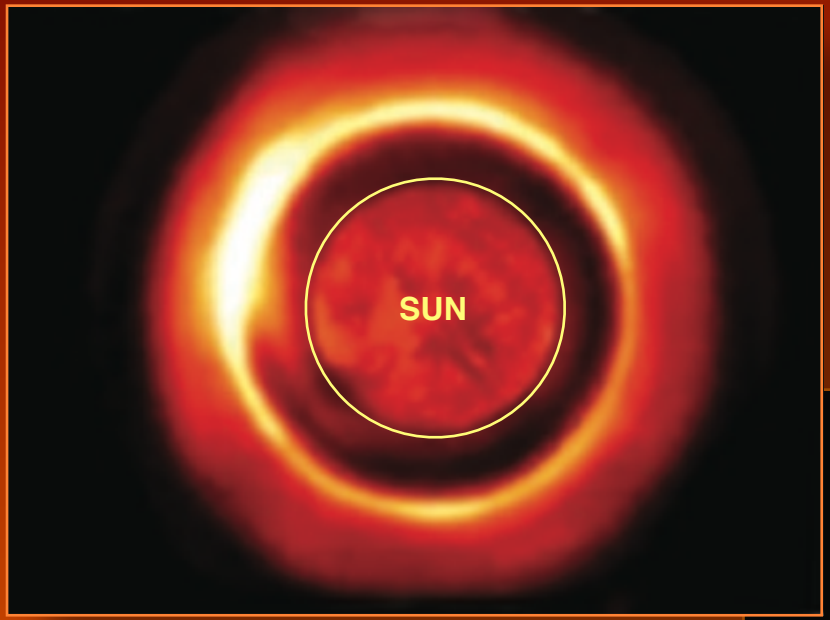
However, the magnetic fields generated by internal 'dynamo' models do not match the magnetic field of the real Sun.

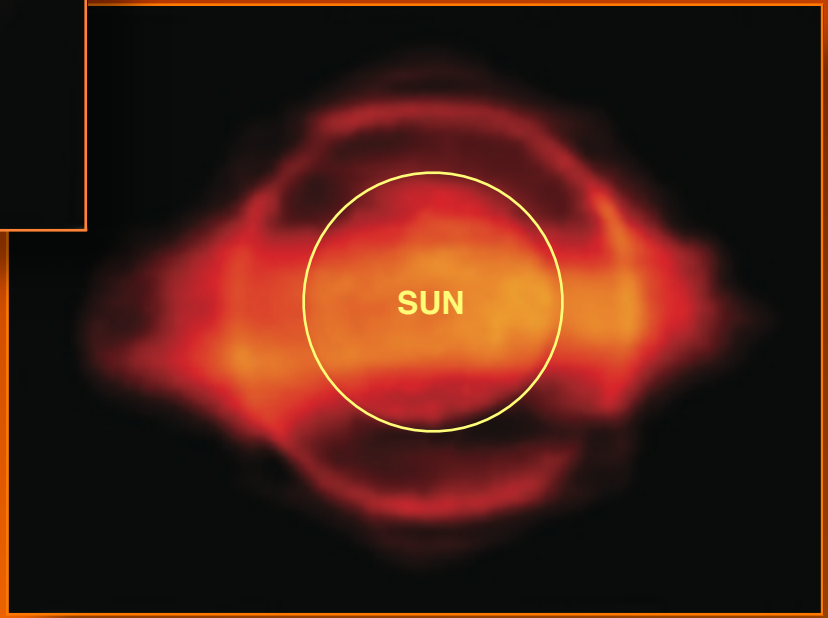
Sunspots: the electric model

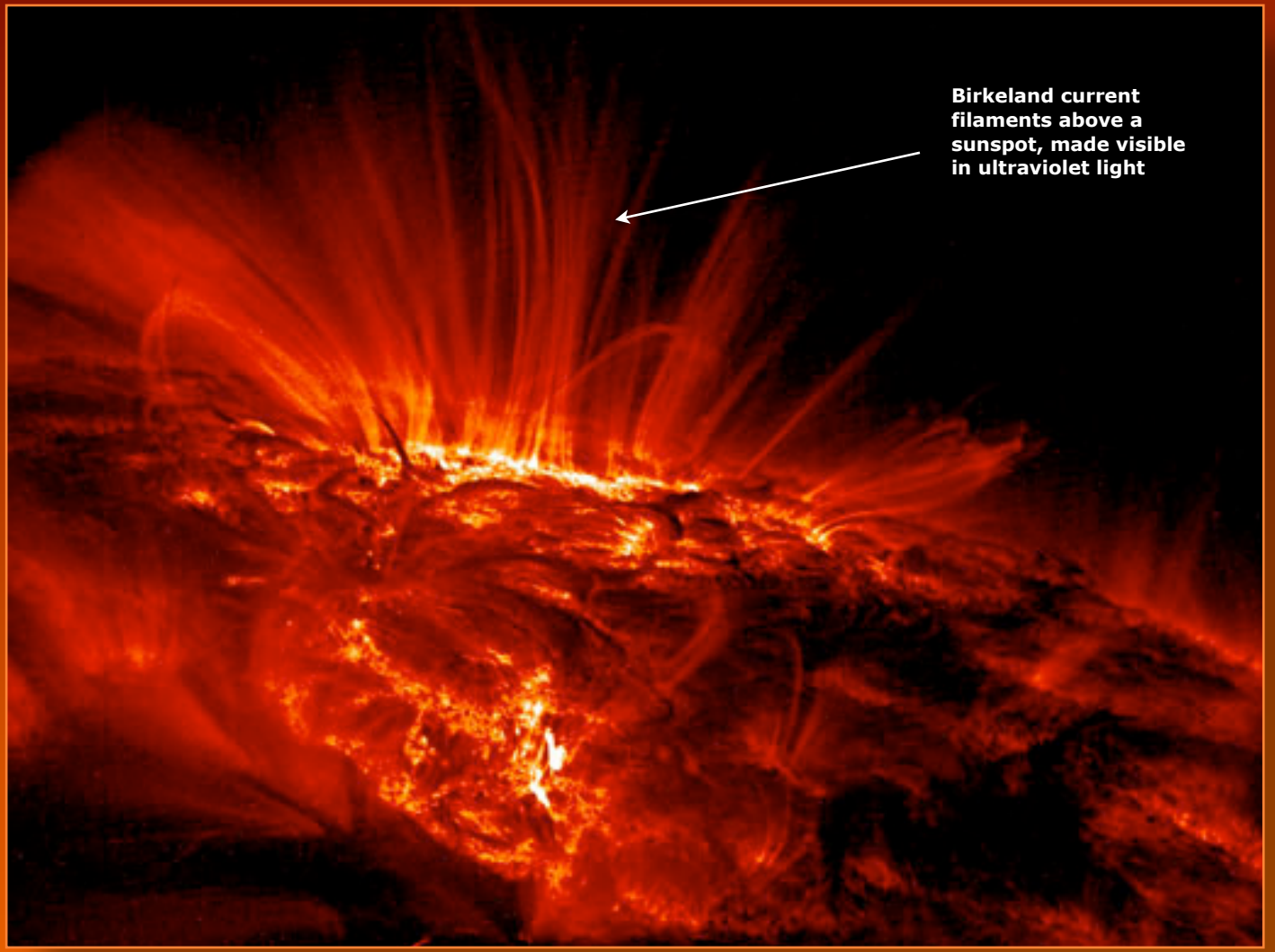
An equatorial plasma current ring or *torus* surrounds the positively charged Sun. In the same way, a charged, magnetized sphere produces a torus in the plasma laboratory.

Sunspots are dark regions where an electric discharge from the surrounding torus has displaced the bright photosphere. In fact, Kristian Birkeland's laboratory experiments replicated the solar torus and sunspots many decades before astronomers discovered magnetic field concentrations in the Sun's photosphere.

