The Aura of Einstein and General Relativity

Sanford Aranoff
535A Ardmore Rd, Monroe Twp, NJ 08831
aranoff@analysis-knowledge.com

Abstract. Einstein's theories of special and general relativity stand as monumental achievements in our understanding of the universe. However, many human influences have worked to confuse researchers and hamper scientific progress. This paper discusses examples of such influences. One is the power of personality. A well-known example is the Pope's slowing down the development of astronomy. Medical scientists publish falsehoods in peer-reviewed journals in order to gain money or prestige. The influences of great people, such as Bill Gates or Albert Einstein, have had negative influences on the advancement of software and physics. Incorrect understanding of fundamental theoretical physics causes many to express incorrect ideas about things such as Black Holes. These misunderstandings are discussed. Finally, cultural influences affect science. The popularity of Cubism discouraged Einstein from making further insights to use Special Relativity to unify most of 19th century electromagnetism.

I. The current crisis in science

Science is unfortunately in crisis. One example is scientists publishing falsehoods in peer-reviewed journals. In so doing, they act for personal gain or for sociological reasons. This causes harm to our quest for knowledge and understanding of reality. In order to deal with this, we need to understand it. Computers need antivirus software to protect against damage. Medical personnel need to understand diseases in order to protect people and enhance their lives. Likewise, scientists need to understand the pressures and influences that detract them from comprehending and disseminating correct knowledge. Consequently, we cannot simply rely upon scientific teams to perform research and to publish. Guidelines and peer-review do not suffice. We need to discuss this problem and to talk about what we can do.

A second example of the crisis in science is the undue influence of personalities. Scientists are human after all, and are influenced by other people, with the result they are not fully objective. We will discuss this below after we discuss the publishing falsehoods.

Here is a letter to the editor[1] discussing published falsehoods:

> Some of the worst of these flawed papers have conveyed false alarms about the safety of gene-spliced (or "genetically engineered") plants, which subsequently have been extensively reported in the popular press.
>
> A case in point is a 2001 paper in the British journal *Nature* that purported to show that genes from a pest-resistant, genetically engineered variety of corn had migrated into native corn plants in Mexico. However, colleagues of the authors had pointed out flaws in the methodology and results months before the article was submitted to the journal. The publication triggered criticism from major research groups that was published subsequently in *Nature* and eventually the original paper was condemned by the editor in chief.
>
> Another example of apparent bias appeared in an article in the British medical journal *The Lancet* which claimed to show that introducing into potatoes a gene that codes for a substance toxic to insects caused damage to the immune system and stimulated abnormal cell division in the digestive tract of laboratory rats. However, many research groups have shown that the experiments' research methodology was fundamentally flawed and that no conclusions about the safety of biotech foods can be drawn from them. After an extensive review, the British Royal Society unequivocally condemned the study.
>
> The editors of the journal remonstrated that in spite of the article's admittedly deficient methodology—and over the strenuous objections of the paper's referees—they published it to "make constructive progress in the debate between scientists, the media, and the general public" about a very politically charged issue. Unleashing such a sham has proved to be anything but constructive, because its findings are frequently cited as presumptive validation of its spurious conclusions.
>
> These kinds of failures of peer review and editorial judgment corrupt the traditional process by which new scientific knowledge is obtained and reported, and they inflict irreparable harm on the reporting and archiving of scientific developments for policy makers, the media, the public and the scientific community.

Another example of false publications is the topic of global warming. There are many peer-reviewed scientific publications supporting the false notion of anthropomorphic global warming.[2]

Scientists publish falsehoods because they stand to gain money, prestige, or power. This false information is presented as scientific truth. We need to be vigilant to investigate the extent of which the scientist can benefit financially or otherwise, and use this information to further question the validity of the research. With research on drugs or global warming it is easy to see how scientists can gain.

II. The influence of personality.

Scientists can publish falsehoods for another reason, independent of money and prestige. This is the influence of personality. People can be unduly influenced by the aura of a great personality to the extent of not being fully rational. We will look at some examples in order to clarify and understand this, and to be able to plan on how to deal with it.

