How the Non-Physical Influences Physics and Physiology: a proposal

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(v7)

Outline of Talk

1. The Mind-Body problem and possible solutions
2. The Non-Physical
3. Finding a Soft Spot in quantum physics
4. Varying Electric Permittivity of the vacuum
5. Energy is not always conserved locally
6. ‘Targets’ as a new level of physics for physiology
7. Numerical models of changing proteins
8. Summary

The Problem

- Many talks at this SSE-PA convention provide evidence for novel causes and effects related to non-physical minds
- We see effects in physical things.
- Many effects of mind on our body every second.
- Crossing the mind-body gap.

We ask:

- Is something incomplete about physics?
- Could experiments see specific new predictions?

Ways to cross mind-body gap

- Monism (not really any gap):
    - A combined physical + mental world has a uniform system of causes and effects
    - What is mental is really physical & vice-versa. Strange.
- Dualism (2 levels)
    - There do exist distinct physical and mental substances.
    - Separate but inter-connected in specific ways.
    - No causal closure anywhere, but interactions
- I base my theory Discrete Degrees (generalized dualism)
    - From Emanuel Swedenborg: multi-level discrete degrees.

What is the Non-Physical?

Non-physical
Physical

- Many discrete degrees or planes:
  - Spiritual → Purposes → Mental → Intentions → Sensorimotor mind → Spiritual body → Final causes , Targets → Physical Changes

- Here I focus on the last steps into the physical
  - **How the final causes could create targets which affects what happens in physics**
  - This can be applied to all kinds of spiritual and mental discrete degrees.
  - So **I take final causes & targets to be causally active**
  - Use non-physical and physical as different kinds of substances. We see how dualism can work.

Non-physical effects on Physical

- Something is different in physics and physiology because of non-physical input targets
  - Should be effects in general cellular bio-chemistry
  - Then <u>also</u>:
    we have effects of mental desires and intentions on neurons, leading to bodily movements

- Try to keep existing structure of physical theory as much as possible
  - Computers, microscopes, suns: all still work.
  - Find a ‘soft spot’ in physical theory so laws are <u>not</u> always fixed, but vary as part of a bigger picture.

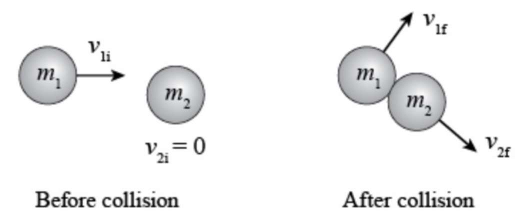
Physics in Living Systems

- All living systems have bodies made of protons, neutrons and electrons.
- These made into atoms and molecules.
  - In particular: very large <u>protein</u> molecules in cells
- Many of these molecules have to fold into specific shapes to be catalysts or enzymes.
  - The speed and directionality of folding is still a puzzle in biophysics (Levinthal’s Paradox since 1969)
  - I predict:
non-physical influences in living cells could provide targets for protein folding and so speed up folding.

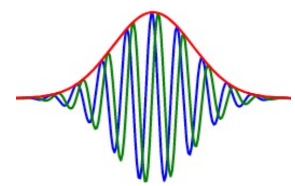
Discrete Degrees in Physics

- going from effects to causes, all connected

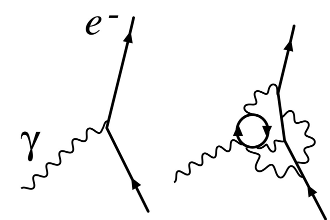
- Classical Newtonian Physics describes most large objects.
  - Forces acting on masses giving acceleration



- Quantum Mechanics is more accurate for particles, atoms and molecules.
  - Wave packets governed by Schrodinger Equation

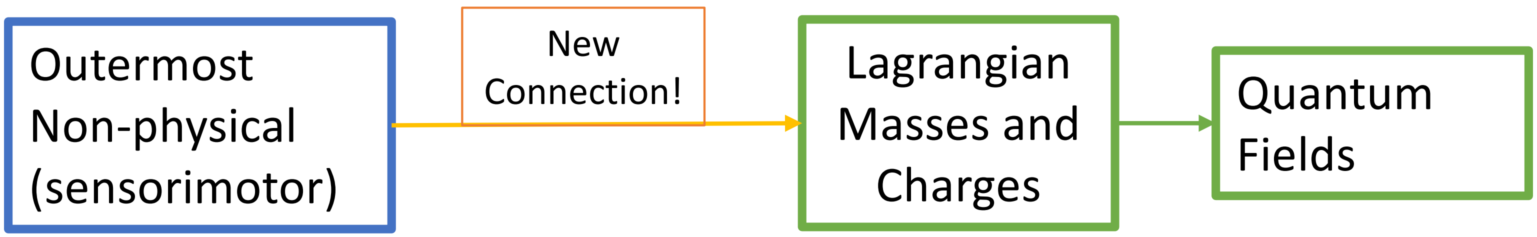


- The masses and forces in quantum mechanics determined by Quantum Field Theory
  - Massive and massless fields governed by Field Lagrangians



- What determines Lagrangian masses and charges?