The solar equatorial current ring in ultraviolet light, seen from the polar view (left at right) and side view (right). This is the *plasma torus* circling the sun.


SUN


SUN


Birkeland current filaments above a sunspot, made visible in ultraviolet light

Sunspots: the electric model

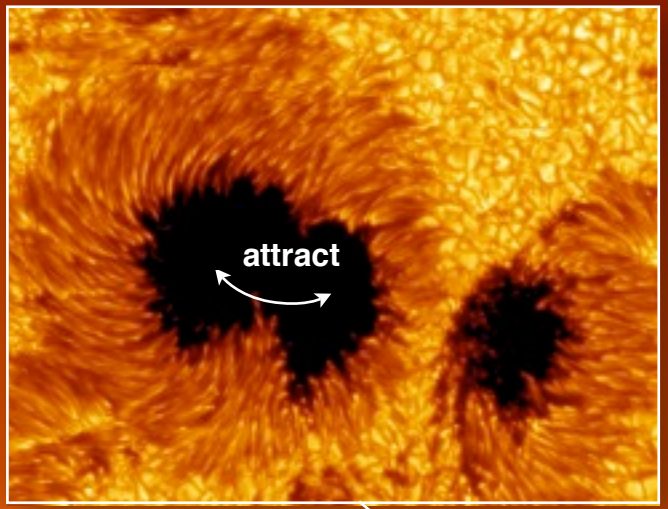
Sunspots have strong magnetic fields.

Lightning in the Earth's dense atmosphere is magnetically "pinched" by the current and follows an exceedingly thin path. Similarly, Birkeland currents compress and strengthen the Sun's ambient magnetic field by the "pinch effect" as they enter the solar atmosphere.

Sunspots: the electric model

One of the key questions about sunspots is "how do sunspots remain intact with magnetic fields repelling each other?"

The answer is simple in the electric model. Parallel Birkeland current filaments *attract* each other until they are very close. Electric charge is then redistributed within each filament in such a way that they rotate around each other. The twisting motion gives rise to a repelling force between the filaments at close range so that sunspots maintain their integrity even in the process of coalescing (see right).



Birkeland currents
(parallel current filaments with same magnetic polarity)

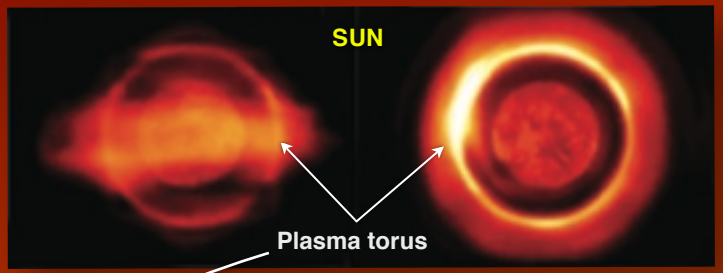
Discharge from plasma torus punches a hole in photosphere: a ‘sunspot’

attract

sunspots

attract

The sunspot-neutrino connection



Neutrinos of all kinds are produced in the nuclear reactions in the bright photospheric plasma discharge

Heavy elements are produced in *all* stars, not just rare supernovae

sunspots

No neutrinos are formed in sunspots

Earth

Neutrinos come from the photosphere and are modulated by the number of sunspots

Invisible 'dark current' mode discharges

Discharges from the plasma torus punch through the photosphere to create the sunspots

Sunspots & neutrinos: the electric model

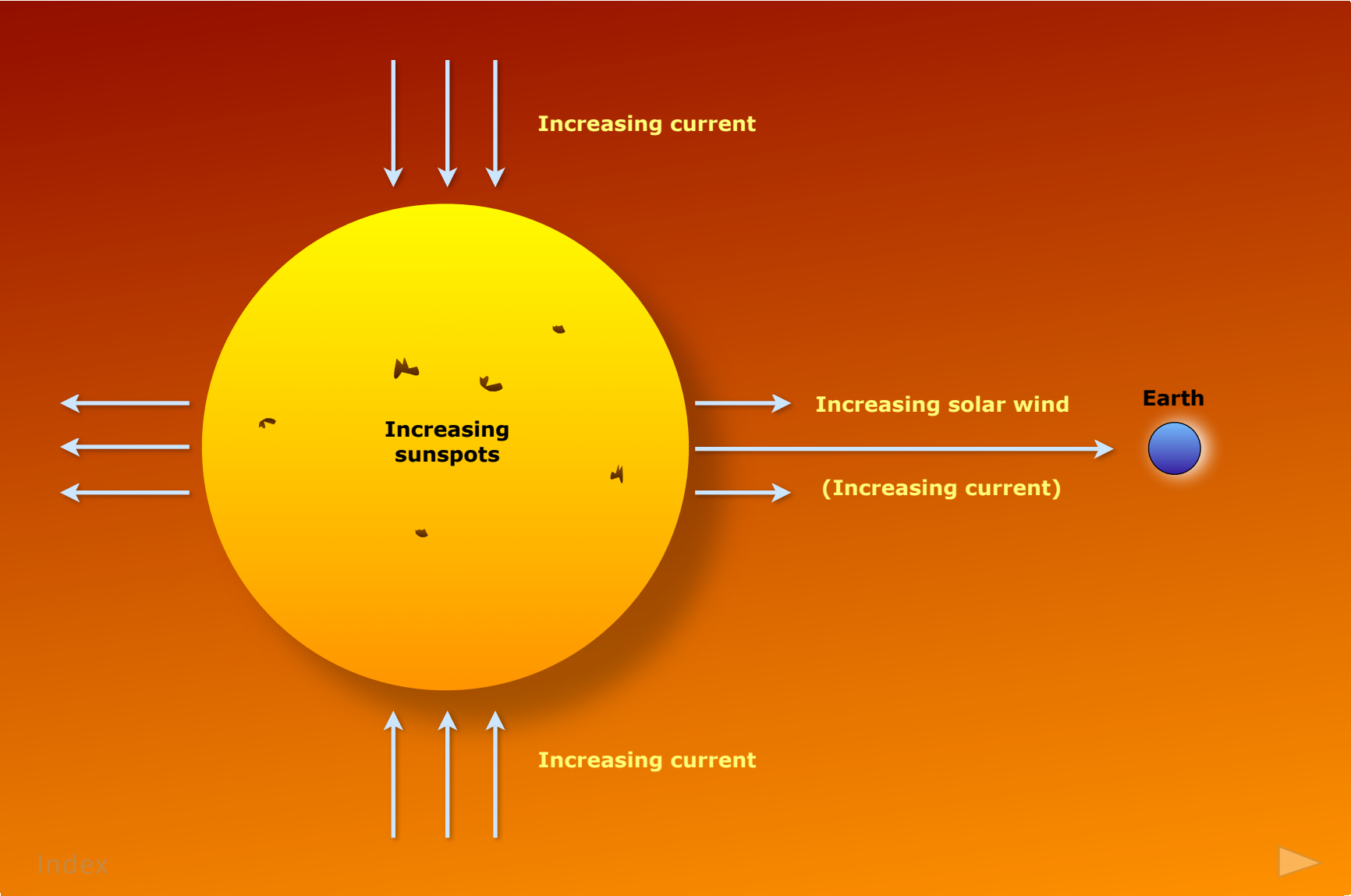
The electric model holds that nuclear reactions occur *in* the Sun's photosphere. The nuclear reactions produce neutrinos.

