Christians at Work: Science and Faith

A night-time time-lapse image of the sky over a church in Sounio, Greece

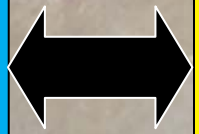
Tim Collins • Rochester Christian Reformed Church • Sunday Sep 12th 2010

Science and faith occupy very different places in mainstream cultural consciousness

Some cultural associations:

Science:

1. Atheist scientists
2. Benefitting society (medicine, technology)
3. Evidence
4. The physical world
5. Deduction



Faith:

1. Devout laypeople
2. Breeding ignorance and fear
3. Trust *without* evidence
4. Ethics and morality
5. Inspiration

Each of these represents a *false dichotomy*

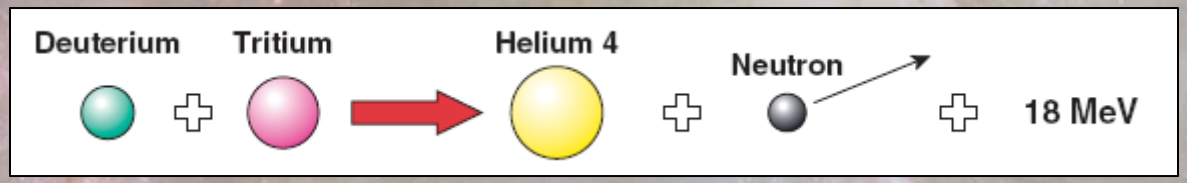
Faith can interact with research in appreciation of God's world, and in the way ones experiences problem solving

Outline

- **A brief look at what I do**
- **What is science?**
- ***Deduction* vs. *Inspiration* in science**

I study nuclear fusion

- My degree is in astrophysics from the U. Rochester, where I studied *cataclysmic variable* binary star systems, neutron stars, and planetary nebulae
- I am currently a scientist at the UR studying nuclear fusion
  - ❖ In our experiments lasers are used to implode a ~1-mm deuterium-tritium pellet producing fusion reactions:

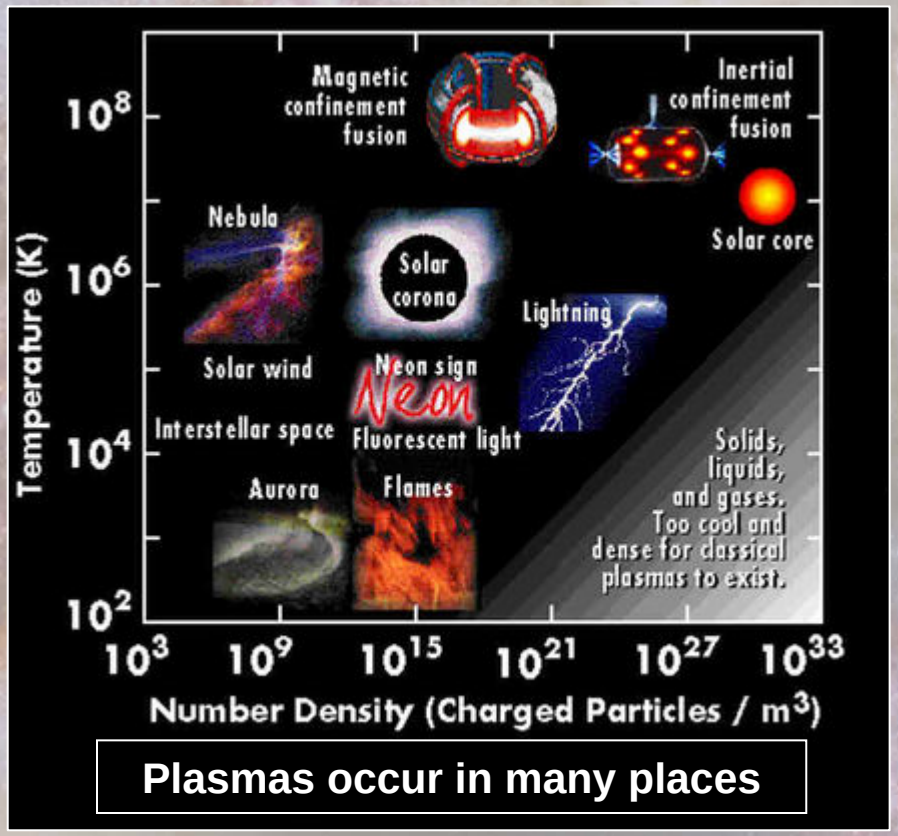


  - ❖ The goal: a power source which is more efficient than fission, relies upon isotopes of Hydrogen (abundant: present in water at the fraction 1/6500), without the dangerously radioactive byproducts or the possibility of a meltdown