Connecting outermost mental degree with innermost physical degree



- The sensorimotor mind is outer-most non-physical
- The Lagrangian is the inner-most physical degree

- This is where some connection should be expected!
(or a new degree between them)

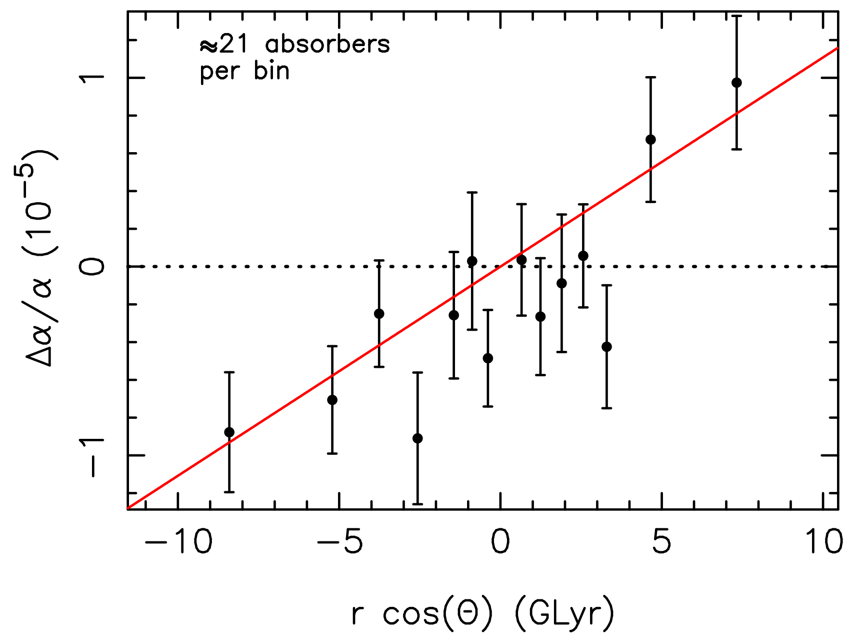
- Propose:
The non-physical influences the values of the Lagrangian masses and charges

Are Lagrangian coefficients fixed?

- Many people think so.
  - See ‘Parameters of the Standard Model’ in Wikipedia.
- But these observed values are not the starting parameters.
- RATHER:
  - By a process called ‘renormalization’, the initial numbers are tuned to give the observed numbers as output.
- But renormalization method is not fixed in theory.
  - Method could be fine-tuned depending on place and time!
  - Starting numbers <u>could</u> give varying masses and charges.

Have Charge Variations been seen?

- Perhaps comparing with very distant stars:
- John Webb *et al*, (2001, 2011):
  - Measured variations in ratios of frequencies of spectral lines
  - Found evidence that the electron charge q is very slightly smaller for distant stars (that is, in the past),
    by 1 part in 10^{5}:
- So: variations are conceivable



Non-physical Effects on the Physical

Our idea:

- the fine-tuned parameters (masses, charges) can be varied locally in order to achieve ends in nature.

We will focus on electric charges.

- Physicists have proposed varying charges over the age of the universe.
- Now we propose to vary it over micro-seconds, and within living organisms.
  A new idea.

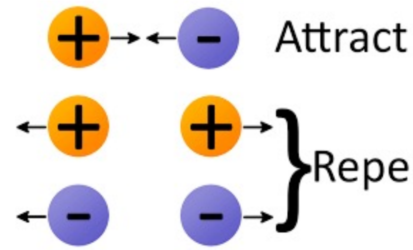
Varying Electric Charge as a Non-physical effect

- A new discrete degree inside quantum field theory:
- ‘Targets’ received into the physics of physiological systems
  - Final causes set targets (ends), to determine the ‘means’
  - Reach targets by adjusting electric parameters of physical fields.
- This is real fine-tuning,
  - not gradually over whole universe (or fixing in the Big Bang),
  - but <u>differently at each time in each place</u> in an organism

“Local”, not “global” physics variations!

