1. Quantum Mechanics
    1. Quantum (spin) statistics; ‘Degeneracy pressure’
    2. …The whole thing
    3. Nonlocality/realism
2. QED
    1. Dad figured a lot of this out already. But it may be necessary to mathematically show what he figured out about the anticorrelation experiments.
3. QCD/Standard Model
    1. What are the strong and weak interactions?
4. Relativity
    1. Everything
    2. Gravitational lensing?
    3. All the white hole/wormhole stuff is gone obviously.
5. Condensed Matter Physics
    1. Superconductivity, Bose condensation, quantum statistics in general,…
    2. ALL of this crazy stuff they’re seeing that has no physical explanation but that is modeled by “quantum mechanics”! (To get started on this, need a theory of what electrons are, free vs. bound states etc.)
6. AMO
    1. Light-matter interactions
7. Astrophysics
    1. Relativistic jets

The List

UNANSWERED QUESTIONS (FOR PROFESSORS):

RELATIVITY AND SPACE:

-Regarding the **redshift of light received from other galaxies**: What about gravitational redshift? At the very least, the light has to be redshifted by the gravity of the star which emitted it. This, I presume, would be a tiny effect compared to the redshift they see. But wouldn’t it be redshifted by the gravity of the entire galaxy (once it escapes), according to GR? (seeing as GR is based on potentials). Also, due to different gravity of different stars, wouldn’t each star emit differently redshifted light? (if it’s a tiny effect, it doesn’t matter.)

-Have any experiments measured the one-way speed of light, **or light-speed isotropy**, with a MOVING apparatus? Have any experiments measured the VERTICAL speed of light? (up or down relative to surface of the Earth)

-Suppose an observer is in outer space among the stars, but is sufficiently far from any particular star so that (or the stars are configured such that) there is negligible gravitational field

('curvature') at his location. Say the observer is in some arbitrary trajectory relative to the stars. What determines whether his motion is **inertial** or not, i.e. whether he feels a force or not?
-**Noon-midnight problem:** Why does the sun's gravity not seem to affect (eg via time dilation. eg on different sides of the earth) anything on the earth apart from putting the earth in orbit? Why do we see no transverse Doppler shift (as opposed to only gravitational) of hydrogen lines on the sun even though it's moving at 30 km/s relative to us?
-What's the **speed of gravity** (ask an astrophysicist), e.g. in binary star orbits? Why isn't there a 'Poynting-Robertson effect' for gravity (violation of angular momentum conservation)?

-If you zoom through the cosmos at close to the speed of light, every planet increases in mass, right? What happens to their orbits/gravity then?
--Why does GR produce a precession in the perihelion of Mercury? What's the physical reason? (Read Ives' paper.)
-Radiation by accelerated charges in comoving frame

QUANTUM:
-Why does the **existence of lasers not contradict the Heisenberg uncertainty principle** (as Heisenberg and Born originally thought, according to Carver Mead via Caroline Thompson)?
-If we can only measure the spin of a particle to be sh' at most, then how do we know (observationally) that its spin is actually \sqrt{s(s+1)}h' in magnitude?
-Does anything happen between fermions or bosons that are *different* particles (e.g. an electron and a proton, a He3 and He4)? That is, does the fact that they're fermions or bosons have any effect on interactions between non-identical particles?
-How does particle exchange produce an attractive force
-Magnetic reconnection (uniform magnetic field with perpendicular shear)
-If light has orbital angular momentum, what's the reason for the \delta l = +-1 selection rule? Anticipated response: a single photon cannot have angular momentum. But the PT article says it can! Does that work in wave mechanics? **Update** Heppelmann says that since the photon originates at r = 0, it cannot have orbital angular momentum relative to the atom. But how do we know it does originate at r =0? Maybe it originates some distance out, like an electron shell?
-Why are muons so penetrative?