Omega laser target chamber

Our implosions generate high-density plasmas

- **A *plasma* is a gas or fluid in which the pressures or temperatures are high enough that electrons are no longer bound to nuclei**



Fusion experiments seek to replicate conditions inside the sun

- I numerically solve the equations describing the radiation hydrodynamics and thermonuclear burn of a plasma:

$$\frac{d\rho}{dt} + \rho\nabla\cdot\mathbf{u} = 0$$

Mass is conserved

$$\rho\frac{d\mathbf{u}}{dt} = -\nabla p$$

Momentum is conserved

$$\rho C_{ve}\frac{dT_e}{dt} = -p_e\nabla\cdot\mathbf{u} - \nabla\cdot\mathbf{q}_e + S_l + Q_{ei} + Q_{Rad}$$

$$\rho C_{vi}\frac{dT_i}{dt} = -p_i\nabla\cdot\mathbf{u} - \nabla\cdot\mathbf{q}_i + S_f + Q_{ei}$$

Energy is conserved

- In our experiments the target implodes in the time it takes light to go one meter
- In this regime matter is driven supersonically resulting in shock waves

Show simulation movies Sim1.mov, dXd3.1_accel.avi, dXd3.1_decel.avi

Science offers a paradigm for investigating the world

- Scientific models must have
  - *Reproducibility:* The experiment must be repeatable
    - ❖ Or, as for astrophysics, there must be an ensemble of events/objects
    - ❖ The Big Bang: physics tested elsewhere is *applied* to a singular event
    - ❖ Counterexample: Cold fusion, Pons & Fleischman, 1989
  - *Clarity:* The questions and measures must be well-defined;
    - ❖ Counterexample: "Do you love your wife"? (important but not quantitative)
    - ❖ This is related to the possibility of *mathematical modeling*
- Science has been tremendously successful
- However, science has limited scope, excluding ethics, history, theology, some elements of consciousness, etc.
- Much of theology, in contrast, revolves around the relationship with a *person*—God—making it hard to address with science

See Ian Hutchinson, "Faith's Failure of Nerve," *Cross Currents*, 40, 213 (1990)

Other criteria are crucial, but harder to quantify

- Science is more often about *consistency* than proof
  - ❖ Ex: Newtonian mechanics:

> "Newton had no proof that the earth moved, or that the sun was the center of the planetary system. Yet, without that assumption, his system didn't make much sense. What he had was an elaborate and highly successful scheme of both explanation and prediction, and most people had no trouble believing it, but what they were accepting as truth was a grand scheme whose validity rested on its coherency, not on any proof" [1]

Play "BigBangTheoryClip.mov"

- Simplicity, or elegance
  - ❖ Ex: Grand unified theories of physics seek to unite the theories of the four basic forces (gravity, electromagnetism, weak and strong nuclear), to gain insight through *simplicity*
- An extreme example: String Theory can't be experimentally tested, so is judged by its elegance and consistency, leading some, like Burton Richter of Stanford, to complain that it's "theology"

Owen Gingerich, "Is there a role for natural theology today?", in *Science & Theology, Questions at the Interface*, ed. Murray Rae et al. (Eerdmans, 1994) p. 43.

Scientism is the belief that only by science can we learn about the world[1]

- As far back as Francis Bacon, the father of philosophy of science, the "two books" perspective reigned:
  - ❖ The book of nature—science
  - ❖ The book of Scripture
- In the 1800s these appeared to diverge, as astronomy and geology appeared to fly in the face of Biblical interpretation, mechanics suggested a deterministic world, and biology was leading to the view of man as an animal
- This led to the apparent conflict between science and faith, devaluing the questions science can't address
- ***The fatal mistake*: Discounting non-scientific evidence, e.g. historical evidence**
  - ❖ **So the historicity of the resurrection becomes irrelevant, unscientific, and even an embarrassment, despite evidence in its favor**

***Angels & Demons* trailer**

[1]Ian Hutchinson, "Science: Christian and Natural", ASA Conference, 4 Aug 2002

An uneasy truce exists between science and faith

- **Lawrence Krauss, physicist at Case Western Reserve, in a NYT op-ed:**

> **"The point here, which should be obvious, is that science and religion are separate entities: science is a predictive discipline based on empirically falsifiable facts; religion is a hopeful discipline based on inner faith"**