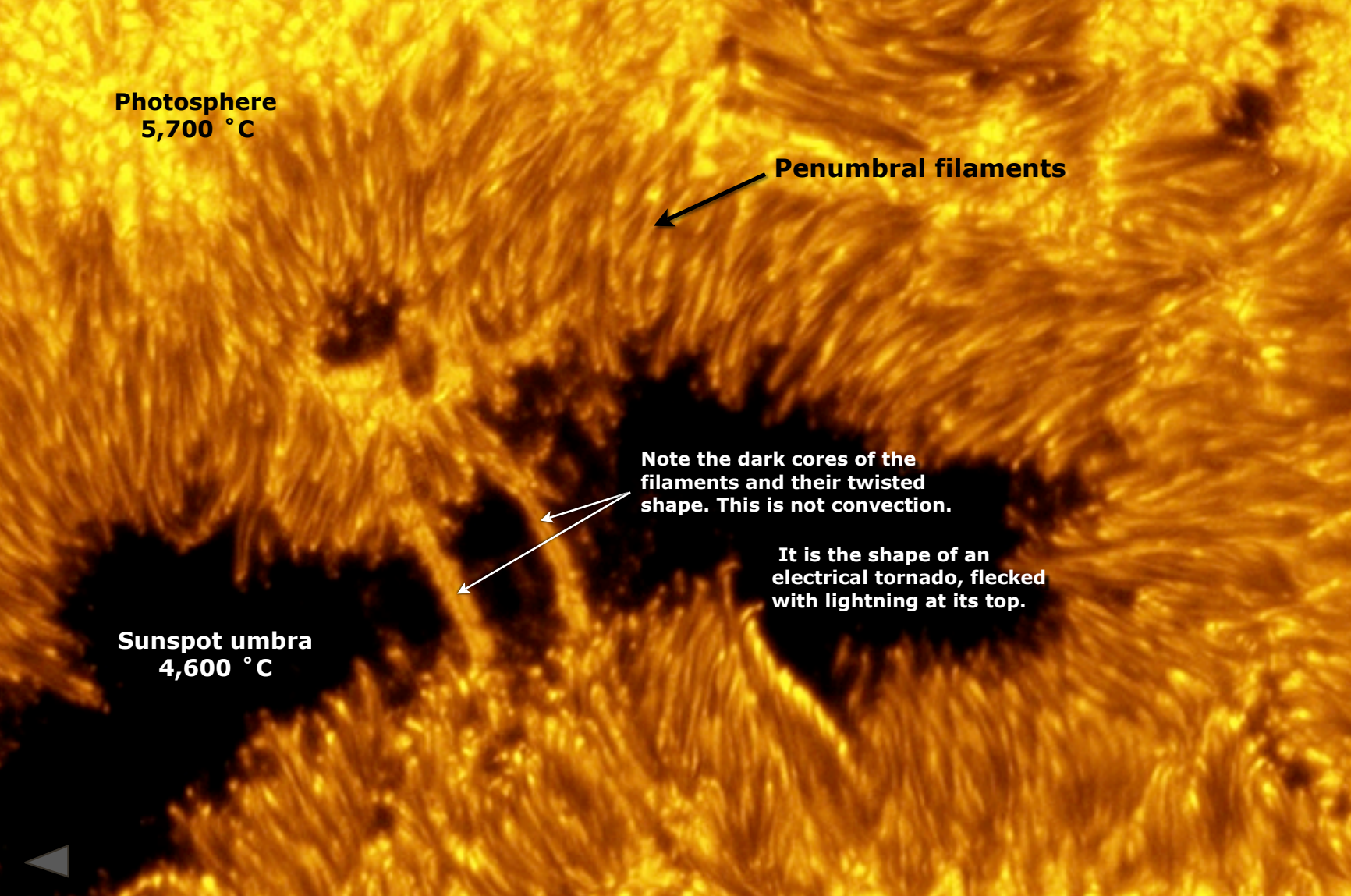
As emerging sunspots *reduce* the area of electrical-discharge activity in the photosphere, declining neutrino counts are expected.

Nuclear reactions in the Sun's core could have no plausible influence on sunspot numbers at the surface.

Sunspots & the solar wind: the electric model

Sunspot number is also directly related to solar wind acceleration. When the power to the Sun increases the sunspot number increases and the solar wind ‘blows’ more strongly.


Increasing current
Increasing sunspots
Increasing solar wind
Earth
(Increasing current)
Increasing current


Photosphere
5,700 °C
Penumbral filaments
Note the dark cores of the filaments and their twisted shape. This is not convection.
It is the shape of an electrical tornado, flecked with lightning at its top.
Sunspot umbra
4,600 °C

Sunspot penumbrae: the electric model

In the cool margins of large sunspots we see structure and movement—corkscrewing penumbral filaments. There is no thermonuclear model of sunspot penumbrae. They are an enigma.

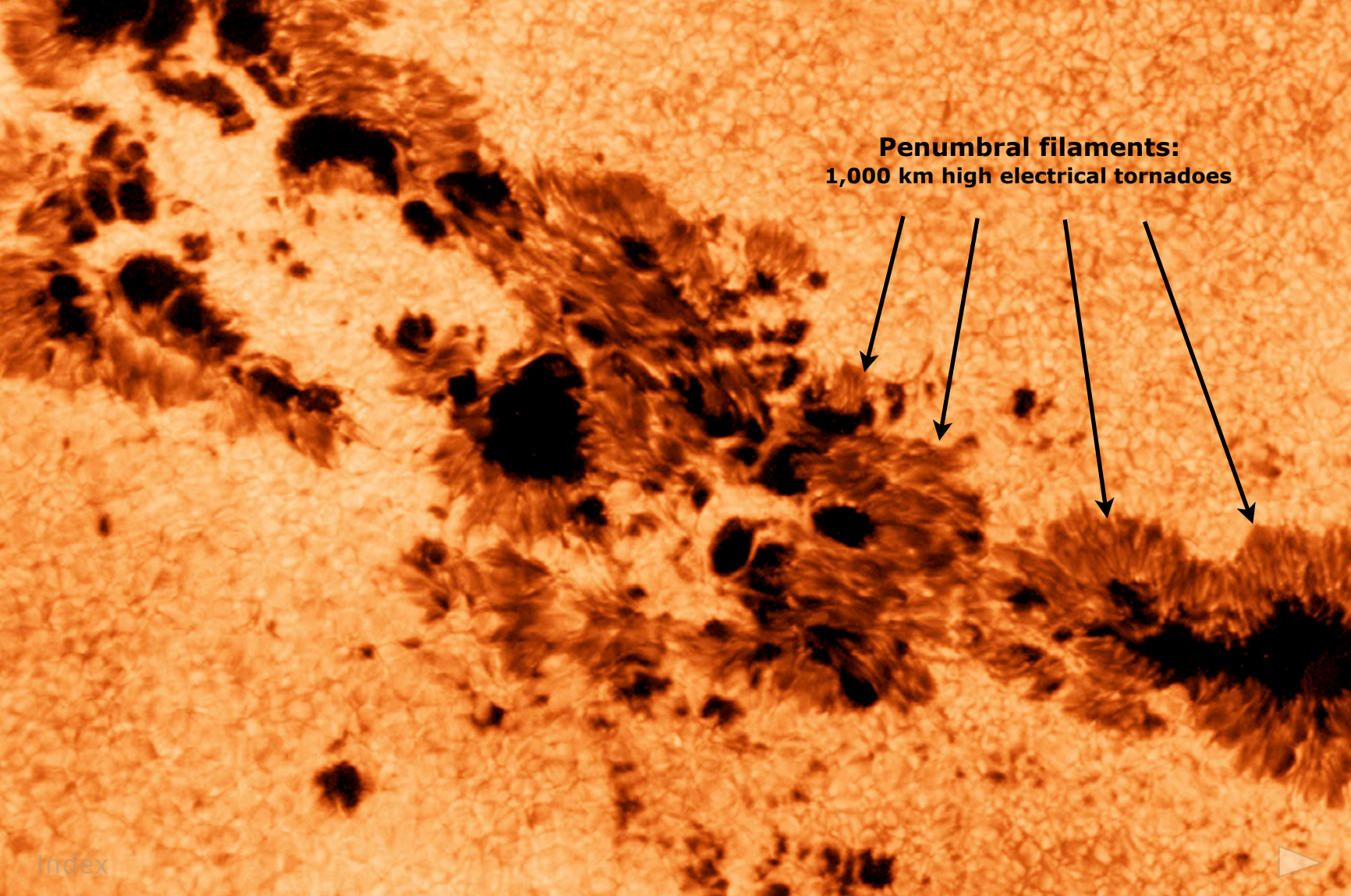
If these filaments were due to convection, as the thermonuclear model proposes, temperatures at the deeper levels should be hotter than at the surface. But they are a thousand degrees cooler. Nor would ‘convection currents’ produce the filamentary bridges seen in the image.