In the 17th century, Galileo Galilei published some scientific findings. The Pope disagreed. Galileo recanted in order to save his life. The Pope, using the power of government, succeeded in temporarily halting the advancement of science. We must understand that in addition to the Church's power, there was the aura of the papacy. Millions accepted papal teachings and pronouncements simply because they accepted the greatness of the Pope. Many people bitterly opposed Galileo, sincerely believing that he was wrong. People felt that their rational thinking led to the conclusion that Galileo was wrong. This is one of the most famous examples of personality aura affecting scientific thought.

An example from the 20th century of undue influence by personality aura is Bill Gates. Bill Gates is one of the world's richest men, and has been so for many years. He is highly respected for his original thinking and brilliance in bringing forth computers to where they are today, and in so doing has changed the world.

The reality is slightly different. In 1986, the Apple and Atari computers were superior to the Microsoft PC. Yet Gates knew how to sell. He would repeatedly issue pronouncements of great things on the way. These announcements were simply lies, and were called "vaporware". However, people believed Gates, due to his success beating IBM. In 1986, I worked as a software engineer at a defense company. I told my fellow engineers that the Apple was better than the PC as it had a mouse, and the PC did not. "Who needs a mouse!" they retorted. The aura of Bill Gates was so great that people did not see the reality of the inferior PC product. This situation continued for over a decade, until the hardware became so powerful that the inferior PC was able to beat the Apple.

Unfortunately, Gates was a brilliant kid, not a mature adult. He rejected established software engineering practice, causing great harm. For example, one rule is that programs and data must not reside on the same place on the disk. Gates violated this rule, with the consequence that changes in data can affect programs. This is the reason for the plague of virus and crashes. Before Gates, computers were completely reliable. Banks trusted the IBM and other mainframe computers. Software engineers went to great pains to insure reliability. Crashes and such were unheard of.

Another rule that Gates violated was clarity in programming. In contrast to COBOL, the language of the IBM mainframes, Gates supported c. This language is cryptic and error prone, hard to read and debug.

The bad and immature practices Gates followed harmed generations of software developers, who wrote code using the faulty attitudes Gates pioneered. When we look at the truly great things Bill Gates did, we must not forget the great harm he also did by people accepting the aura or cult of his personality.

For Gates to have violated centuries-old accepted rules of software engineering is equivalent to the construction engineers in New Orleans, who enriched themselves 30 years before Hurricane Katrina by building with substandard concrete.

Today Gates has left software, and entered charity work. He is involved with helping the poor in Africa. One of his projects is building nets to fight malaria. However, it is far more effective and cheaper to use DDT. If Gates were truly intelligent and interested in saving lives and making people healthier, he would use his influence in promoting DDT. How did he make this mistake? The reason is that he did not delve deeply into focusing on the real problems and possible solution. The problem is malaria, and the solution is DDT. Rational thinking must start with stating, "What is the problem?", as Aranoff[3] stressed.

We see if we are interested in the integrity of rational thought, we must remain on guard against influence by powerful people. We also see clear examples of this in current political discussions, where many people are under the aura of the President of the United States, and so make statements that are not rational.

III. The influence of Albert Einstein

Albert Einstein was a great personality, whose aura continues to influence rational scientific thought. He was the most famous physicist of the 20th century. His theory of gravitation, called General Relativity, superseded the centuries-old Newtonian gravitation. Sir Isaac Newton published his theory of gravitation in the 17th century. This explained the motions of the objects in the solar system, as well as the tides. The Newtonian picture of the solar system was planets being attracted to the sun due to the sun's mass. The sun, millions of miles from the earth, attracts the earth, causing it to orbit the sun. The planets orbit the sun in ellipses.

Newton was a great physicist. He overturned Aristotelian thinking that force depends upon velocity. Newton said that force depends upon the change of velocity. This new concept allowed Newton to develop his theory of gravitation.

By the way, when students learn Newtonian physics, they usually do not learn *why* Newton was so great. They do not learn the old way people thought for a millennium, and so fail to appreciate his greatness. I tell my students that we know the faster we ride a bicycle the harder it is to pedal, making one think that force depends on velocity. This does not contradict Newton, as the air resistance slows one down. The ancients did not consider air resistance.