- **Steven Jay Gould (paleontologist), referring to Pope Pius's *Humani Generis*, writes:**

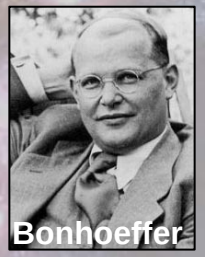
> **"No such conflict should exist [between science and religion] because each subject has a legitimate *magisterium*, or domain of teaching authority—and these *magisteria* do not overlap…**
>
> **The net of science covers the empirical universe: what is it made of (fact) and why does it work this way (theory). The net of religion extends over questions of moral meaning and value. These two magisteria do not overlap, nor do they encompass all inquiry (consider, for starters, the magisterium of art and the meaning of beauty)"**

- **"The Bible tells us how to go to heaven, not how the heavens go." –Galileo**
- **Sounds reasonable, right…?**

Non-overlapping Magisteria leads to the "God of the gaps"

- If God is permitted only where science can't explain then as science expands, God is squeezed out
- This implicitly assumes that if science can provide an explanation for an event, then any further explanation is not just unnecessary, but is wrong
- This compels some Christian apologists to find evidence of God in the *failures* of science (e.g. some understandings of Intelligent Design)
- Dietrich Bonhoeffer:

> ...how wrong it is to use God as a stop-gap for the incompleteness of our knowledge. If in fact the frontiers of knowledge are being pushed further and further back (and that is bound to be the case), then God is being pushed back with them, and is therefore continually in retreat.
>
> We are to find God *in what we know, not in what we don't know*; God wants us to realize his presence, not in unsolved problems but in those that are solved.[1]


Bonhoeffer

- Conclusion: When the book of nature and the book of Scripture appear to conflict, we cannot discard either to solve the problem

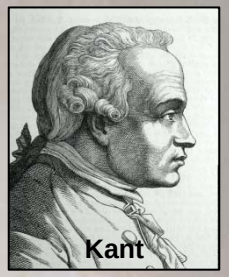
[1] *Letters and Papers from Prison,* ed. Eberhard Bethge

How science learns: The Newtonian Model

- To discuss the apparent dichotomy of deduction vs. inspiration, we consider models of scientific knowing, or *epistemology*
- Newton (1642-1727) imagines observing the world through a part of the brain called the *sensorium*, and drawing conclusions from these observations
- phenomena ⇒ observation ⇒ deduction by abstraction ⇒ scientific concepts
- Ex: This model is like an Englishman trying to deduce the rules of baseball by watching a match on TV with the sound off
- Newton: "I frame no hypothesis"—in experimentation, everything is *deduced* from observation then rendered general by *induction*

The Newtonian model is *necessarily incomplete*

- **Newton's success with Calculus and the laws of motion leads others to believe his practice matches his model, *even though it doesn't*:**
- **David Hume (1711-1776) points out that Newton didn't observe the *space and time* in which motion takes place**
  - ❖ **Hume's Ex: You may *think* when you observe a rock shattering a window that they are causally related, but really they are just adjacent perceptions**
  - ❖ **Critical elements of the scientific inquiry come not from observation but *are added to them by the observer***
- **Immanuel Kant (1724-1804): We not only discover form in nature; *we also impose it with our minds***
- **This is a shift from the intrinsic intelligibility of the universe to the constructive power of the mind which reads rational structure into nature**


Kant


Newton


Hume

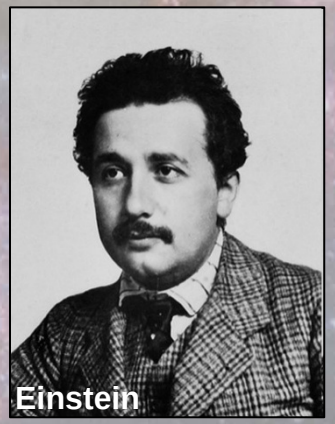
How science learns: Einstein's model

- **Einstein (1879-1955) asserts that *neither* view is complete because we learn through *intuition and inspiration* which occur as we study the world:**

> **"A new idea comes suddenly and in a rather intuitive way. That means it is not reached by conscious logical conclusions. But, thinking it through afterwards, you can always discover the reasons which have led you unconsciously to your guess and you will find a logical way to justify it. Intuition is nothing but the outcome of earlier intellectual experience."**