The electric model views the penumbral filaments as electrical vortices, or ‘tornadoes’—a slow form of lightning discharge.

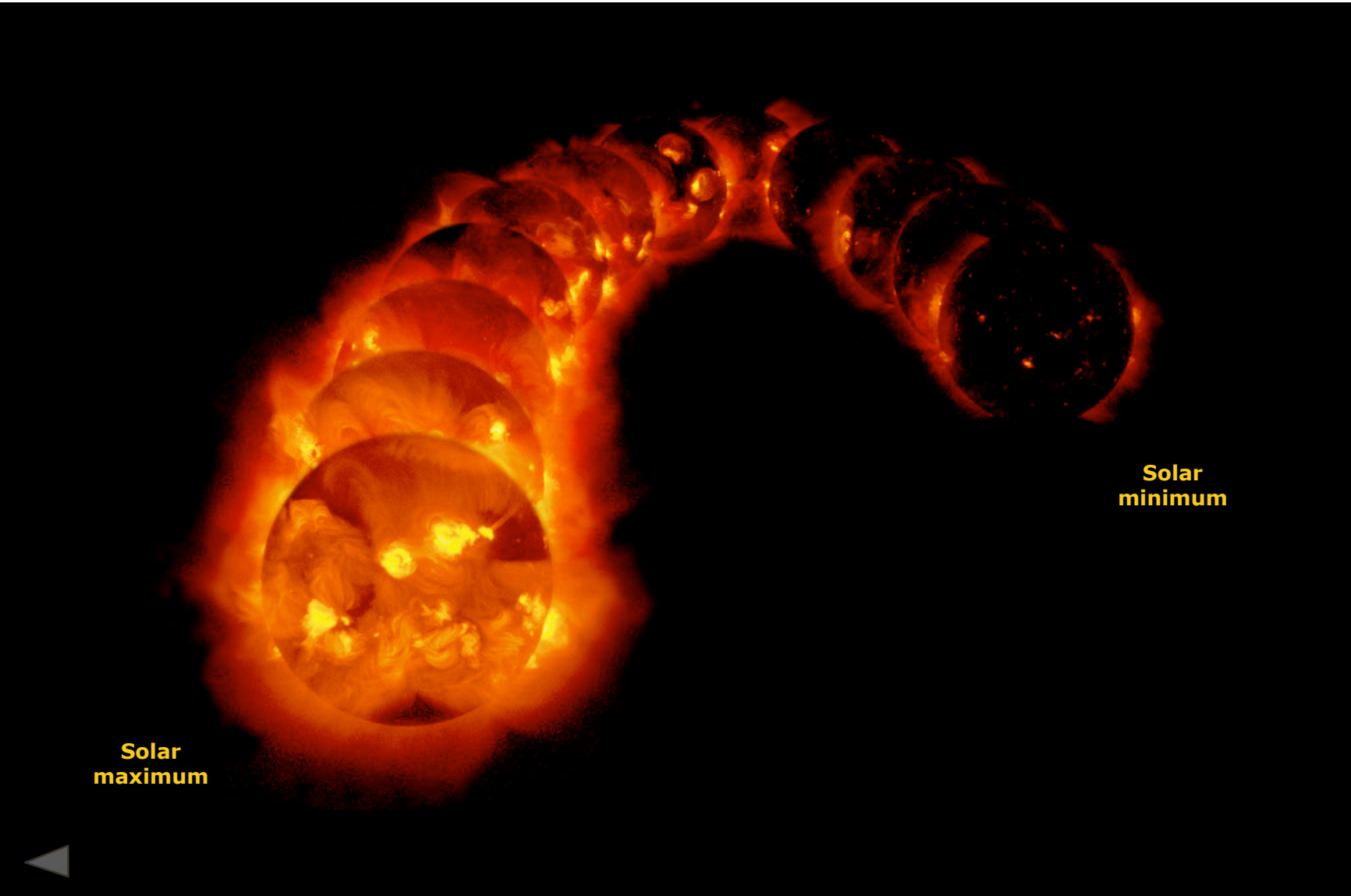
The enigmatic ‘granulation’ of the visible surface of the Sun can thus be seen as the billowing tops of the solar tornadoes, flecked by ceaseless lightning.

The intense electrical discharge producing these filaments is the true source of the Sun’s nuclear reactions.

Nuclear fusion is not hidden in the core of the Sun; it is a surface event, thus explaining the heavy elements (fusion byproducts) seen in the solar spectrum.