After three centuries, Einstein developed a different explanation of gravity. Einstein said that the mass of the sun changes the “curvature” of space. Earth moves along a straight line in this curved space. Instead of Newtonian action at a distance, the sun distorts the geometry of space. This distortion moves outward at the speed of light. The earth is affected by its local space, not by the action at the distance from the sun. Results agreed with observations, such as the orbit of Mercury or bending of starlight near the sun during an eclipse.

Just as Newton was praised for a revolutionary way of thinking, overturning centuries of thought, Einstein was praised for the same reason, introducing a revolutionary way of thinking overturning centuries of thought.

Einstein developed his theory very differently than other theories, such as Newtonian gravitation or electromagnetism. Newtonian gravitation is based upon a simple equation describing the force between two masses at rest. Starting with this, Newton then developed the mathematics to deal with situations that are more complicated. The theory gave predictions of the planets’ orbits, which were observationally confirmed.

Let us look at the great 19th century theory of electromagnetism. This is built out of a few simple assumptions. One is the existence of charge, which can be positive or negative. The force between two charges is given by a simple equation. Charges flowing in a wire constitute a current, and this current (which has no net charge) exerts a force on a moving charge. There are a few other simple assumptions underlying the theory. We then introduce various mathematical quantities, such as field vectors and their derivatives. We get various mathematical equations, called Maxwell equations that agree with our basic assumptions. The predictions are all in agreement with experiment.

Although the mathematics of electromagnetism is complicated, the beginnings were simple. People observed the attraction and repulsion of charges and magnets, and noticed how currents affected magnets.

In this sense, both Newtonian gravitation and Maxwell electromagnetism start from various observed phenomena, and have a mathematical framework built around these observations. Indeed, one can build many different mathematical frameworks around simple observed phenomena, which are very useful.

Einstein adopted a different approach. He started with simple ideas, not experimental observations as the older theories started with. He then developed them to arrive at novel conclusions. Einstein’s Special Theory of Relativity has two simple ideas. One is that the laws of physics must be the same for all observers moving at constant velocities. A scientist on the ground performing measurements of an experiment on the ground must observe the same physics as another scientist in doing the measurements of the experiment while in a truck moving at a constant speed. Of course, the numerical values of the measurements will differ, due to the locations of the scientists; however, if we perform the correct mathematical transformations we will arrive at the same physics.

The second assumption was that the speed of light must be constant as measured by the above two scientists. The scientist on the ground sets off a flash of light on the ground and measures the speed of light. The scientist in the moving truck performs measurements of the flash and must get the same value for the speed of light.

These two postulates sufficed to arrive at the Special Theory of Relativity, SR. To do this, he had to modify the mathematical transformations from the ground system to the moving truck system.

What people unfortunately forget is that Einstein was just a brilliant kid, very smart but immature. He failed to act like a mature scientist. People did not seem to notice, due to the aura of his personality. He failed to go to the next step a mature scientist would go to. He did not ask if it were possible to get the same conclusion with a different, and maybe better, set of assumptions. The answer is, of course, yes.

Einstein postulated that the laws of physics must be the same in all inertial systems. This means that if a scientist performs experiments on electromagnetism on the ground, and another scientist in a truck moving at a constant velocity observes this experiment, both will agree what the laws of physics are. The laws of electromagnetism are embodied in Maxwell’s equations, ME, and explain the nature of light. In particular, the speed of light is related to the various constants in ME. Therefore, the scientist in the moving truck must arrive at the same speed of light.

There was no need for Einstein to introduce a new postulate that the speed of light must be constant.

The fact that Einstein was not mature enough to investigate further his postulates confused many physicists later on. It is not good enough to be brilliant to discover a revolutionary theory that agrees with observations. One must also study and question the theory for rigor and simplicity, which Einstein did not do.

I wrote in a paper submitted for publication that a postulate of SR is the fact that ME must be valid in all inertial frames. A referee disagreed, saying that the constant speed of light is the postulate. The proof the referee gave was Einstein's statement. This shows how the aura of a personality can affect science. The referee did not say constant light speed must be the postulate for whatever reasons, but simply because Einstein said so. This type of talk is not science.