- **Real science proceeds not just with deduction and induction but by necessary "ah-hah" experiences in which inferences are made and patterns recognized**

> **"While actively engaged in the process of inquiry, the knower in another sense is, in Einstein's own words, 'helpless… until principles he can make the basis of deductive reasoning have revealed themselves to him'"** [1]


Einstein

- **Ex: In developing his theory of Special Relativity in 1905, Einstein had to have the tremendous leap of intuition to recognize that time and space are themselves mutable**

[1] Quoted in E. Colyer, *How to Read T. F. Torrance* (IVP, 2001), p. 333

Polanyi: The intuitive leap is analogous to visual pattern recognition

- Michael Polanyi, British physicist and philosopher of science (1891-1976) proposes:
  - The intuitive leap is drawn from what he called “tacit knowledge”, which we may not even be aware of
  - This enables us to “discern… patterns or coherence previously undetected in a given field through a heuristic leap from the parts to the whole”
- He likens this to psychological experiments with glasses designed to invert vision:
  - After eight days bumping around, suddenly the brain comprehends what it sees

A volunteer experiencing balance problems immediately after putting on Image-inverting glasses

Graduate student Fred Snyder after 30 days wearing the glasses, is able to ride and control a bicycle flawlessly—but after taking the glasses off is unable to maintain his balance (~1950)

Einstein's model isn't just true of giants and geniuses

- I have observed this behavior even in ordinary scientists such as myself, my colleagues, my father (a physicist), etc.
- Some straight-forward problems are amenable to deduction,
- But the interesting problems are solved by immersion, followed by a period of waiting helplessly for inspiration
- Few scientists recognize this helplessness, behaving as if they had *accomplished* the act of intuition
- This is the source of the common advice: when stuck, go take a shower!
- What Einstein describes is the psychological phenomenon of *incubation*:

The thinker senses that a problem is soluble (and perhaps what direction the solution will take), but fails to solve it on his or her first attempt; later, after a period in which he or she has been occupied with other concerns (or, perhaps, with nothing at all), the solution to the problem emerges full-blown into conscious awareness.[1]

[1] *Implicit Cognition*, ed. G. Underwood, p. 257;
Is this model of learning true just for theorists?;
See the quotes by nobel-prize-winning experimentalists in *Am J Phys*, Jan 2010, p. 5.

Scottish Reformed theologian T. F. Torrance uses Einstein's model to describe "scientific theology"

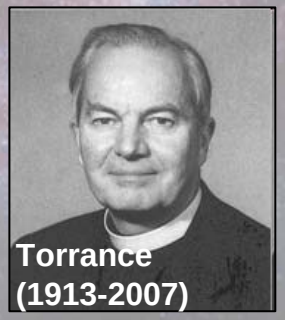
- **Torrance refers to the immersion in the data under study as "indwelling":**

> **"We indwell the field of inquiry, in this case the biblical witness, until a structural kinship arises between the human mind… and the interrelations and intrinsic structures in the realities to which the Scripture bears witness"[1]**

- **For Torrance, the development of the doctrine of the Trinity and Incarnation in the 3rd & 4th centuries is an example of this process:**

> **"We cannot deduce or abstract the incarnation or the Trinity… from the 'data' concerning the historical Jesus, for these doctrines arise out of a much more complex integrative theological activity concerned with the conjoint witness of Scripture to God's *oikonomia*.[2]" [Colyer, 350]**

- **For Torrance a truly scientific understanding of Biblical study is necessarily *holistic*: to perceive the patterns in the Scriptures, study must be done in light of the plan and history of salvation; this rules out atomistic study of Scripture**