- We suggest that this is specific to living organisms. That it occurs at all scales of psychology and biology: every day and every second of our lives.

Electric Forces (inverse square law)



The electric force F on charge q_1 at position r_1 and q_2 at r_2 is:

$$F = \frac{1}{4\pi\varepsilon}\frac{q_1 q_2}{|r_1 - r_2|^2}$$

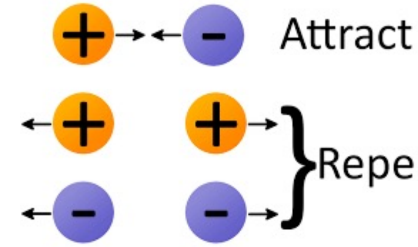
This force is proportional to the product of the charges $q_1 q_2$.
It depends inversely on the square of the distance $r_1 - r_2$ between the two particles.
There is an overall scale factor of $1/4\pi\varepsilon$
depending on 'electric permittivity' ε.

This is Coulomb's well-known inverse-square law.

Varying q_1 will vary force F.
Not a new force, but adjusting an existing one.

If mental input could vary any of the charges q_1,
then they could vary the forces on electrons and ions.

Electric Permittivity Varies



Jacob Beckenstein (1982, 2002) showed very similar effects, while keeping charges q constant, is to vary permittivities ε_1, ε_2.

Maxwell's equations allow ε to to vary in dielectrics (capacitors):

$$F = \frac{1}{8\pi}\left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2}\right)\frac{q_1 q_2}{|r_1 - r_2|^2}$$

If $\varepsilon_1 = \varepsilon_2 = \varepsilon$, this reverts to standard Coulomb's law on the previous page.

Physics is thus easier to vary just ε, not charges q.

But here, <u>permittivity variations even in vacuum</u>.

Electromagnetic fields

- Even with increasing or decreasing local vacuum permittivity ε, the fields can still follow strict Maxwell equations

$$\nabla \cdot (\varepsilon E) = \rho \qquad \nabla \cdot (\mu H) = 0$$

$$\nabla \times H = J + \frac{\partial(\varepsilon E)}{\partial t} \qquad \nabla \times E = -\frac{\partial(\mu H)}{\partial t}$$

Keep permeability $\mu = 1/(c^2\varepsilon)$ so constant speed of light c (Einstein is happy)

- The input to Maxwell equations is:
  - Initial values of electric field E and magnetic field H.
  - Electric charge density ρ, and electric current J of charges

- Electrostatics is simpler:
  - Charge density ρ is source of electric field E : $\nabla \cdot (\varepsilon E) = \rho$

- We can calculate e.g. how protein molecules move.

Energy is not always conserved

- Noether's theorem (Emmy Noether, 2015):
  If physics laws depend on time, then energy and momentum are not necessarily locally conserved.
- Permittivity is now $\varepsilon(r,t)$: varying in time & space.
  So energy us not conserved.
- For example:

  Electrostatic energy $= \frac{1}{8\pi}\left(\frac{1}{\varepsilon(r_i,t)} + \frac{1}{\varepsilon(r_j,t)}\right)\frac{q_i q_j}{|r_i - r_j|}$
- Can still do physics calculations using electrostatics:

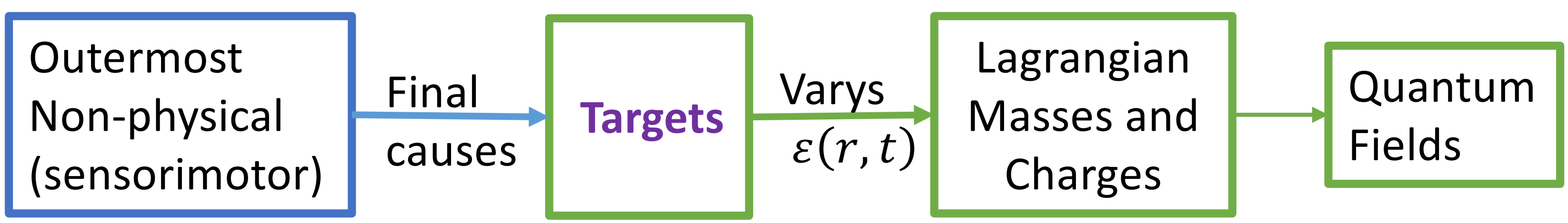
$$F_{ij} = \frac{1}{8\pi}\left(\frac{1}{\varepsilon(r_i,t)} + \frac{1}{\varepsilon(r_j,t)}\right)\frac{q_i q_j}{|r_i - r_j|^2}$$

Other schemes trying to keep Conservation of Energy

- Physics extensions have been proposed which keep
  - Energy conservation and
  - Causal closure of the physical.
- For example:
  - Biased probabilities in quantum mechanics (John Eccles)
  - Varying time of probabilistic events (Henry Stapp)
  - Moving energy from one location to a nearby place
    But does not conserve energy locally.
  - Non-local entanglement (Amit Goswami)
    But cannot be used for signals.
- Remember: changes in quantum chances are very small!
- Electric changes are bigger.