One can go further in thinking about the foundations of SR. Instead of postulating ME, one can postulate that the Lorentz transformation must be used when going to another inertial frame. That is, we postulate that when the scientist in the moving truck measures an ongoing experiment on the ground, he must transform the distance and time coordinates according to the Lorentz transformation. A postulate is an arbitrary statement, and this is a fine arbitrary statement.

The conclusion is that if we postulate the Lorentz transformation, we can derive ME from the observed Coulomb's law. We just say that the Coulomb potential transforms as a 4-vector. This is a truly extremely powerful statement. We can then say the Einstein's SR made a grand unification of 19th century electromagnetism. Instead of forces between static charges, forces between charges and currents, currents due to changing magnetic fields, and such, we have one single force and one assumption.

People have praised Einstein and given him credit where he does not deserve it, while not giving him credit where he certainly deserves the highest praise. SR was the culmination and apex of 19th century physics. The applications of ME are everywhere, in power generation and use, television, optics, computers, and many, more.

Electromagnetism is, in my opinion, the very most beautiful theory of physics. Its sheer raw beauty exceeds other branches of physics, such as statistical mechanics and thermodynamics, quantum mechanics, and gravitation, to mention a few. I challenge the physics community to think how we can present ME to undergraduates as a unified whole, in the spirit of the unification of Albert Einstein. Currently, students learn electrostatics, magnetism, currents, etc., etc., and may never see the incredibly beautiful entire picture. We need to think how we can give it as one shot, and then give Einstein the credit for the ability to develop this.

When Brian Green discusses String Theory, he says the hopes are to unify physics. Unfortunately, Prof. Green fails to mention the great unification Einstein did. We need to understand this unification, not only for the esthetic beauty of it, but also as a possible model for further unifications.

IV. The General Theory of Relativity

Einstein was brilliant in developing his General Relativity, GR. Here again he was a brilliant kid lacking maturity. This lack of maturity caused great harm to subsequent generations of physicists. Let us analyze Einstein's approach, and then discuss developments by other physicists extending GR while under the influence of Einstein. We will show how this influence detracts physicists from objectively looking at the various situations. This is similar to the well-known fact that driving under the influence of alcohol is dangerous as the driver cannot properly objectively look at the situations.

After developing SR, Einstein did what scientists normally do. Noting that SR involves two inertial frames (systems moving at constant speed), he worked on investigating systems that move at any speed. He generalized the assumptions. He asked what would be the case if the moving truck performing measurements of an experiment on the ground while going around a curve. As the truck makes a left turn, passengers feel a force to the right. Einstein then postulated that this moving force is the same as gravitation, that is, there no way scientists in a closed truck can determine, by local measurements, if the forces acting on them are due to the truck moving around, or due to gravitation.

In order to make use of this postulate, we first have to perform the transformations from the ground to the moving truck. In contrast to SR, the truck can accelerate and make turns. Einstein investigated the type of mathematical transformations the scientists in the moving truck need to make.

Here the mathematics gets complicated. Levi-Civita in 1901 developed tensor theory, a mathematical approach to transform from one system to another, and applied this to Newtonian physics. This is called a covariant transformation. Einstein choose to use this transformation.

Here is brief introduction to this concept.

Imagine a flea walking on a horse's saddle, while the horse is prancing around. As the flea walks in what it thinks is a straight line, another flea is also walking in what it thinks is a straight line. Which flea will get further? This depends on the shape (the curvature) of the saddle, for if the fleas walked on a flat table, they would walk in straight lines and move the same distance. To describe the position of a flea relative to a starting point, we need four numbers: The position east of the starting point, the position north of the starting point, the position above the starting point, and the time after the starting time. It is customary to write these as x_μ, where the Greek symbol μ is 0 for time, 1 for the east, etc. The position of the flea is described by a 1-rank tensor, where the 1 stands for one symbol, as x_μ. This is also called a 4-vector.