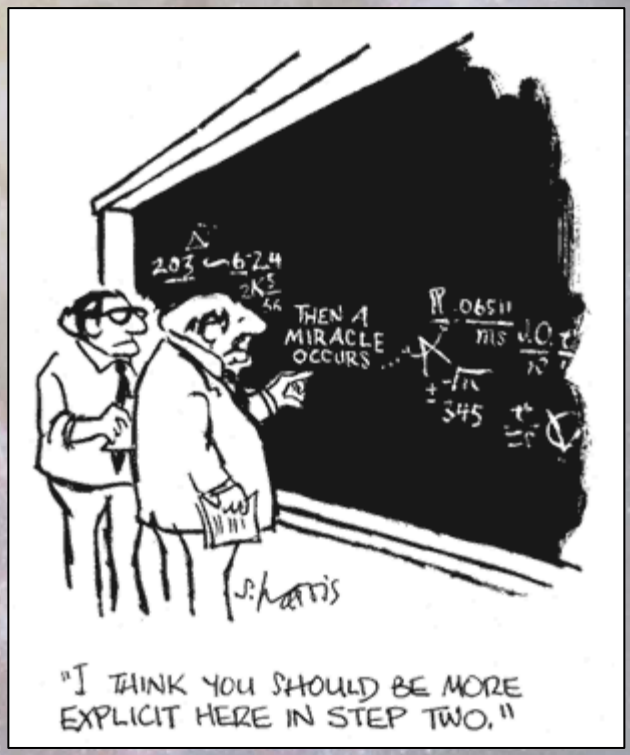

Torrance (1913-2007)

[1] E. Colyer, *How to Read T. F. Torrance*, p. 350-351 ; [2]*oikonomia*: from Irenaeus, God's plan of salvation, also called his "economy of salvation"

There are many fascinating implications for science and theology

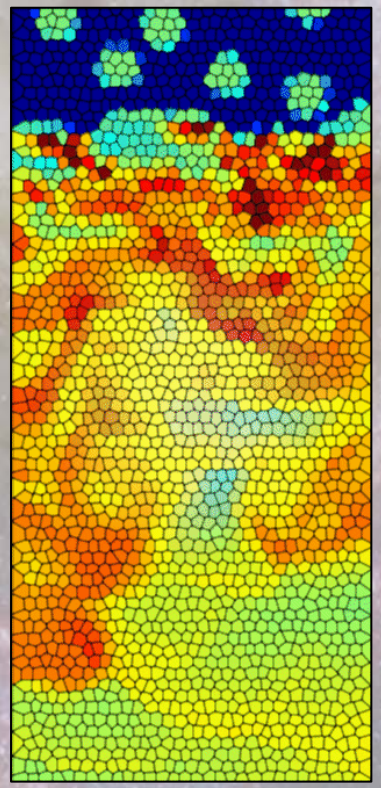
Four unrelated implications:

1. **To prepare yourself for inspiration of *any sort*, immerse yourself in the subject**
   - **E.g., when praying for someone in need**
2. **Learning is primarily not *volitional***
   - **We prepare the soil for inspiration, but don't *choose* to have an intuitive leap**
   - **So the divisions between common grace, psychology and divine action become blurred**
3. **Parables, central to Jesus' teaching, are ideally suited to this form of learning, since they are *not deductive*, and invite *immersion* in the story**
4. **Imagine the subject isn't the physical world, but rather a *person.* How do you immerse yourself in a person, whether human or divine?**



Science and faith can both benefit from recognition of the learning process

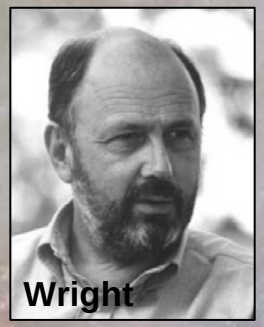
- As scientists we may gain humility by the recognition of our helplessness *during* incubation
- People of faith may at times short-change the immersion process
  - ❖ in prayer
  - ❖ in study of Scripture
  - ❖ in seeking discernment, etc.



For Tom Wright, this immersion in the data is analogous to Christian love

"My sense from talking to some scientific colleagues is that, though it's hard to describe, something like this is already at work when the scientist devotes him- or herself to the subject matter so that the birth of new hypotheses seems to come about, not so much through an abstract brain… but more through a soft and mysterious symbiosis of knower and known, or lover and beloved…

"Love is the deepest mode of knowing, because it is love that, while completely engaging with reality other than itself, affirms and celebrates that other-than-self reality. This is the mode of knowing which is necessary if we are to live in the new public world, the world launched at Easter, the world in which Jesus in Lord and Caesar isn't."[1]


Wright

- **Immersion in the subject, rather than representing mastery over it, is better understood as *submission* to it (Dan Griswold, Trinity Reformed)**

[1] Tom Wright, "Can a scientist believe in the resurrection?", The James Gregory Lecture 2007