TO-DO:

-Analyze the Gravity Probe B experiment and its results

- !! Study the origins of Schrodinger's equation (classical mechanics) and its analogies with optics/classical mech very thoroughly (start with Whittaker)!! This means something. Try to figure out what it means for the nature of matter and the de Broglie waves. (Apparently matter and light have a lot in common – figure out exactly what. Figure out if the commonalities are different for electrons vs. more massive particles.)
  - Investigate how de Broglie interference is done with atoms and molecules. Why the hell does the wavelength depend only on the mass of the molecule and not on its complicated structure and geometry (and e.g. ionization state)? Maybe

studying their methods will help answer this question, e.g. it may turn out that for large molecules the dependence is more complicated.
- Also, just study *all* of Whittaker and/or Maxwell.
- All of the probabilistic interpretations of QM came *after* Schrodinger (who did Hydrogen, the HO, perturbation theory, …). Figure out if what Schrodinger did is all physically real, and what (if anything) the probabilistic stuff means and why it so easily emerged from the same framework as Schrodinger's work.

-Read all about the Couder-type pilot wave experiments, and about Bohmian mechanics/pilot-wave theory
-Read about Maxwell's vortices model of electromagnetism (investigate possible connection with Aharanov-Bohm effect also)
-Relativistic electrodynamics and plasma physics
-study Condensed matter and nanophysics (nano optics, AMO, ...)
-Dynamo theory
-Density wave theory
-Bell's theorem (I think the QM result must be wrong. So, using the knowledge that everything is waves/wave structures, I may be able to find a fundamental flaw in all their experiments that propose to violate Bell's inequalities. Or it's just as Carolyn Thompson says – there are too many loopholes and too much room for 'adjustment' of the experiments to get the right results, and perhaps experiments with negative outcomes aren't published because they don't have a 'theory' to explain their result)
-Aharanov-Bohm effect
-Read about Riemann's mechanical ether (apparently Einstein used his math):
Title: Bernhard Riemann's *Gesammelte mathematische Werke und Wissenschaftlicher Nachlas*s, Hrsg. unter Mitwirkung von Richard Dedekind, von Heinrich Weber.
Author: Riemann, Bernhard, 1826-1866. (source: *Wikipedia*, 'Mechanical explanations of gravitation'
-Read Tipler/Dupre Aether GR, Painleve and Alvar Gullstrand's early articles about how GR is just flowing space, Electrodynamics of Radiating Charges (and Davis Expansion Myths), and Hrvoje Nicolic Quantum Myths

Interesting quotes:

In Feynman's QED, he says QED also gives photons an amplitude to move at speeds other than c, but these cancel out when the distances become larger than some very small number. I think he also says that all of **the infinities in QED come from assuming that one can go to an infinitely small distance scale**, or something, and they get rid of them by stopping the calculation at a scale close to the Planck scale (10^-30 meters I think he said?). But with renormalization he showed that the final answers you get don't depend on where you stop the calculation, only some not-directly-observable theoretical numbers do???

Hardy, in "A Mathematician's Apology"
"I began by saying that there is probably less difference between the positions of a mathematician and of a physicist than is generally supposed, and that the most important seems to me to be this, that the mathematician is in much more direct contact with reality. This may

seem a paradox, since it is the physicist who deals with the subject-matter usually described as ‘real’; but a very little reflection is enough to show that the physicist’s reality, whatever it may be, has few or none of the attributes which common sense ascribes instinctively to reality. A chair may be a collection of whirling electrons, or an idea in the mind of God: each of these accounts of it may have its merits, but neither conforms at all closely to the suggestions of common sense.

I went on to say that neither physicists nor philosophers have ever given any convincing account of what ‘physical reality’ is, or of how the physicist passes, from the confused mass of fact or sensation with which he starts, to the construction of the objects which he calls ‘real’. Thus we cannot be said to know what the subject-matter of physics is; but this need not prevent us from understanding roughly what a physicist is trying to do. It is plain that he is trying to correlate the incoherent body of crude fact confronting him with some definite and orderly scheme of abstract relations, the kind of scheme he can borrow only from mathematics. “

From lecture “The History of Field Theory” to the general public on February 3, 1929 by Albert Einstein: (link)

“While physics wandered exclusively in the paths prepared by Newton, the following conception of physical reality prevailed: Matter is real, and matter undergoes only those changes which we conceive as movements in space. Motion, space and also time are real forms. Every attempt to deny the physical reality of space collapses in face of the law of inertia. For if acceleration is to be taken as real, then that space must also be real within which bodies are conceived as accelerated.