To describe the curvature of the saddle, we need a 4-rank tensor $R^{\rho}{}_{\sigma\mu\nu}$. This is the Riemann curvature tensor. One of the four subscripts (or superscripts - another complicated feature!) is the 4-vector position of the flea. Another subscript describes the "straight" line the flea is walking. The line is not straight, of course, which we note by looking at the saddle. However, the flea thinks it is walking on a straight line. In order to evaluate the curvature, we need to compare with another flea. The third subscript describes the line this flea is walking. The fourth subscript describes a line connecting these two lines. Wow, the complexity! A flea on a saddle, with three lines describing the curvature!

Einstein said it has to be simpler. He looked at the trace of the Riemann curvature *R*. Let us first explain the word trace. Let a pair of subscripts of *R* both be 0, and evaluate *R*. Then let the same pair be *1*, and evaluate *R* again. We sum all these evaluations for the subscripts running from *0* to *3*. This sum is called the trace. What is interesting is that due to the mathematics and symmetry of *R*, there is only one way to evaluate this trace. We get a *2*-rank tensor $R_{\mu\nu}$. which we call the *Ricci tensor*.

Einstein's new idea was to postulate that gravitation is not a force caused by a distant mass as Newton stated, but objects move in "straight lines" in curved space, where the distant mass curves space. He used the Levi-Civita formalism to describe the curvature of space.

Einstein then made two assumptions. One is that the mass determined by the gravitational force is equal the mass in the acceleration equation $F = ma$. This is the assumption that the scientists in the moving truck cannot determine if the forces acting on their bodies is due to gravitation or the motion of the truck.

The second assumption is that the Ricci tensor vanishes in a region where there is no mass. To quote Einstein in 1918, "Of two theoretical systems which agree with experience, that one is to be preferred which from the point of view of the absolute differential calculus is the simplest and most transparent".

Actually, it is about as transparent as Obama's policies. Taking a 4-rank tensor, assuming the trace vanishes where there is no mass, and lo! and behold! we get new results in physics that agree with observations. No, this is not simple! We need to find something simpler.

Einstein took the novel mathematics that Levi-Civita developed for transforming from one system to another, and made some assumptions. These assumptions lead to Einstein's theory of gravitation, called the General Theory of Relativity, GR. He succeeded to get a theory of gravitation that was better than Newton's theory. For example, the observed orbit of Mercury agreed with Einstein's results better than Newton's results.

V. Some more comments about Einstein and GR

Einstein was brilliant. However, he was even more brilliant marketing himself. He succeeded in being hired by the Institute for Advanced Study in Princeton, not affiliated with the university. He got a lifetime appointment to do research with no teaching responsibilities. He went on the lecture circuit, wowing his audience. He managed to get the State of Israel to ask him to be president of Israel. Einstein declined, but this remained a feather in his cap.

What Einstein failed to do was to stand in front of undergraduate students for a semester, explaining his ideas, listening to their questions and criticisms, and marking their homework and tests. This means he failed to formulate his ideas clearly, with the consequence that people are confused to this day. In summary, Einstein's research suffered because he did not teach his ideas to students.

Einstein's immaturity is evident with his GR. A mature scientist knows that any theory of physics can be only partially true. It is important to perform experiments to verify the extent of validity of the theory. When the bending of starlight passing near the sun verified GR, Einstein expressed nonchalance. No, Dr. Einstein! You were wrong! You do not know that the experiment will validate the theory until you perform the experiment!

Einstein never questioned the possibilities of getting the same results with different assumptions. He never asked if we could find something that will give the same results without insisting that the Ricci tensor vanish in a region where there is no mass. Only very recently[4] has someone attempted to derive the accepted results of GR. Why was it necessary to wait almost a century for people to start thinking in this direction?

Einstein never asked what the assumption about the Ricci tensor means, and how we can think about setting up experiments to verify the assumption. What type of equipment would we place on the moon to evaluate the Ricci tensor, and how would we notice a difference if we placed the equipment in a cave on the moon? The assumption is that the Ricci would vanish on the surface and be nonzero in the cave. Another question is how we can verify the identity of gravitational and inertial masses.