Achieving useful ends: Targets.

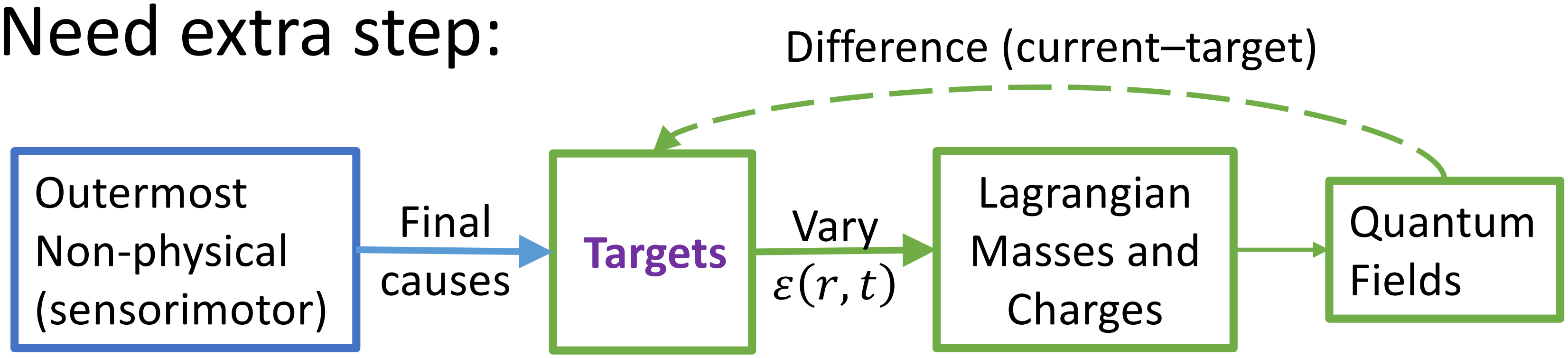
- How does an organism vary the $\varepsilon(r, t)$?
- We have talked of final causes, ends, targets
- Propose new discrete degree in the gap:



1. Outer-most non-physical (eg. sensorimotor mind)
2. <u>Targets</u> set by nonphysical for required physics shape
3. The field Lagrangian is the inner-most physical degree

Achieving Targets in New Physics

- Michael Levin (2012): cells need feedback system to
  1) know the shape S it is supposed to achieve (target),
  2) tell if its current shape S_0 differs from this target,
  3) compute means-ends analysis to get from S_0 to S,
  4) perform a kind of self-surveillance to know when the desired shape has been reached.
- Need extra step:



Three Function of Targets

1. **Receive final-cause** from non-physical degree – giving the target configuration
2. **Determine differences** between current state and target configuration
3. **Vary electric permittivities** $\varepsilon(r, t)$ to minimize difference, and so achieve the target.

We want this done in a physical degree, so

- not using higher mind itself for micro-managing.
- anticipate futures if needed, but not using time travel.
- make some kind of physical feedback loop

Still some details to work out

Anticipating future configurations?

- Targeting would be more effective if it could anticipate physical configurations in near future
  - Needed, say, for a flying bird to intercept an insect.
  - Target now specified as some future target-time.
- Then adjust permittivities in whole time interval from now until the target-time.

- This can be done in physics if we separate 'metric time' from 'process time'.

Metric time and Process time

- Since Henri Bergson, A.N. Whitehead, and quantum mechanics, we expect 2 kinds of time:
  - Metric time (clock time) : measurable time like space (i.e. spacetime)
  - Process time of changes of state (successive actualizations of propensities, such as in quantum selections)

- We are going to use both kinds of time.
  - To extrapolate present causes into effects in the near future of spacetime, as metric future exists now already.
  - Thus allow a targeting system to measure the current-extrapolation difference to its target.

Adjusting Future Permittivities

- Use forward-propagated waves in metric time.
  - So extrapolation—target difference found at the target-time.
- Back-propagate adjoint waves in metric time
  - Time-reversed solution of Maxwell equations (for e/m waves) and of Newton equations (for particles) from target-time back to present.
- These adjoint waves give the sensitivities needed to vary the permittivities in between to reduce the extrapolation—target difference.
- Repeat at intermediate process times, so the physical system reaches the target in reality.