Newton saw this with perfect clarity and consequently he called space "absolute".”

From book “Albert Einstein, Philosopher-Scientist”, essay “Gravitation without general relativity” by E.A. Miln, pg. 412:

“But it is open to doubt whether the general principle of relativity, that all sets of co-ordinates will yield the same forms for laws of nature, i.e., that all observers are equivalent, should be expected to hold good in the universe at large. According to the views of Mach, gravitation, in particular, is a consequence of the general distribution of matter in the universe. If that be so, then only those observers who stand in the same relation to the whole distribution of matter in the universe would be expected to be equivalent, i.e., would find similar descriptions of the law of gravitation.”

Whittaker, *A History of Theories of the Aether and Electricity*, page 159 of vol. 2:

“It might be thought that by following up the consequences of this principle [Einstein’s principle of general relativity] we should obtain important positive results. However, Ricci and Levi-Civita had shown long before that from practically any assumed law we can derive another law which does not differ from it in any way that can be tested by observation, but which is covariant. The fact that a formula has the covariant property does not, therefore, tell us anything as to whether it is correct or not. We are, however, perhaps justified in believing that a conjectural law which can be expressed readily and simply in covariant form is more worthy of attention (as being more likely to be true) than one whose covariant form is awkward and complicated.

Not only must the general laws of physics be covariant, it is also necessary that every single assertion which has a physical meaning must be covariant with respect to arbitrary transformations of the co-ordinate system. Thus the assertion that an electron is at rest for an interval of time of duration unity cannot have a physical meaning, since this assertion is not covariant."

Wikipedia, "Shapiro delay":

"From the near-simultaneous observations of neutrinos and photons from SN 1987A, the Shapiro delay for high-energy neutrinos must be the same as that for photons to within 10%, consistent with recent estimates of the neutrino mass which imply that those neutrinos were moving at very close to the speed of light."

Wikipedia, "Electron":

"The issue of the radius of the electron is a challenging problem of the modern theoretical physics. The admission of the hypothesis of a finite radius of the electron is incompatible to the premises of the theory of relativity. On the other hand, a point-like electron (zero radius) generates serious mathematical difficulties due to the self-energy of the electron tending to infinity."

"Observation of a single electron in a Penning trap shows the upper limit of the particle's radius is 10−22 meters."

"The apparent paradox (mentioned above in the properties subsection) of a point particle electron having intrinsic angular momentum and magnetic moment can be explained by the formation of virtual photons in the electric field generated by the electron. These photons cause the electron to shift about in a jittery fashion (known as zitterbewegung),[89] which results in a net circular motion with precession. This motion produces both the spin and the magnetic moment of the electron.[8][90] In atoms, this creation of virtual photons explains the Lamb shift observed in spectral lines.[83]"

"The law of reflection arises from diffraction of a plane wave with small wavelength on a flat boundary: when the boundary size is much larger than the wavelength then electrons of the boundary are seen oscillating exactly in phase only from one direction – the specular direction. If a mirror becomes very small compared to the wavelength, the law of reflection no longer holds and the behavior of light is more complicated." – *Wikipedia*, "Specular Reflection"

Feynman on spin:

"This brings up an interesting question: Why is it that particles with half-integral spin are Fermi particles whose amplitudes add with the minus sign, whereas particles with integral spin are Bose particles whose amplitudes add with the positive sign? We apologize for the fact that we cannot give you and elementary explanation. An explanation has been worked out by Pauli from complicated arguments of quantum field theory and relativity. ...The explanation is deep down in relativistic quantum mechanics. This probably means that we do not have a complete understanding of the fundamental principle involved."

Halliday and Resnick, *Fundamentals of Physics* 9ed, ch.44.4:

"Physicists gradually learned that the neutrino that appears in Eq. 44-7, associated with the production of a muon, is not the same particle as the neutrino produced in beta decay,

associated with the appearance of an electron.We call the former the muon neutrino (symbol nm) and the latter the electron neutrino (symbol ne) when it is necessary to distinguish between them.

