IS PHYSICS SLOWLY CHANGING?

1 The Reluctant Copernicans

I suppose it began with the "flat meadow" people and progressed slowly to the "flat earth" paradigm. With the exception of Aristarchus and a few bright lights there then ensued about 1800 years of Ptolemaic, earth centered solar system. Scientists today are very proud that through their discipline the insights of Copernicus and Galileo finally prevailed. But then there was the Milky Way and it took a while to accept that the sun revolved around the center of our Galaxy. Of course there was a big fuss before it was acknowledged that our galaxy was not the only one in the universe.

Moving on to modern times, many planetary scientists spend their time criticizing evidence that there is life in meteorites, on planets in interplanetary space. One would have thought they would have learned to say "Well we are probably in no special position, there is probably life elsewhere but we just do not yet know in what forms." Instead we get the patronizing and puritanical "It is wrong to excite the public with improper speculation". Fred Hoyle and Chandra Wickramsinghe discussed cogent evidence for panspermia which had predictable responses. But the Indian, high altitude balloon experiments seem to be now supporting their conclusions. As for extragalactic civilizations, I guess we would probably have difficulty recognizing any very intelligent ones.

But the Oscar for egocentricty goes to the currently dominant theory of the universe. Everything created instantly out of nothing. It had a point beginning and we were right there! If we look around us we do not see galaxies made of matter which is older and younger than us - They are all OUR age! Moreover if we look at the constituent particles of matter, electrons and protons etc., we assume that over all the universe, they are exactly like ours. And also immutable in time. God in the image of contemporary man.

2 Is Relativity becoming more "General"?

General Relativity which eschews any primary reference frame rests, ironically, on the above very earth centered assumption that the masses of elementary particles are everywhere just like the terrestrial values. But slowly it seems to me that we are more and more seeing different ways of expressing the supposedly all encompassing conservation equations of momentum and energy. For example, Olive and Qian [1] (Physics Today October 2004) show one mathematical representation where particle masses vary as a scalar field. In 2002 a book on Le Sage gravity [2] (p.3) listed a sample of 10 different authors who considered physical phenomena from the standpoint of flat space time, no singularitiies and general distinction between proper time and universal time. The Michelson Morley experiment (1887) is now being interpreted in terms of an ether in a preferred rest frame (astro-ph 0311576).

The beginning of this change and clearest illustration of the trend for me, however, goes back to 1977 when Jayant Narlikar [3] solved the field equations for particle masses as a function of time, i.e. $m = m(t)$. Friedmann in 1922 had made the approximation $m =$ constant in the differential equations before he solved them. His expanding space-time solutions were then not general. Of course, after the more general solution the approximation m = constant can be made locally to obtain all the usual tests of relativity. But in the realm of the galaxies, the non physical invention of curved space was needed to acccomodate the supposed observational data that the universe was expanding.

This brings us to the conventional assumption of extragalactic redshifts as representing large recessional velocities versus the evidence for their being an intrinsic property of young matter. The key here is the rock upon which science is founded - the observations. Large redshifts differences are observed between whole extragalactic objects which are at the same distance. Intrinsic redshifts are required. But now what is the consequence of having low mass fundamental particles? It is simply that low mass electrons transitioning between atomic orbits will emit and absorb lower energy photons, i.e. they will appear redshifted compared to atoms with heavier particles.

What Narlikar showed is that the rigorous solution of the field equations (which in flat space are simply conservation of energy/momentum) requires the elementary particles to gain mass as $m = t^2$. This actually requires that galaxies all born at the same time show a scatter free Hubble relation matching the observed slope of about 50 km/se/Mpc.[4] Moreover, as we shall discuss briefly in the next section, it predicts that extragalactic objects should have high intrinsic redshifts when they are young and lose their excess redshift as they age.

3 Observations of Growth and Change in the Universe

When dark matter and dark energy become stale we can go back to the observarions. Galaxies, like a group of animals, reveal at a glance all stages of birth, growth and maturity. Take one example. M87 is a famous galaxy near the center of our Local Super Cluster. In 1918, even before the recognition of galaxies, it was observed with a small telescope to have a blue spike coming out of its center[5]. With the most expensive modern day telescope, the Hubble Space Telescope, Fig. 1 shows this spike contains a number of small, compact objects. These objects are radiating a continuous spectrum of synchrotron (charged particle) radiation. The conventional view is that they are clouds of hot gas ejected from the nucleus with about the speed of light (observed from displacement over time).