There is another problem with GR that Einstein ignored. Once a scientific theory is shown to contain intrinsic contradictions, we must do what we can to address these contradictions, or else accept these contradictions as limitations on the theory. In the 1950's, people spoke about a contradiction inherent in electromagnetic theory, EM. There are two solutions of the EM equations for an accelerating charge. One is the retarded solution. A distant observer will be affected by the charge's motion at a later time, the time it takes light to travel this distance. The other is the advanced solution, where the distant observer will be affected at an earlier time. This violates the causality postulate of physics. Wheeler and Feynman[5] found a solution to this problem, thereby rescuing EM. Einstein said their solution would not work for GR. This means that there is an intrinsic problem with GR. I am not aware of any efforts Einstein worked on to deal with this problem. We would expect him as a mature scientist, to spend time working on this issue.

One solution of Einstein's field equations of GR is the concept of a Black Hole, BH. In spite of the many contradictions inherent in the idea of a BH, physicists strongly adhere to this idea, trying to expand the significance of the concept. A reminder to the mature scientist: One cannot ignore a contradiction to a theory. A theory with a contradiction is a hypothesis, not a theory.

The center of a BH has a singularity.[6] This is clear proof that Einstein's GR is not valid here. Yet physicists refuse to acknowledge this reality. Let us refresh the reader's memory what the word singularity means. It simply means an invalid point, such as division by zero ($\tan x$ is not defined at $x = \pi/2$. Yet one reads that this point matter is crushed to infinite density. This pains me to read, for it shows a lack of understanding of the mathematics of infinity.

There are other problems with a BH. Due to time dilation, it takes forever for an observer to reach a BH. Although it takes a finite time to reach the BH from the point of view of the falling observer, a distant observer notes that it takes forever. This being so, it is pointless to speak about the inside of a BH.

The confusion is that one of the solutions of the Einstein field equations (yes, there are two different solutions!) is that from the point of view of the observer, the observer can reach the BH and indeed enter. People say that if one enters a massive BH, such as the BH at the center of our galaxy, one can cross the event horizon without being torn apart by tidal forces. However, once the event horizon is crossed, the observer loses all contact with the universe. This means that the observer does not exist. People who believe in the possibility of crossing the event horizon of a BH are the same as people who believe that a dead person goes to Heaven, losing all contact with the universe, but being aware. It means that religious ideas are entering science. Yet too many scientists are willing to accept this, instead of saying that Einstein's theory regarding BHs is simply wrong, or that this solution is wrong.

Another issue is the possible loss of information as an object falls down a BH. What this means that what previously happened to the object happened and did not happen, a contradiction. Yet for a number of years people spoke with confidence about loss of information. Now there are various solutions, such as the holographic universe.[7] What is disturbing, however, is the equanimity for which people accepted the possibility of loss of information, instead of screaming that the theory must be wrong.

There is another simple point. When one reads about GR, the discussions invariably turn to a concept they call "curvature of space-time." These descriptions say that space is curved the way a mattress is curved when one lies on it. Gravitational attraction is simply moving in straight lines in this curved space. Well, a mature scientist would examine the extreme case of the statement. If mass can curve space, what will happen if the mass is large enough to curve space into a closed curve? The idea of a closed curved space-time is nonsensical, showing that the idea is fundamentally unsound.

Mitra[8] showed that if a BH exists, it must have mass *0*. Aranoff[9] also discussed the possible non-existence of BHs. Saying a BH does not exist avoids the above problems. Mitra said that Hawking's theory was incorrect. After having said this, Mitra was ostracized by his colleagues at the Bhaba Atomic Research Centre for daring to challenge Hawking. This is similar to President Obama's recent State of the Union speech, when the Chief Justice mouthed, "You are wrong!" and was criticized. One does not criticize great people. This is in America, the land of freedom of speech!

There is an important point we need to make. The contradictions with the BH idea do not invalidate GR. All that it does is invalidate the solution of the equations from the point of view of the falling observer.

An experiment to test this would be to watch something falling towards a BH. If the point where it gets red-shifted out of existence is a finite distance from the center of the BH, then we can say a BH has a definite size.