These two types of neutrino are known to be different particles because, if a beam of muon neutrinos (produced from pion decay as in Eq. 44-7) strikes a solid target, only muons—and never electrons—are produced. On the other hand, if electron neutrinos (produced by the beta decay of fission products in a nuclear reactor) strike a solid target, only electrons—and never muons—are produced."

MISC. IDEAS:

- If I get a chance, I should take a course in atomic/AMO physics –it's really interesting and may be useful for the FS redshift experiments. I also should take a course in computational physics, because I might really need it for some FS simulations, e.g. dark matter… Or maybe better to just teach myself when the time is ripe.
- As far as I have seen, all of the infinities/**divergences in QED, QFT**, electromagnetism, etc. come from assuming that something is infinitely small (e.g. the electron is a 'point particle') or that one can subdivide space infinitely (i.e. continue a calculation to arbitrarily small distance scales). If space is quantized, that gets rid of all those problems immediately.

ENTROPY AND THE EVOLUTION OF COMPLEXITY

The second law of thermodynamics ($\Delta S \geq 0$), contrary to common belief, is not (or at least, should not be) an absolute 'law'. Entropy is actually a measure of probability: $S = k \ln \Omega$, where Ω is the number of microstates (microscopic organizations of the system – positions, velocities, etc. of each particle) that would produce the same observed macrostate (another stupid observer-based concept, I know).

The second law is simply the statement that a system is will *always* evolve into more probable/less 'ordered' states rather than less probable/more 'ordered' states. But there is a big problem with this statement: the word "always". It is extremely obvious that this should be changed to "usually"; this is a probabilistic law for Christ's sake!! For example, given a mixture of two types of gas molecules, there is an extremely small probability that, at some point, the two types of gas molecules will just happen to separate from one another completely and occupy separate halves of the container. It's extremely unlikely, but not impossible, and things like it (but much less extreme) happen all the time.

But that 'always' is what leads physicists to do idiotic things like applying this concept to the *entire evolution of the universe*, which is *exactly* the situation that must be an *exception* to the rule. Complexity evolves exactly during that small part of the time where the system evolves into a *less* probable/more ordered state – which, by definition, is a violation of the second law! So saying that evolution of the universe – galaxies, star systems, geology, chemistry, lifeforms, etc – obeys the second law is applying the law exactly where it is *not* applicable.

E&M

- As dad says, relativistic atomic clock-slowing is part of the key to relating the 'quantum' world to space and gravity. I think, similarly, that the relation between spin, orbital angular momentum of electrons/light,and macroscopic angular momentum (e.g. via the Einstein-de Haas and Barnett effects) are part of the key to understanding spin in terms of spatial processes. I have similar thoughts about how various things (e.g. symmetries and interactions) will help us understand the electric and magnetic fields, and the structure of elementary particles, in terms of spatial processes.
- If the speed of light is not the same for all inertial observers, this invalidates relativistic electrodynamics. **NOTE** actually maybe it wouldn't, because relativistic invariance is based on very specific assumptions about how things are measured, and these assumptions may have nothing to do with how things are actually measured (or with fucking reality). But that's another problem in itself.
    - (Older): If the speed of light is indeed *c* relative to the aether only, not to any 'inertial' observer (as some experiments/devices suggest, e.g. the MMX experiment detecting the Earth's rotation), then doesn't this mean Maxwell's equations aren't really Lorentz covariant?! **Update** No, because the Lorentz transforms also include a clock-synchronization term –vx/c^2.
- If light really does change direction at shears in the aether, that tells us something about the nature of light. The fact that a shear is a transverse process is enticing.
- Hydrogen electronic transition rules: If an electric dipole oscillation only occurs during a transition between orbitals with wavefunctions of different parity (symmetric vs. antisymmetric), does this say something about how wavefunctions and their interference are connected to the electric field? Maybe this in turn explains the use of imaginary numbers to model wavefunctions as well as EM oscillations… eh, maybe.
- Aether cell flows basically have to be divergent (source/sink => gravity) or rotational/vortices (=>? electromagnetic phenomena or neutrinos). Look into Maxwell's/Lord Kelvin's vortex theory of molecules/E&M. **Note:** Dad says it shouldn't be a bulk ether flow because then it would counteract gravity and have some common effect on *all* particles.
- The other possibility for electromagnetism is that aether cells have parts/structure and electromagnetic fields have to do with motion of that inner structure, not translational motion of ether cells. This may be supported by the apparent experimental evidence that electrons are 'point particles' (since we think electrons are purely electromagnetic and have no gravitational mass). (Update: If ether cell elongation is true, then ether cells *do* have structure/parts, I think.)