But how do you accelerate a cloud of hot gas to velocity near c? How do you get a hold of it? And why does it not just go POOF and dissipate? Even more revealing, one sees these objects grow in size and luminosity as they move outward along the jet. What do we see further out along the jet? For one, a radio, X-ray galaxy (M 84) with swept back X-ray isophotes indicating travel out along the jet. It is closely accompanied by a high redshift ($z \sim 1$) quasar. Further out is a very bright radio, X-ray quasar with flanking quasars around z = 1. This is all set in an extended line of X-ray sources and older, more evolved galaxies[5].

So we have spread out before us a more or less complete empirical demonstration of how galaxies are born and evolve. As the variable mass theory requires, the emergence of new matter near m = 0 requires speeds of pure energy near c. As the particle masses grow they slow down in order to conserve momentum in the extragalactic rest frame. That means the elementary particles cool. Together with the increasing gravity the growing matter condenses into a proto quasar/galaxy. (No dark matter needed!) When atoms form they at first radiate weak, high redshifted photons. The redshift then decreases with time as it evolves into a more normal galaxy. *The variable mass theory requires the younger galaxies to have intrinsic redshifts which diminish as they evolve.*

M 87 is just one example but there are now dozens of galaxy/quasar/redshift observations which tell the same story[6]. The cry that has always gone up is that there is no viable theory to explain the redshift anomalies. But more than 20 years ago I left my office at Santa Barbara St. and went down to campus to ask Dick Feynman his opinion. After a considerable talk, not all of which I understood, he summed up by saying: "The Hoyle-Narlikar theory is a complete theory and is not contradicted in any respect. But we do not need it because our present theory explains everything. " There is always the chance he was putting me on a bit but I feel strongly that he could see the evidence today he would say we need it.

4 The Hidden Battle over Low Mass Electron-Positron States

(Or, how communication is science is less than ideal.) Physicists stick to the many decimal point facts of their laboratories. They also tend to be alpha males who relegate astronomers to be laborers in the fields. Astronomers for the most part are careful to bring back attractive fruit. But it is always been my unstated opinion that Astronomy, covering such a much vaster volume of space and time, really had the ultimate advantage in dealing with fundamental physics. (and I mean that in a deeper, more general and encompassing sense).

At any rate, again decades ago, I gave a lecture to the astronomers at Cornell about my observational findings. At the end Carl Sagan stood up and said, "Well I have heard of people who did not believe in religion and other things, but you don't believe in anything! Everyone had a good natured laugh and as we filed out Tommy Gold took me aside and said, "We cannot have low mass electrons floating around in the universe because we would detect them in our laboratories." The best answer I could give was, "All the particles in our galaxy would be the same age so I would expect very few intergalactic ones." And added, "Also perhaps we have detected some, but have not realized it".

Imagine my reaction when reading a book review in Physics Today I caught a glimpse of the words "low mass electrons". It turned out to be "Selectivity and Discord" a book by Allan Franklin [7] about controversial experiments some of which were ultimately accepted and some of which were rejected. The introduction to the chapter on low mass electron-positron states read: ". . . the earliest results were all thought to be in sufficient agreement to support the existence of the electron-positron states . . . . Eventually the results were shown to be incorrect. The consensus is that there are no low mass electron-positron states." Franklin shows enough of the observed peaks observed in high energy heavy element collisons in accelerators to indicate the strength of the evidence. Some of them fit ratios of quasar redshift peaks. I can only remark that low mass electrons from nearby galaxies or quasars would be expected to show peaks at certain preferred values. Low mass electrons from higher redshift objects would have displaced peaks.

In addition, this younger material is ejected intermittently in different directions from notoriously variable centers. I wonder why it was not possible just to say we do not have an explanation for these laboratory observations but perhaps it will become clearer as time goes on. Somehow I am reminded of the remark that some scientists would rather be wrong than uncertain. It seemed like a rather bitter controversy with damage done to some participants.

I am also bemused by the fact that neither I nor my astronomical colleagues knew about this rather hot conflict. At this point we might recall history and ask: Why are scientists such reluctant Copernicans? The problem seems to be about approval and fear of disapproval, jockeying for power and position. One thing sems observationally clear, lasting changes come slowly.

References

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[6] Arp, H. Catalog of Discordant Redshift Associations, Apeiron, Montreal (2003).
[7] Franklin, A. "Selectivity and Discord", University of Pittsburgh Press p 92 (2002).

Fig.1 Hubble Space Telescope image of the jet emerging fron M 87. The plasmoids are moving outward with velocities near c and becoming brighter.