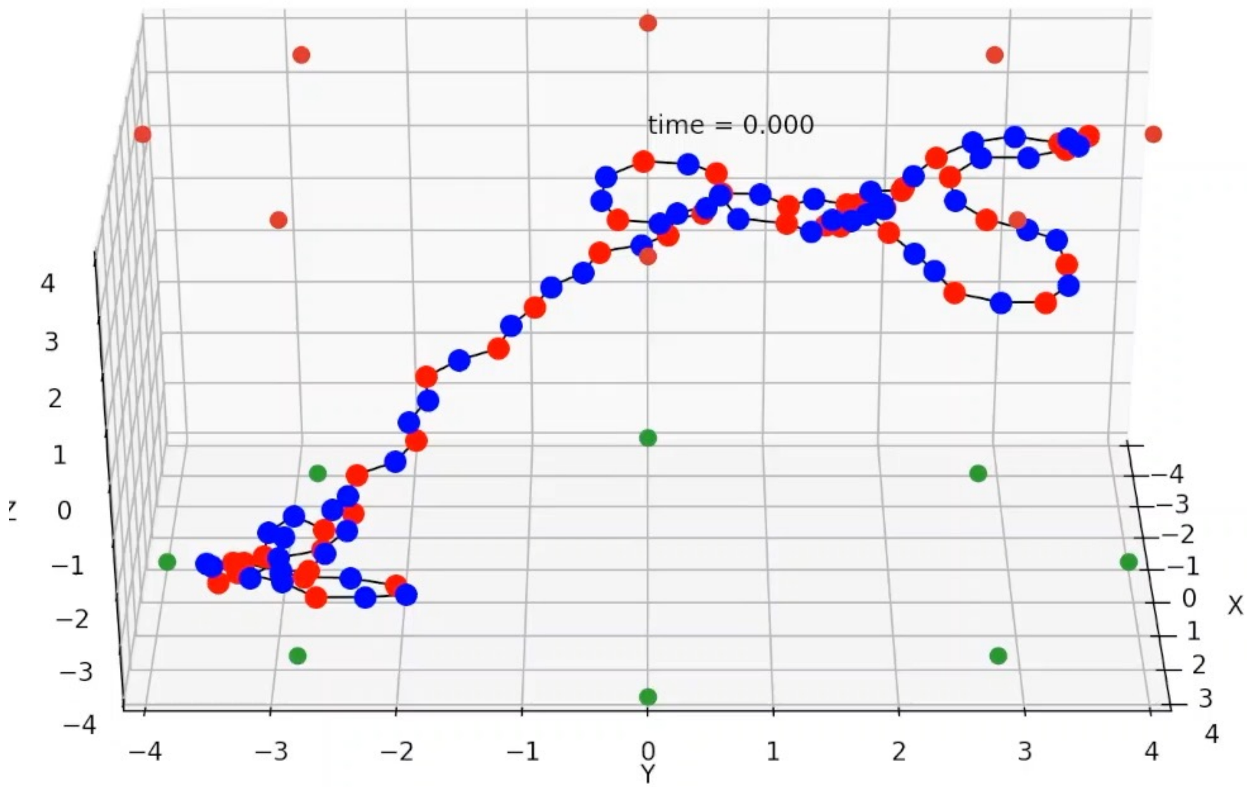
Numerical Examples of Targets for Proteins, Using Molecular Dynamics models

Forward- and back-propagation
to reach Targets by Varying Charges

Demonstration using 100 particles inside a cage of 2 rings, 16 charges

A molecule put in a cage.

Units
Time:
ps = 10^{-12} s
Space:
nm = 10^{-9} m



Calculate trajectory vectors $\vec{x}_i(t)$, $\vec{v}_i(t)$ for each particle i.

Blue: +0.2*e* charge. Red: -0.2*e* charge (*e*=unit charge).
Cage charges are -3*e*, like GroEL chaperone molecule

Bond lengths and angles specified.
Repulsive cage wall. No water

Targets and Adjustments

- **Target** = Φ_i: the desired position for each particle i, at some later time T_g.
- **Goal** function = G which gives difference to target.