The question is why have people not objected? Why have people accepted Einstein's GR for almost a century without questioning? The answer is the aura that Einstein very successfully created about himself. The implication is that this aura is preventing further research in this area. We need to be careful and on guard.

Scientists must always criticize other scientists. We all must be aware of rational thinking, and this includes saying the great are simply mistaken and are very foolish. Efforts to squash such thinking are detrimental to the advance of rational thinking, in science or government.

We must look for alternative derivations of a theory of gravity, one that will not lead to contradictions and absurdities, while agreeing with the current verified observations. It will require honesty and sincerity to do this.

VI. Cultural influences on scientific research directions

In addition to the above-mentioned influences on research, namely, profit, prestige, and the aura of great people, we must also consider the culture in which scientists live in. We must never forget that scientists are people, and subject to influences that all people are subject to. Let us begin by asking the question why Einstein failed to make the simple jump from saying that SR is based on the constant speed of light to saying that SR is based upon the Lorentz transformation. Had he done so, he would have realized the fact that SR unifies most of 19^{th} century physics, and so would give him recognition as one of the greatest scientist in centuries. Einstein was certainly intelligent enough. His breath and depth of understanding of physics certainly sufficed for him to make this intellectual leap. Why then did he simply accept saying constant light speed is the basis of SR?

To help understand this, we can look at the artistic culture of the time. This was Cubism, pioneered by Pablo Picasso. Cubism was one of the most influential art movements (1907-1914) of the twentieth century. It coincided in time with the development of SR. In Cubism the subject matter is broken up, analyzed, and reassembled in an abstracted form. Picasso's compositions are broken into planes with open edges, sliding into each other while denying all depth. These planes have thick straight lines as borders.

The artists of the time had "lively discussions of art and science." The science they knew was 19th century physics. This was a collection of separate theories with sharp lines between them. Electrostatics, magnetism, currents, and optics, to mention a few, were all clear, well-established theories that seemed to have nothing to do with each other. Reality was multi-faced with sharp divisions between them. Living in such a culture, Einstein did not see the need to unify physics.

Today when professors teach EM, they present it as a Cubist painting. They present the different aspects of EM as different and isolated theories. When we look at a Cubist painting of a person, we all know how unreal this is. This means that professors teach a subject in an unreal form. We need to move on to show others the beauty, depth, and unity of physics. We need to start discussing EM from a unified standpoint.

Science and art influence each other. The collection of disjoint theories influenced Cubism, and Cubism influenced science not to strive for unity.

One can possibly show how different developments in physics coincided with different artistic styles. As an example, supersymmetry coincided with abstract art, with a clear connection between science and art.

The lesson we can learn is the need for greater awareness of cultural influences on science. Scientists need to try to understand the hidden messages of the art and music of the time, and to examine their theories to see how they can better strive for objectivity in spite of the cultural influences.

VII. Inability to look at different scientific approaches due to cognitive dissonance.
One reason for the continued acceptance of falsehoods in spite of clear evidence to the contrary is *cognitive dissonance*. Cognitive dissonance is an uncomfortable feeling caused by holding two contradictory ideas simultaneously. What people do is to reject one of the ideas. We have to understand our psychology if we are to adequately deal with this problem.

Steven Weinberg wrote a book[10] in which he discussed the postulates of General Relativity. I asked him why was the vanishing of Ricci in a massless zone a postulate, especially since it does not make sense that it is non-zero only in a region with mass. His answer was curt and not at all clear. This is cognitive dissonance. For years, he accepted this idea, won the highest honors from the physics community, and so is unable to accept the possibility that things could be otherwise.

The same thing happened to me years ago with the very simple Special Relativity.[11] Consider at an object at equilibrium under forces and torques. Look at the same object from a moving system. There were so many stubbornly held wrong ideas that I had to collect them all and publish them, pointing out the errors.

We see that cognitive dissonance is a very serious genuine problem, affecting the greatest scientists. This being the case, we must be on our guard to try to minimize this harmful effect.