Index


Solar
minimum
Solar
maximum

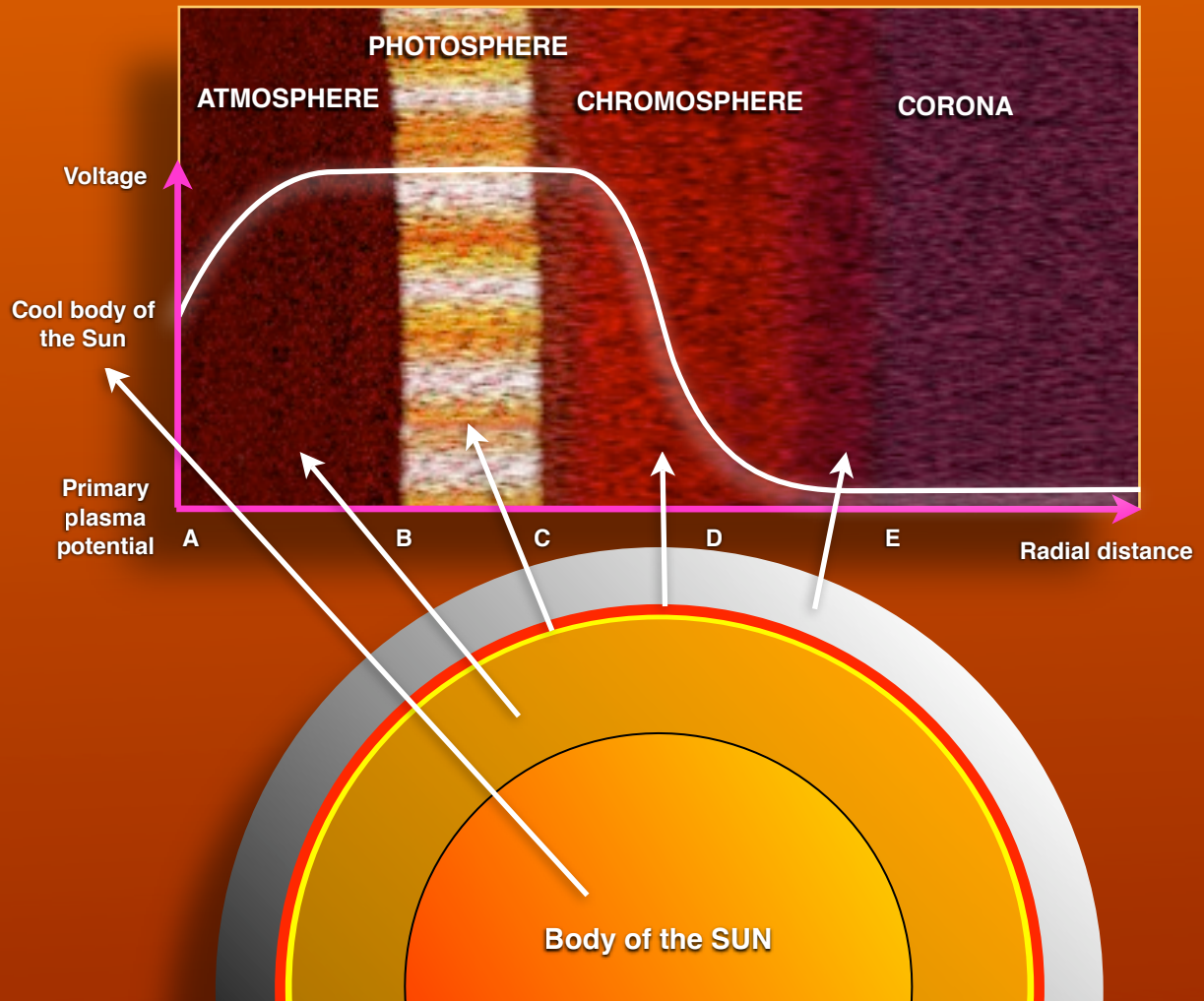
Sunspot cycle: the electric model

X-rays are a measure of electrical activity, like sunspots. They change together.

The Sun is connected to a galactic circuit which, like all circuits, is subject to resonant behavior—that is, cyclical change. The origin of the sunspot cycle is not *in* the Sun, it is not *on* the Sun, it is *beyond* the solar system.

Seen in x-rays over an 11-year period, the Sun is a "variable x-ray star." How can this be when the heat and light from the Sun is constant to within a tenth of one percent?

The answer is very important for it explains why most bright stars shine steadily.

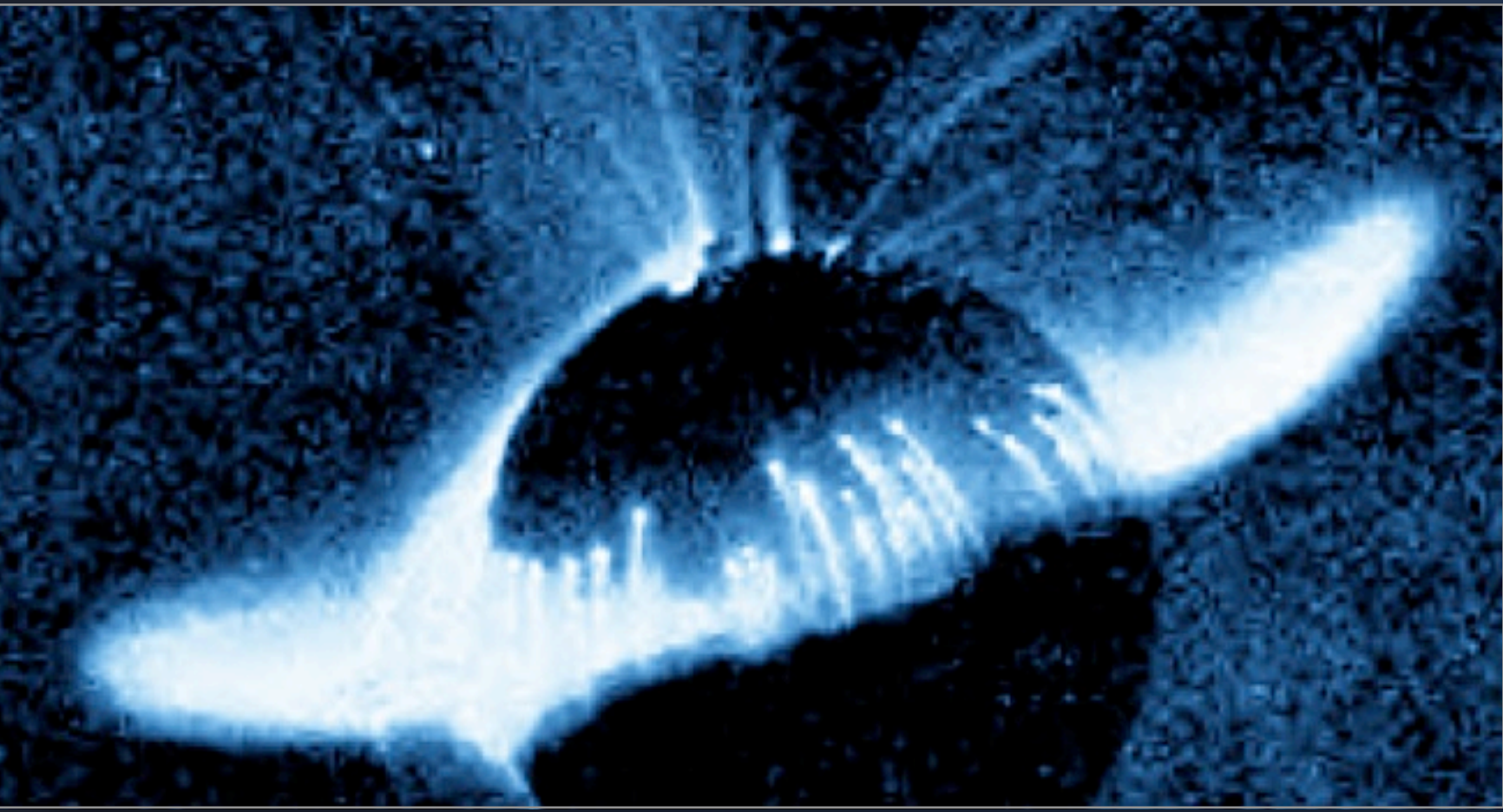

PHOTOSPHERE
ATMOSPHERE
CHROMOSPHERE
CORONA
Voltage
Cool body of the Sun
Primary plasma potential
A
B
C
D
E
Radial distance
Body of the SUN

Sunspots & the photosphere: the electric model

The Sun's thin photosphere exhibits a distinctive voltage curve (left), suggesting that this plasma layer acts as a PNP transistor (a device used to control current flow), thus maintaining a steady heat and light output from the photosphere while the power input varies over the sunspot cycle.