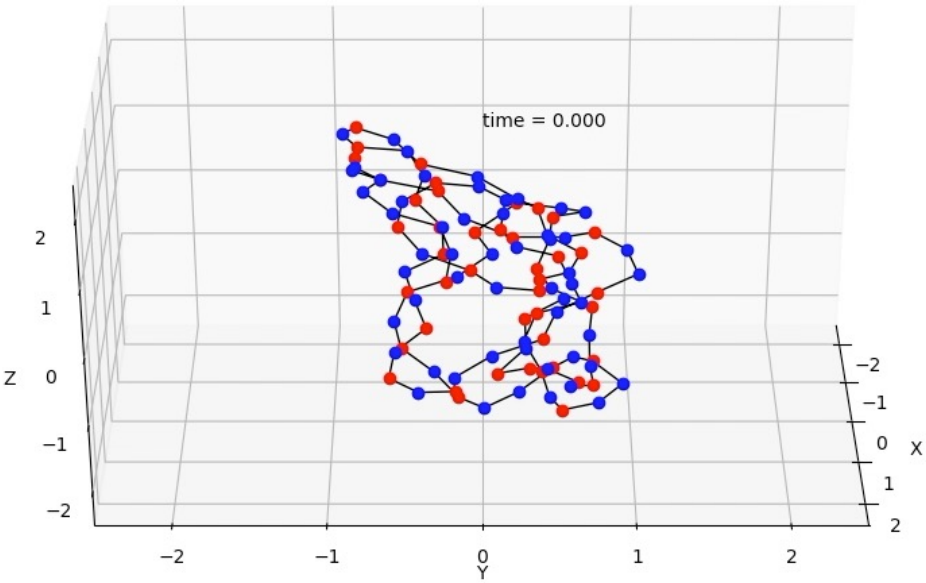
$$G = \sum_i (\vec{x}_i(T_g) - \Phi_i)^2.$$

So goal is minimize G. Preferably to $G=0$.

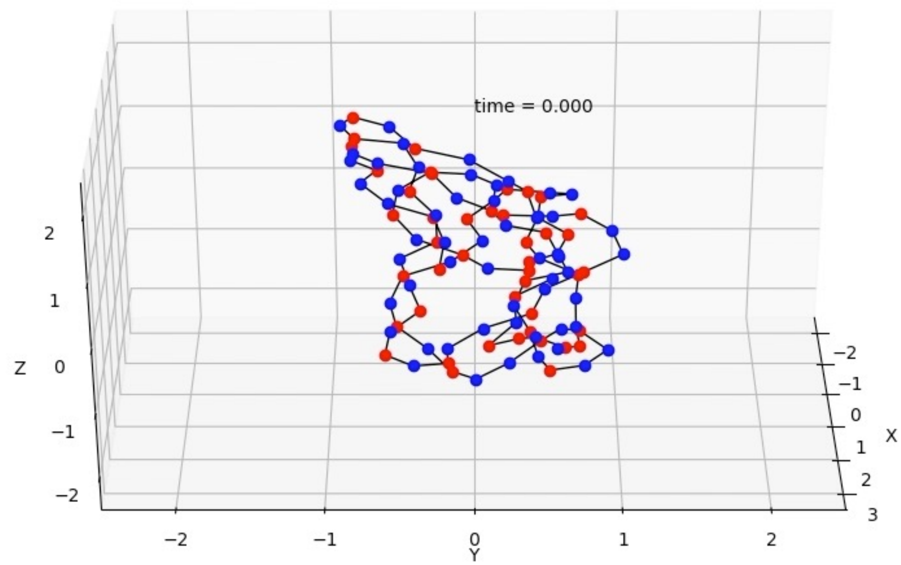
- **Adjust** permittivities = 'dielectric constants' (effectiveness of charges) by functions $\psi(r_i, t)$,
  so $\varepsilon(r_i, t) = e^{2\psi(r_i,t)}\, \varepsilon_0$ (for each particle i)
  - So $\psi(r_i, t) = 0$ is no change: $\varepsilon(r_i, t) = \varepsilon_0$

Done with 3700 lines of Python, with Cython to compile C kernels.