ELECROMAGNETIC MASS

- Do electrons produce gravity? Is it possible to slow them down to zero velocity?
- Dad says neutrinos are associated exclusively with source/sink flow (gravitational/hadronic mass), not EM stuff.
- Dad says relativistic mass increase is only inertia increase and probably is an electromagnetic, rather than 'hydrodynamic', phenomenon.)
- Electrons are the only stable leptons and also the least massive ones. Also, the other leptons decay into electrons + neutrinos, which, along with dad's hypothesis (see above), supports the theory that electrons are purely EM 'swimmers' while muons and tauons

have a hadronic component. Protons, too, are the only stable hadrons and also the least massive ones. The mesons all have lifetimes of less, primarily much less, than 10^-8 seconds (which I think is the pi-meson lifetime).

- Ch. 19 from vol 2 of Feynman Lectures on Physics (of the same title as this section) is VERY important.

QUESTIONS/PROBLEMS TO INVESTIGATE:

- Quantum:

-Einstein–de Haas effect; Barnett effect.
-What is stimulated emission? Is it related to the index of refraction re-emission of an identical (but slower) wave?
-I get the impression that EM radiation tends only to affect the outer electrons of an atom, while cathode rays (electrons) can affect any electron in an atom (probably with different intensities). Is this true? Update: No, I think UV and x-rays can eject inner electrons too.
-How do we know that the magnitude of a particle's spin is $\sqrt{s(s+1)}$ rather than just $s\bar{h}$ (which is the maximum value we can directly measure for it)? Maybe a special type of experiment measures L^2.
-How do electrons and large molecules self-interfere in double slit experiments? (these are the things that I know definitely exhibit self-interference).
-What is the de Broglie wavelength and why does it follow the same formula for electrons, neutrons, and atoms/molecules(?) alike? Or does it? Do molecules not follow the formula exactly (I suspect so b/c the studies involving interfering molecules don't seem to attempt to measure the wavelength)? Also, apparently the dB wavelength of an atom stays the same even if you ionize it, since they apparently detect the atoms by ionizing them in these studies.
-Feynman lectures on physics (principle of least action chapter, ch 19 vol 2), and wikipedia, say that the path integral formulation of quantum mechanics treats quantum particles just like QED treats photons. WTF does this mean??? Does it necessarily imply a wave nature? Is this conceptually different from Lagrangian mechanics (which chooses path of least action, but apparently doesn't do so by adding/interfering phase contributions from all paths)?
-Fermions, bosons, indistinguishability: WTF? Why do they correspond to half-integral or integral spin?**(see interesting quotes) Also, how do they determine whether a given particle is a fermion or boson? I think the answer has to do with the fact that these particles are wave structures, and perhaps different types of waves correspond to fermion/boson statistics.
-What is spin?!
-Why can electrons in atoms be modeled as harmonic oscillators w.r.t. light interactions? Feynman in sect 31-2, pg 31-4 of Vol 1 Lectures on Physics says: "The correct picture of an atom, which is given by the theory of wave mechanics, says that, so far as problems involving light are concerned, the electrons behave as though they were held by springs." O rly? How and why?

-Try to figure out refraction and other behaviors of light and light-matter interactions entirely in QED terms
-MO and VB theories of chemical bonds: they're not equivalent and MO, though computationally superior, is (apparently) ad hoc and not even internally well-defined. What is

the truth?
-What (*really*) is superfluidity, superconductivity, BE condensation, metamaterials, etc...
-Sonoluminescence
-The physicality of the magnetic vector potential A (Tonomura/Aharanov-Bohm effect [speaking of which, read up on that kind of stuff some more])

- Nuclear/QCD:

-Are quarks real? What are the 'scattering centers' inside of hadrons, of which baryons have three and mesons have two; what did they actually see? I guess since electrons are colorless and flavorless they should scatter the same way from each quark; is this what was seen? Why were they scattered by the quarks at all, just through the electric charge of the quarks?