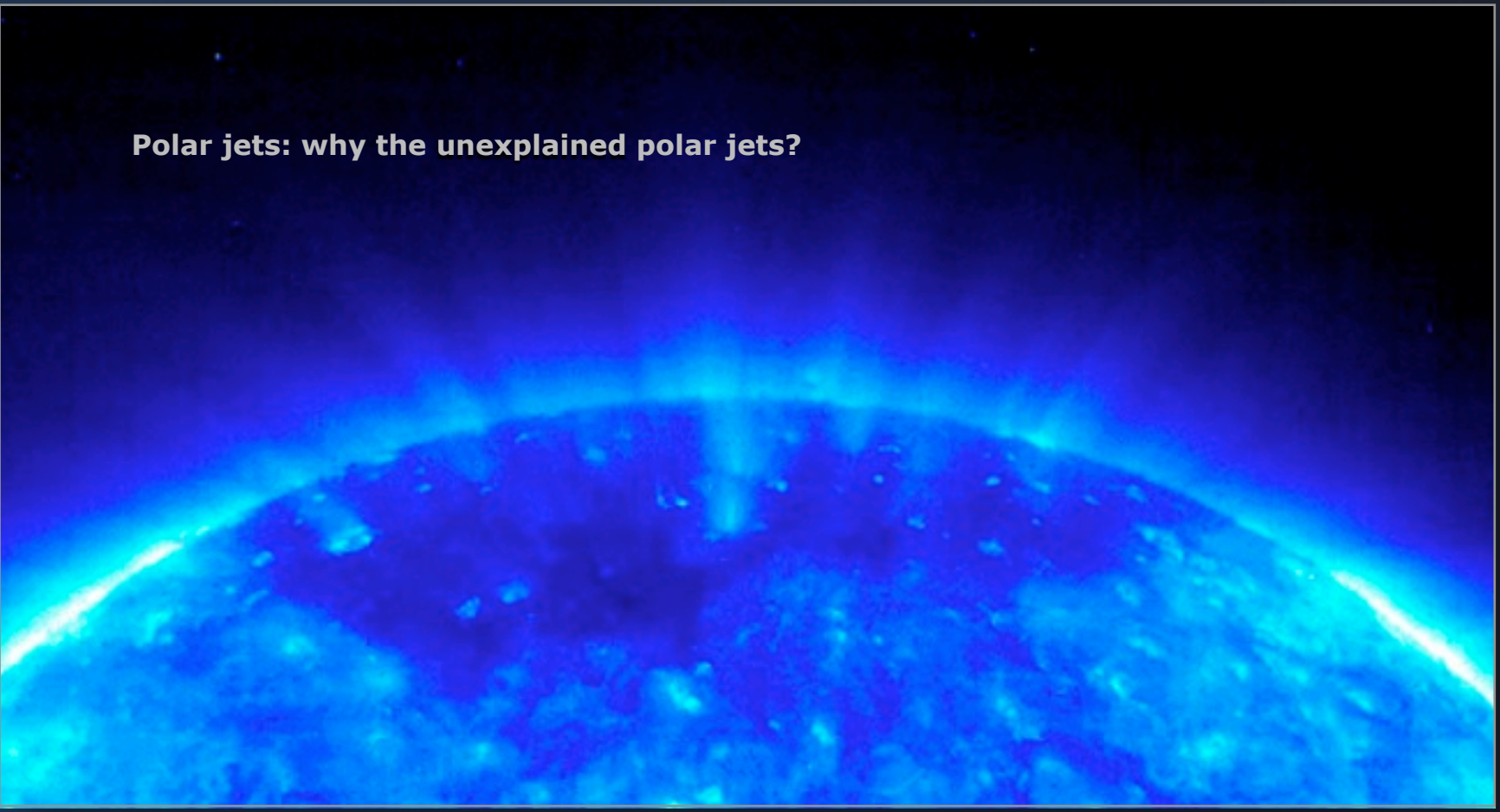
Positively charged protons will "roll down the hills." So the photosphere (B-C) acts as a barrier to limit the Sun's power output. When it is breached we see gigantic mass ejections.

Solar protons that reach the point (C) on the voltage curve accelerate down the 'waterfall' and cause the 'turbulence' at the bottom of the steep curve, which heats the million-degree corona.



Polar jets in Birkeland’s experiment

Polar jets: why the unexplained polar jets?



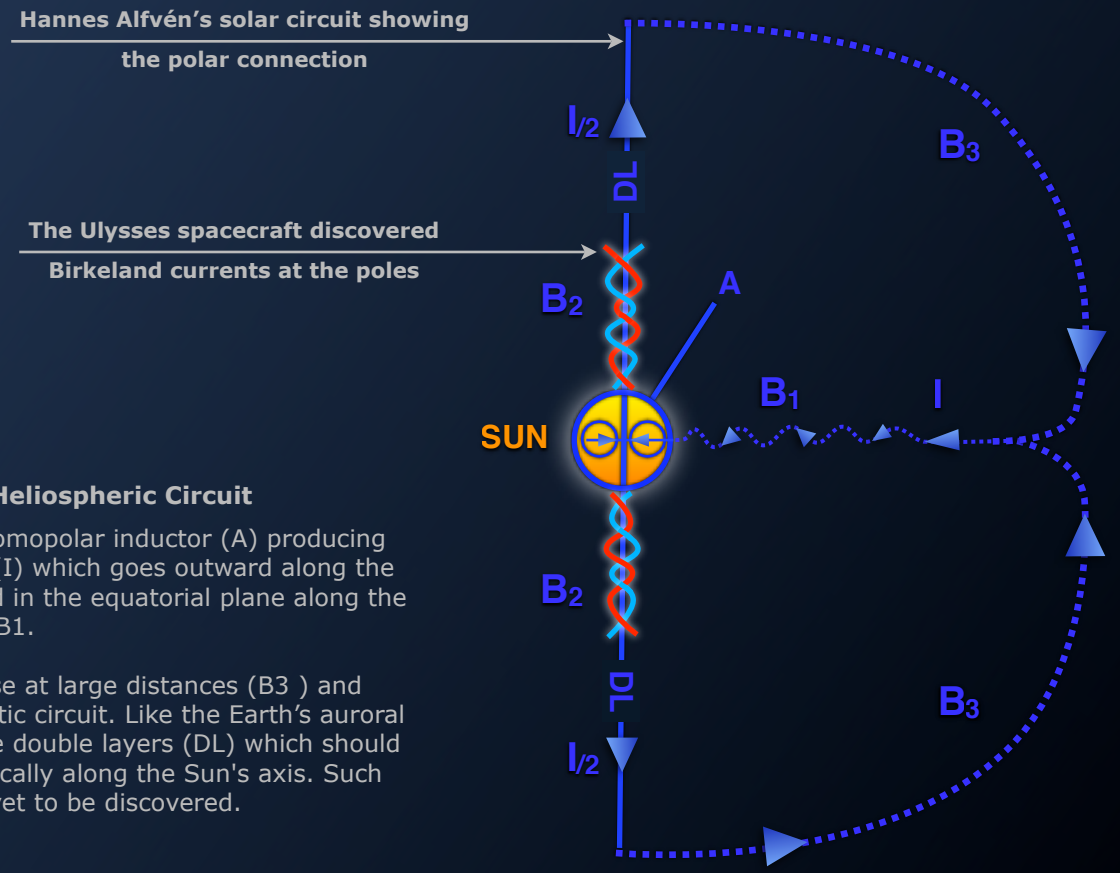
Polar jets on the Sun seen in x-rays

Polar Jets: the electric model

The Sun’s polar jets are unexplained in the thermonuclear model.

In the electric model the polar jets, together with the ‘coronal holes,’ are regions where the current in the Sun’s circuit is unhindered. The solar ‘wind’ flows faster there, while the temperature is paradoxically lower because there are fewer particle collisions.

The polar jets connect to the Sun’s polar circuit, as defined by Hannes Alfvén (right). The spiraling magnetic fields of the Birkeland currents in that circuit were discovered by the Ulysses spacecraft as it flew over the Sun’s poles.



Alfvén's Heliospheric Circuit

The Sun acts as a homopolar inductor (A) producing an electron current (I) which goes outward along the axis (B2) and inward in the equatorial plane along the magnetic field lines B1.

The circuit must close at large distances (B3) and connect to the galactic circuit. Like the Earth's auroral circuit, there may be double layers (DL) which should be located symmetrically along the Sun's axis. Such double layers have yet to be discovered.

Index

Why the mystifying Sunspot behavior?

Why abundant electric currents and magnetic fields on the surface of the Sun?

Why the production of heavy elements by *surface* events?

Why the unexplained *polar* jets?

solar spectrum
neutrino deficiency
neutrino variability
solar atmosphere
neutrinos and solar wind
heavy elements
differential rotation by latitude
differential rotation by depth
equatorial plasma torus
sunspots
sunspot migration
sunspot penumbra
sunspot cycle
magnetic field strength
even magnetic field
helioseismology
solar density
changing size

The observed phenomena of the Sun contradict the ‘thermonuclear fusion’ model. Scientists struggle to find explanations. These explanations often involve inventing theoretical new science—science that has yet to be tested or replicated in a laboratory.

We have only given four examples above, but virtually all of the ‘issues’ and solar attributes (left) can be explained by the ‘electric’ model, using well-established science that has been tested and replicated in laboratories.