There are other reasons why intelligent, educated scientists persist upholding ideas easily proven false, and fight to keep differences away from the public. We must try to understand all these reasons and so the best we can minimize their disruptions. Groupthink[12] is an example. It is imperative for the proper advancement of science that we all maintain full awareness of this problem.

VIII. Concluding comments about personality aura and physics

Einstein's aura is still causing problems. Rutgers University, the State University of New Jersey, is announcing buyoff of senior professors. In addition to saving money, the university said that the replacement of senior professors by young professors would help the advance of knowledge, as the new professors bring in new ideas. It is well known that Einstein did not produce anything significant during his later years. Many people think that this is because he was getting older. This may have been in the minds of Rutgers' administration. My explanation is because Einstein did not teach any undergraduate courses. Professors who lose contact with undergraduates may become stale. Rutgers is wrong in its reason to replace the senior professors, but should insist on professors having more contact with undergraduates, not to use teaching assistants. Indeed, professors would benefit by having contact with high school students. The lesson we can learn from Einstein is that he chose to avoid teaching students, and this choice harmed his physics research. Professors and industry leaders should learn this lesson, to be more efficient we need to be able to communicate with undergraduate students.

We see the same phenomena of aura with the current President. Obama is a man who must read his speech using computers, instead of thinking while speaking and making eye contact. He is proposing a health care plan that would require medical insurance companies to include people with pre-existing conditions, without increasing premiums. This is mathematical nonsense. Premiums are based upon anticipated expenses, and if we increase the anticipated expenses, the premiums must go up. Nevertheless, due to the aura of Obama (whatever this aura is due to), very few people question the logic of his statements.

Einstein was one of the most popular physicists ever. Gates is one of the richest people ever. Obama is the most powerful person ever. People worship greatness, and are reluctant to enter in direct disagreement. No one publicly criticizes Gates. Anyone who criticizes Obama is a racist or a partisan. No one criticizes the logic behind any of their actions. The moment we cease to criticize and ask questions is the moment we cease to be rational.

The lesson we must learn from this is that in addition to verifying the mathematical correctness of our theories, checking the observations and experiments, properly documenting our ideas, conclusions, and methods, we need to be careful about the human aspects of our work. Incorrect ideas caused by a personality aura, financial gain, or cultural influences can be just as harmful as simple mathematical or experimental mistakes. We need to be aware of these influences and document them, trying our best.

Acknowledgements

I wish to thank Dr. Jaroslav Hynecek for fruitful discussions on General Relativity.

Thanks to Devin Hussong for his suggestions concerning psychology, such as cognitive dissonance and groupthink.

---

[1] Henry I. Miller, M.D., *Wall Street Journal*, 3/17/2010.
[2] For a complete discussion, see www.sepp.org. For example, see **Unstoppable Global Warming--Every 1500 Years**, S. Fred Singer and Dennis T.Avery, Rowman & Littlefield Publ, Inc., NY (2007).
[3] **Teaching and Helping Students Think and Do Better,** S. Aranoff (2007), amazon.com, ISBN 978-1-4196-7435-8.
[4] Jaroslav Hynecek, *Physics Essays*, **20**, 313-328 (2007).
[5] J. A. Wheeler and R. P. Feynman, "Interaction with the Absorber as the Mechanism of Radiation," *Reviews of Modern Physics*, **17**, 157–161 (1945).
[6] Roger Penrose, **The Road To Reality,** Knoff, 712 ff (2006).
[7] L. Susskind, *The Black Hole War: My Battle with Stephen Hawking to Make the World Safe for Quantum Mechanics*, Little Brown and Company, (2008).
[8] Abhas Mitra, "Quantum Information Paradox: Real or Fictitious?", arXiv:0911.3518v1 [physics.gen-ph] (2009).
[9] Sanford Aranoff, "Basic assumptions and black holes*", Physics Essays* **22**, 4 (2009).
[10] Steven Weinberg, **Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity** (1972).
[11] "Equilibrium in Special Relativity," Sanford Aranoff, *IL Nuovo Cimento*, **10B**, 155-171 (1972).
[12] Janis, Irving L., **Groupthink: Psychological Studies of Policy Decisions and Fiascoes,** (1982).