- Electromagnetism:

-Does a charge at rest w.r.t the Earth's surface radiate? How much and in what direction? Does it have an electric and magnetic field corresponding to motion at the escape velocity in the aether? If not, maybe electrodynamics is 'relative' in some sense (with respect to velocity, but probably not w.r.t. acceleration in the aether).

- Flowing Space:

-Hatch's objection (GPS clocks going with and against Earth's orbital motion)

- Relativity:

-Wtf is gravitoelectromagnetism?
-Does energy in general produce gravity, as GR claims? I doubt it.
-Does length contraction occur, and is it real? According to Lorentz' calculation, it's the same thing as the contraction of the field of a moving point charge.
-Why does GR produce a precession of the perihelion? Note that the perihelion processes FORWARDS along Mercury's motion.
-Is insufficient distance enough to explain the lack of visible lensing in images of e.g. black holes in the center of the galaxy?

-Why do moving charges and individual atoms (with a suitable electronic configuration) both generate magnetic fields?

-Are electric and magnetic fields completely relative (that is, they transform according to SR, regardless of absolute velocity in space)? I suspect that, since length contraction and time dilation only occur because of motion through space, so should E&M have some dependence on absolute velocity.

-Relativity of simultaneity: is there a physical interpretation of it (e.g. time dilation + light time delay)?
-Do observers moving relative to space *actually* see light as moving at c? Do they see everything else as being length contracted and time dilated (as SR predicts) or just the opposite? If the former, how does this happen, seeing as in fact their rulers are contracted and their time is dilated, not the other way around? (*Dad says that GPS clocks do see the Earth's clocks as*

running slower, and we see their clocks as running faster, based on communications with GPS satellites.)

-Relativistic EM: Simple experiment: Consider an electric charge and a detector at rest with respect to one another. Accelerate both the charge and the detector in some direction, together. Then the charge should produce radiation. But relative to the charge, the detector is stationary, so the detector shouldn't detect anything, right? Does relativistic EM deal with accelerating/noninertial frames? Is there such a thing as 'general relativistic EM'? --Encyclopedia of Physics (synchroton article) says outright that an observer moving with an accelerated charged particle will see plenty of radiation! Maybe they don't mean a co-accelerating observer.
-PROBLEM: Does a charged particle emit radiation when falling freely in a gravitation field? (I think yes because the gradient in the space velocity - or 'curvature of space' - moves different parts of the particle's field relative to one another.) Furthermore, since a charged particle at rest on a table is not in an inertial frame/is accelerating relative to space, does it radiate? Some asshole on Physics Forums says radiation is an observer dependent concept.

- Astronomy

-Rotation of spiral galaxies (like solid bodies) a la ASTRO 292
-Evidently, Jupiter's atmosphere is not well understood!
-Globular clusters
-How the fuck does gravitational binding energy become radiation (preliminary answer: collisions with an accretion disk due to incoming matter or not everything being in perfectly circular orbits. also, how does gas get into a large enough orbit to not fall in in the first place?)
-Learn plasma physics/MHD (read ALFVEN), fluid mechanics, and extract as much understanding as you can from E&M Griffiths

-Black hole/neutron star (/magnetar, pulsar...) magnetic fields and jets: why, how?

- Misc.