As astronomers and astrophysicists come to see the Sun in electrodynamic terms, a revolution in the sciences will surely follow. Is the Sun the center of an electric field strong enough to generate its energetic output?

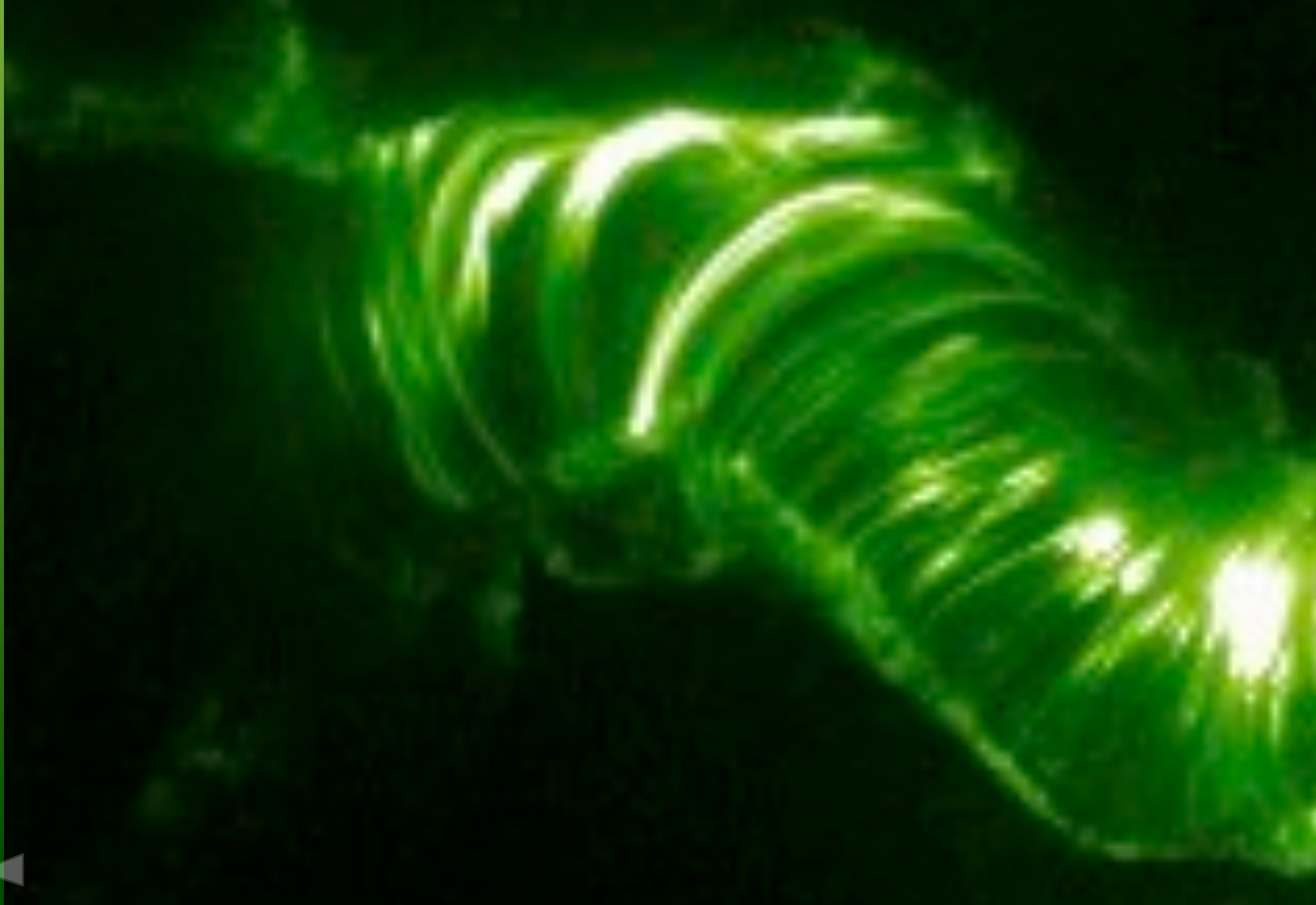
If so, then it will be necessary to consider the effect of this field on a comet as it speeds toward the Sun. Are comets discharging electrically to produce their remarkable displays?

Comet Hale-Bopp

It also will be necessary to consider solar system history anew. In an earlier, electrically active phase of planetary evolution, what was the role of electricity in shaping enigmatic surface features?

Additionally, our own planet's electrical connection to the Sun must be included in the expanding investigation. This electrical circuitry could well be a major contributor to climate change.

4,000 km long, 200 km wide, and up to 7 km deep, the Valles Marineris on Mars is the largest known crevice in the solar system.




the end

collaborators

(alphabetically)

Stephen J. Crothers www.sjcrothers.PlasmaResources.com

David Drew www.PlasmaCosmology.net

Michael Goodspeed www.thunderbolts.info (thunderblogs)

Michael Gmirkin www.thunderbolts.info (thunderblogs)

Kevin Merrell historysaver@gmail.com

Ben Ged Low www.bengedlow.com

C. J. Ransom www.vemasat.com

Donald E. Scott www.electric-cosmos.org

Dave Smith www.PlasmaResources.com

Steve Smith www.thunderbolts.info (picture of the day)

David Talbott www.thunderbolts.info

Wallace Thornhill www.holoscience.com

Ian Tresman www.plasma-universe.com

references

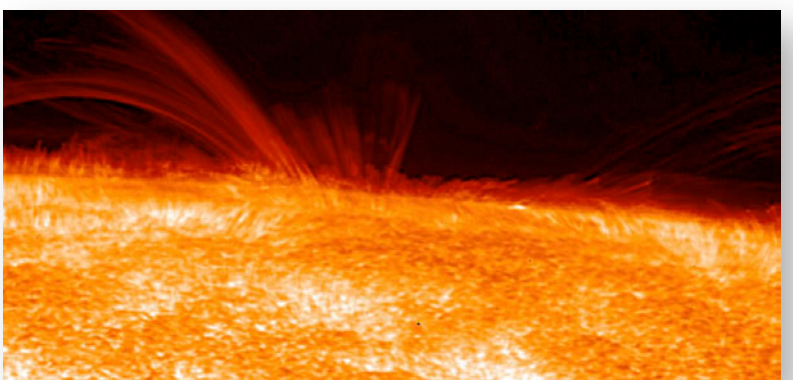
This book was designed for simplicity. It represents an overview of the ideas being explored by **The Thunderbolts Project**. The themes and issues presented here have been dealt with much more extensively in the three books below, all of which contain detailed reference notes.

THUNDERBOLTS OF THE GODS
Talbott / Thornhill, 2005

THE ELECTRIC UNIVERSE
Thornhill / Talbott, 2007

THE ELECTRIC SKY
Donald E. Scott, 2007

see: www.ThunderboltsProject.com



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; Shalon 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.archive.org/details/norwegianaurorap01chririch

"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

"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 Oceangraphic and Atmospheric Administration
http://plasmascience.net/tpu/Museum.Exhibits/NOAA.html
http://www.plasma-universe.com/index.php/Electric_Space

Alfvén, H., "On the Importance of Electric Fields in the Magnetosphere and Interplanetary Space", Space Science Reviews, vol. 7, p.140, 1967
http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=1967SSRv....7..140A

Carlqvist, Per, "Cosmic electric currents and the generalized Bennett relation", Astrophysics and Space Science (ISSN 0004-640X), vol. 144, no. 1-2, May 1988, p. 73-84.
http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=1988Ap%26SS.144...73C

Peratt, Anthony L., "The role of particle beams and electrical currents in the plasma universe", Laser and Particle Beams (ISSN 0263-0346), vol. 6, Aug. 1988, p. 471-491. http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=1988LPB.....6..471P