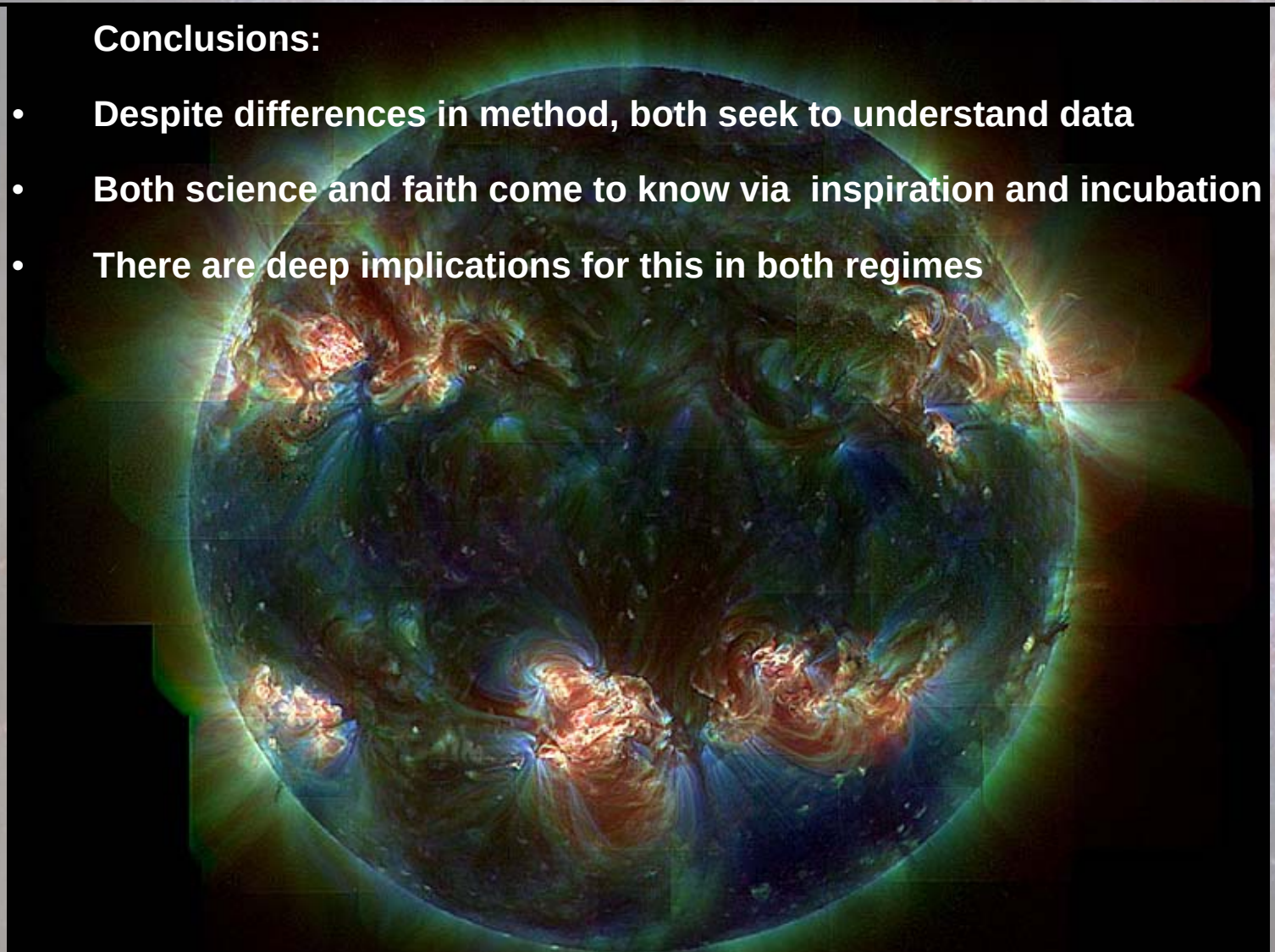
There are many other issues of interest to both science & faith

- **Is there any true randomness? Quantum Mechanics, the Heidelberg Catechism (Q. 27) & You (Polkinghorne et al.)**
- **The universe reflects God's order; does it reflect God's moral nature as well? (Murphy & Ellis)**
- **Zero-energy stochastic perturbations: Models for divine intervention (Polkinghorne et al.)**
- **Open theism & special relativity**
- **Fine tuning and the anthropic principle (Gingerich et al.)**

“Why do you complain to [God] that he answers none of man's words? For God does speak—now one way, now another—though man may not perceive it” (Job 33:13-14)

Conclusions:

- **Despite differences in method, both seek to understand data**
- **Both science and faith come to know via inspiration and incubation**
- **There are deep implications for this in both regimes**



The sun, in the ultraviolet, showing the plasma formations in the corona