-Why does Hamilton's/Fermat's principle (least action) accurately describe so many phenomena in nature?
-Investigate the physical cause of radiation pressure (my initial suspicion: electrons being less massive than protons and pulling them along). [UPDATE: {link} says that this is what Maxwell originally thought but it's wrong. However, I don't really trust this source [or any of the others I have found], partly because it got the direction of the force wrong!] Furthermore, try to figure out why "photons" can be modeled as having "momentum" that they transfer to and from atoms (see also: laser cooling). I wonder why classical EM correctly (or does it?) predicts radiation pressure if it doesn't directly connect it to a physical mechanism? Maybe re-analyze the origin of the Poynting vector...
-Ideal gas law: Simple experimental test: consider a gas enclosed in a cylinder (with a movable piston on one side). Here's a test of the theory that the decrease in temperature of the gas is due to work done on the piston by the gas: Move the piston out faster than the speed of sound, OR, otherwise just get any situation where a free expansion occurs. Does the temperature decrease or not?
-Thermodynamics: wtf?

- Within flowing space

-If the aether is compressible (which it is, according to the cell elongation explanation of 'missing space', it is), would we expect compression waves to exist? Does the aether have properties like 'tension' and 'pressure' (I doubt it, or if it does then they're different from the same thing for ordinary fluid, since aether has no mass etc.) Just think carefully about fluids, and about how the aether could differ from material fluids, and what types of waves it could support as a result.
-How far does the Earth's entrainment sphere extend?

STUFF I'VE DONE:

Light-signal twin paradox (found where third frame is introduced), and also all twin paradoxes, logically
Electronic explanation of electric circuits, circuit components, and batteries
Rayleigh scattering (Hecht)
Feminism (duh), homosexuality, the origin of political correctness or "poz", and the relevant aspects of human biology, behavior
Stuff in those posts --v
Free will
Morality and general ideas about consciousness/cognition (?)
Gases and temperature (?)
Physical understanding of precession (e.g. bicycle wheels)
Meaning and scope of entropy

ayy lmaos
Other stuff I am certainly forgetting

INTERESTING EXCERPTS

From Henri Poincare's Wikipedia page (I added underlines for emphasis):

The mathematician Darboux claimed he was *un intuitif* (intuitive), arguing that this is demonstrated by the fact that he worked so often by visual representation. He did not care about being rigorous and disliked logic.[*citation needed*] (Despite this opinion, Jacques Hadamard wrote that Poincaré's research demonstrated marvelous clarity.[51] and Poincaré himself wrote that he believed that logic was not a way to invent but a way to structure ideas and that logic limits ideas.)

Toulouse's characterisation

Poincaré's mental organisation was not only interesting to Poincaré himself but also to Édouard Toulouse, a psychologist of the Psychology Laboratory of the School of Higher Studies in Paris. Toulouse wrote a book entitled *Henri Poincaré* (1910).[52][53] In it, he discussed Poincaré's regular schedule:

- He worked during the same times each day in short periods of time. He undertook mathematical research for four hours a day, between 10 a.m. and noon then again from 5 p.m. to 7 p.m.. He would read articles in journals later in the evening.
- His normal work habit was to solve a problem completely in his head, then commit the completed problem to paper.
- He was ambidextrous and nearsighted.
- His ability to visualise what he heard proved particularly useful when he attended lectures, since his eyesight was so poor that he could not see properly what the lecturer wrote on the blackboard.

These abilities were offset to some extent by his shortcomings:

- He was physically clumsy and artistically inept.
- He was always in a rush and disliked going back for changes or corrections.
- He never spent a long time on a problem since he believed that the subconscious would continue working on the problem while he consciously worked on another problem.

In addition, Toulouse stated that most mathematicians worked from principles already established while Poincaré started from basic principles each time (O'Connor et al., 2002).

His method of thinking is well summarised as:

Habitué à négliger les détails et à ne regarder que les cimes, il passait de l'une à l'autre avec une promptitude surprenante et les faits qu'il découvrait se groupant d'eux-mêmes autour de leur centre étaient instantanément et automatiquement classés dans sa mémoire. (Accustomed to neglecting details and to looking only at mountain tops, he went from one peak to another with surprising rapidity, and the facts he discovered, clustering around their center, were instantly and automatically pigeonholed in his memory.)

—Belliver (1956)

Attitude towards transfinite numbers

Poincaré was dismayed by Georg Cantor's theory of transfinite numbers, and referred to it as a "disease" from which mathematics would eventually be cured.[54] Poincaré said, "There is no actual infinite; the Cantorians have forgotten this, and that is why they have fallen into contradiction."[55]