Peratt, Anthony L., "The evidence for electrical currents in cosmic plasma", IEEE Transactions on Plasma Science (ISSN 0093-3813), vol. 18, Feb. 1990, p. 26-32 http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=1990ITPS...18...26P

Alfvén, Hannes, "Double layers and circuits in astrophysics," IEEE Trans. Plasma Sci., vol. 14, p. 779, 1986 (on p. 787). Reproduced from "Keynote Address" in Double Layers in Astrophysics, Proceedings of a Workshop held in Huntsville, Ala., 17-19 Mar. 1986. Proceedings (page 12)
http://adsabs.harvard.edu/abs/1986ITPS...14..779A
http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19870013880_1987013880.pdf

Interstellar Electric Fields and Currents

Carlqvist, Per; Gahm, Gosta F., "Manifestations of electric currents in interstellar molecular clouds" (1992) IEEE Transactions on Plasma Science (ISSN 0093-3813), vol. 20, no. 6, p. 867-873. (Dec 1992) http://adsabs.harvard.edu/abs/1992ITPS...20..867C

Additional website links:

http://www.plasmacoalition.org/

http://www.plasmas.com/

http://www.plasmas.org/

http://ippex.pppl.gov/

http://plasmadictionary.llnl.gov/

http://www.plasma-universe.com/

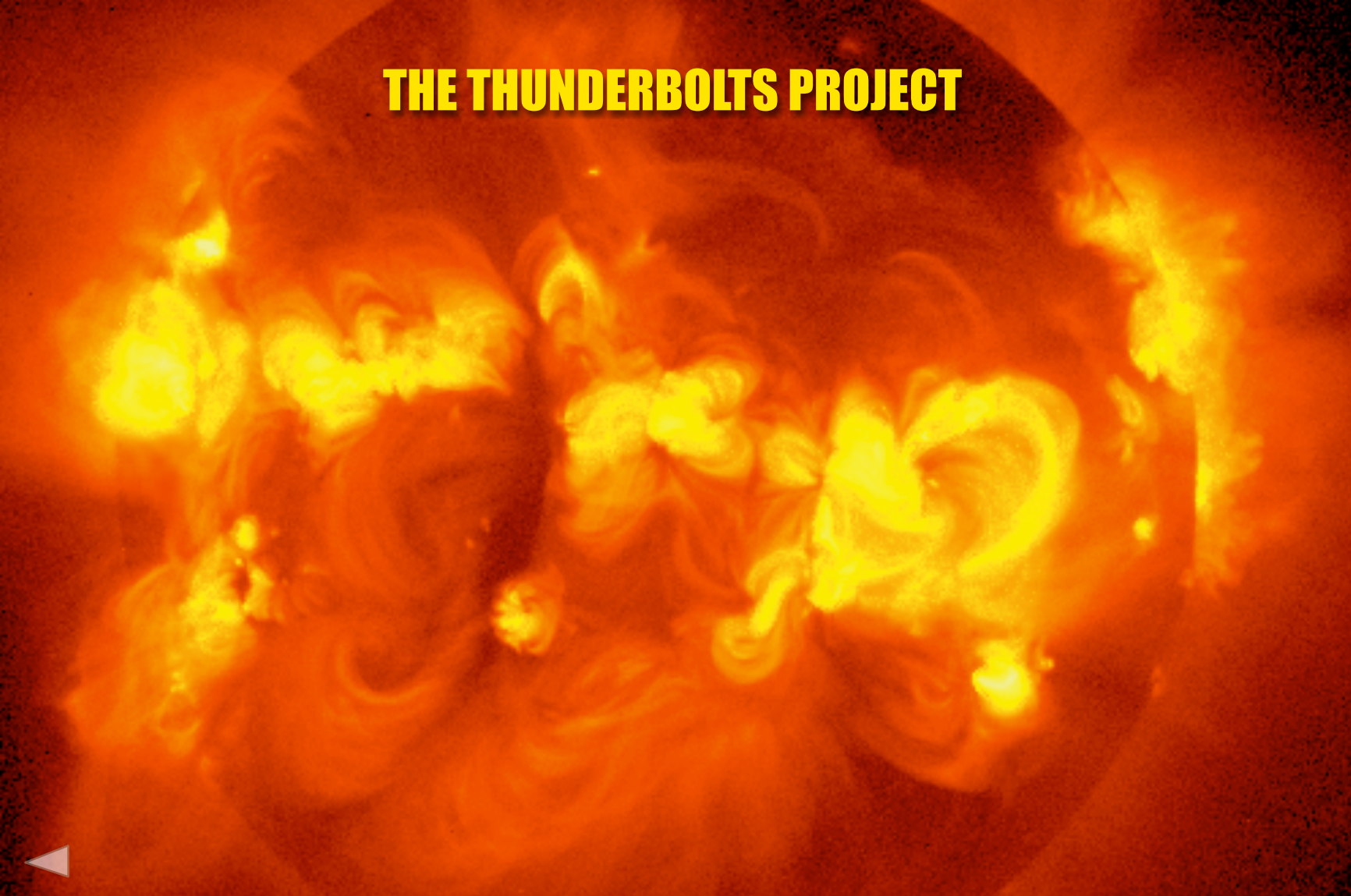
http://focusfusion.org/

picture credits

4. Series of Sun images taken by Japan's Yohkoh satellite.
8. Sun image taken from the SOHO Extreme ultraviolet Imaging Telescope. ESA/NASA
10. Sun in x-ray taken by the Yohkoh satellite.
12. Composite image from two instruments on the SOHO spacecraft
15. Sun - credit: (Image ESA, NASA, SOHO/EIT)
19. Sunspot - Dutch Open Telescope/Sterrekundig Instituut Utrecht.
20. Sunspot - Dutch Open Telescope/Sterrekundig Instituut Utrecht.
21. Sunspot - Dutch Open Telescope/Sterrekundig Instituut Utrecht.
22. Series of Sun images taken by Japan's Yohkoh satellite.
26 Andromeda Galaxy (M31)
29. Credit: TRACE Project, NASA
30. Large eruptive solar prominence. Credit: NASA's STEREO satellite
34. Galaxy m82. Credit: Subaru Telescope, NAO Japan
36. NGC 3370 [Image: NASA/ESA, The Hubble Heritage Team and A. Riess (STScI)]
38. Credit: TRACE Project, Stanford-Lockheed Institute for Space Research, NASA
45. Image credit: Hinode JAXA/NASA
47. 1991 total eclipse (credit: High Altitude Observatory/National Center for atmospheric Research)

50. Laboratory corona discharge.
52 Lab glow discharge. Courtesy of Paul Doherty; The Exploratorium.
53 Total Solar Eclipse 2006, © Miloslav Druckmüller, Peter Aniol, ESA/NASA.
57. Solar Prominence Credit: SOHO-EIT Consortium, ESA, NASA
58. Sun Credit: SOHO/ EIT consortium
60. CME Credit: SOHO LASCO C2 coronagraph
68. Hour glass nebulae Credit: B. Balick (U. Washington) et al., WFPC2, HST, NASA
74. Sunspot Credit: Royal Swedish Academy of Sciences
75 Sunspots
76. Filamentary plasma arcs Credit: TRACE, NASA
79. plasma torus circling sun, Credit ESA/NASA, SOHO
80. Sun in ultraviolet, Credit: TRACE Project, NASA
88. Credit:G. Scharmer, L. Rouppe van der Voort (KVA) et al., SVST
91. Sunspots: Magnetic Depressions Credit: National Solar Observatory
92. Series of Sun images taken by Japan's Yohkoh satellite
96. Birkeland currents created by scientist Kristian Birkeland in his terrella, featuring a magnetised anode globe in an evacuated chamber. Credit: public domain
97. Sun - credit: ESA, NASA, SOHO/EIT
102-3 Credit: NASA, TRACE

the thunderbolts project


THE THUNDERBOLTS PROJECT