Demonstration 1:
Shifting centroid to the left by 1 nm



<u>Normal</u> time changes

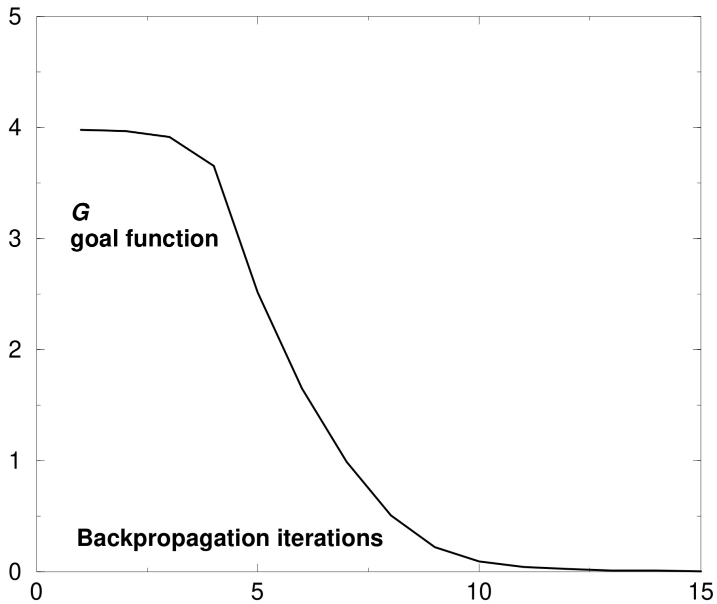


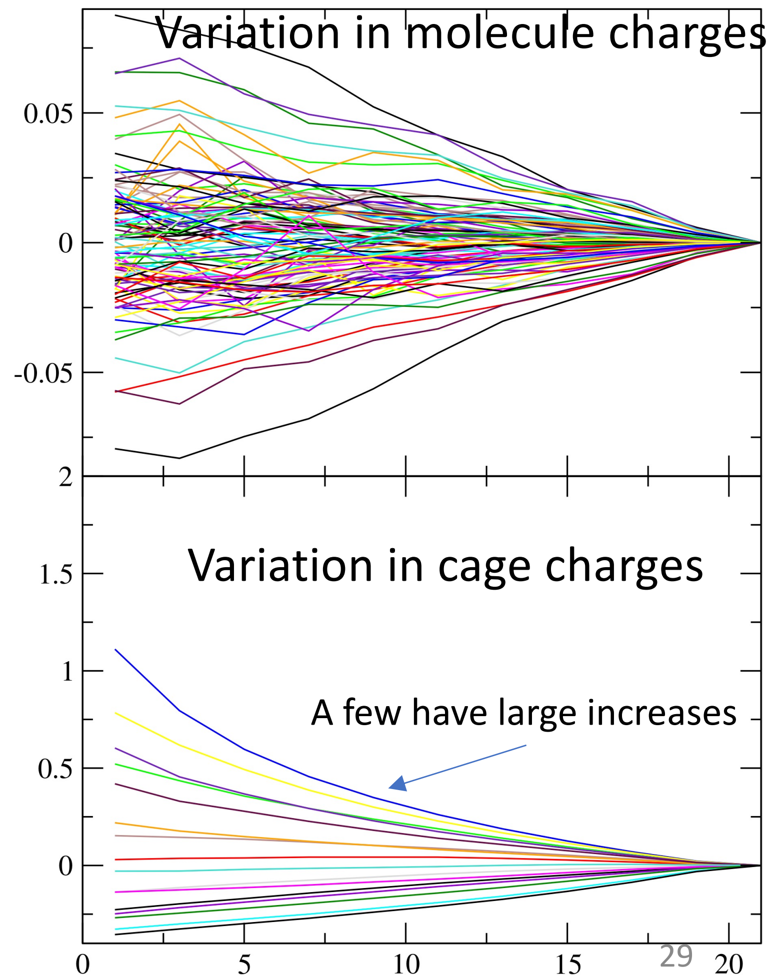
Time changes with <u>varied</u> $\varepsilon(r_i, t)$

Demonstration 1: Shifting left.

Fractional variations when converged to $G=0$

Difference extrapolation—target, with repetitions of forward-back propagations:

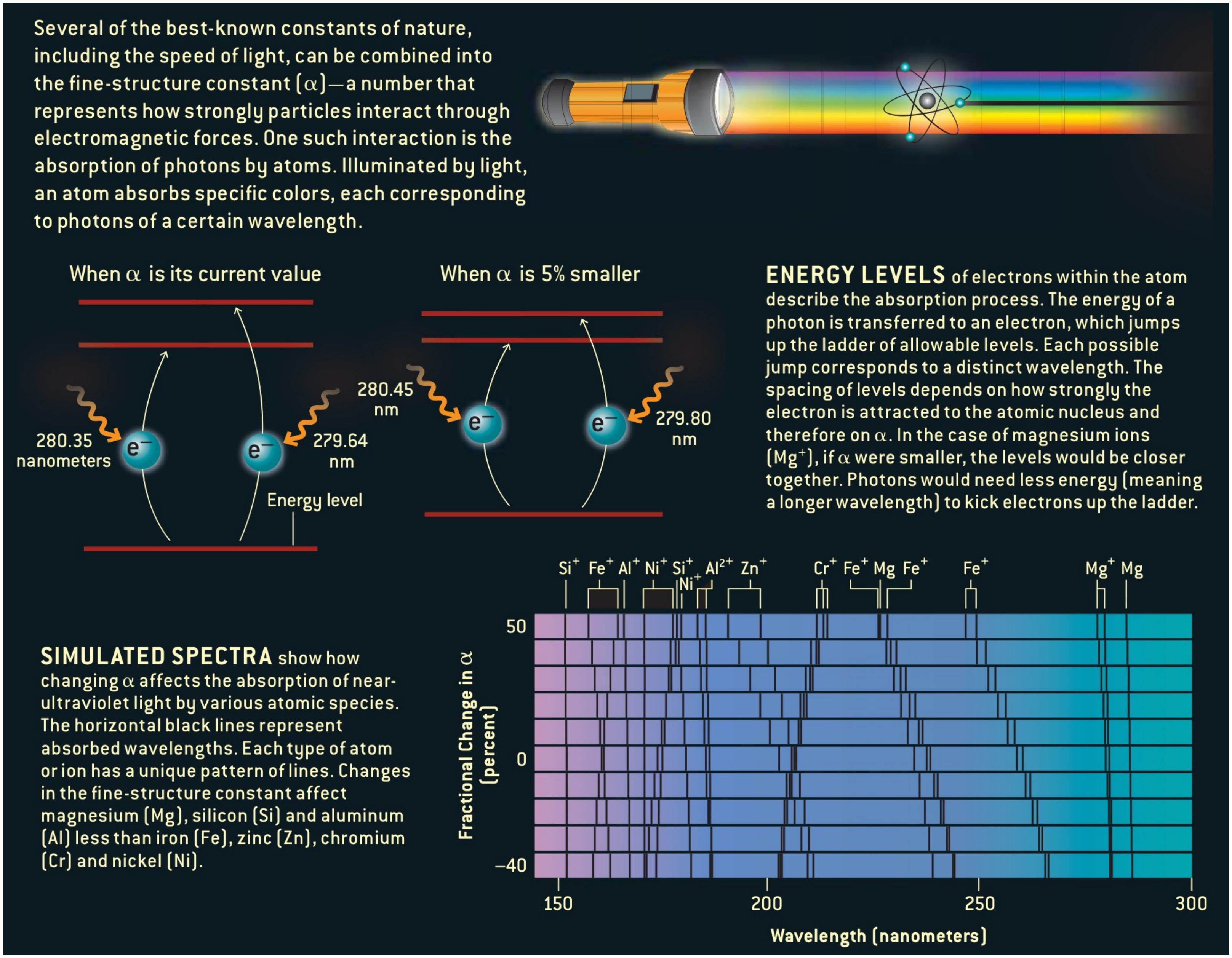




Experimental Test of Predictions

- General predictions:
  - Physical processes proceed more quickly to useful result.
  - This happens particularly with charged particles/atoms.
- Specific predictions:
  - Electric effects in living organisms fluctuate for targets
  - Vacuum Permittivity changes in atoms and in cells
    - Must distinguish from solvent permittivity changes
  - This model only changes the physics parameters needed to get useful results – probably not all surrounding region.
    - So must measure energy level changes in atoms <u>in</u> causal chain
    - Atoms have brief shifts in energies and fluorescent light

Measuring fluorescence spectra



from:
John Barrow & John Webb, Scientific American (2005) 56-63.

Summary of overall answers:

- We can propose two hypotheses to answer the questions:

1. WHAT do mental (etc.) effects change in physics?
   Answer: The relative permittivity of the vacuum

2. HOW these changes could be used in physiology?
   Answer: For target configurations given by input from the non-physical into cells, there is a physical feedback mechanism to bring physical objects closer to this target in the near future.

Implications

- How non-physical things could have effects in nature.
- These effects on permittivity should be measurable

- Final causes and targets would be active in nature.
    - We have a way to bring the future into line,
      without time travel.
- Widens the field of scientific explanations concerning mental and other non-physical causes.

- No longer is the physical universe causally closed.

References

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5. Levin, M. (2012) *Morphogenetic fields in embryogenesis, regeneration, and cancer: Non-local control of complex patterning*, Biosystems, **109**, 243
6. This is a 'backpropagation method' common in computer modeling https://en.wikipedia.org/wiki/Backpropagation .
7. Adjoint solutions are often used in design problems in engineering, to find the sensitivities to all input parameters of an overall performance measure. https://en.wikipedia.org/wiki/Adjoint_state_method

THE END