V. LONG TERM FUTURE ISSUES

Panel: Major Unsolved Problems of Astronomy

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DOES THEORY ADVANCE WITH TECHNOLOGY?

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Observational technology in astronomy moves ahead. We can see a thousand times fainter and ten to a hundred times more detail than 40 years ago. But does our application to research match the engineering progress? Most of us make the easy assumption that theory is right at the cutting edge, waiting to gobble up each new fact into an even deeper, more detailed insight into the universe. But humans frequently misunderstand the real problems and misapply technology – making everything worse for agonizingly long times.

Is it possible that extragalactic astronomy has serious misconceptions? The key point to appreciate is that its whole structure rests on the belief that we know the distances to objects in the universe. The simple shift to the red of the spectrum of any observed object is assumed to measure its distance. But for 25 years evidence has been increasing that drastically incorrect distances can result. Unfortunately, not only quasar distances but the distances to the vast majority of galaxies also depend on redshifts.

Huge observing facilities can only mislead if the objects observed are assumed to be something they are not! Consider the futility of observing a galaxy which is assumed to be a gigantic monster, able to swallow whole groups of well known galaxies – but is actually only a nearby dwarf. The luminosity of various distances indicators will be derived on this wholly false assumption of great distance. Whatever answer comes out will be treated as a startling discovery and applied to the distance of other objects which are presumed to represent the universe as a whole. Fantastically incorrect conclusions will be drawn about the age, origin and evolution of a completely fictitious universe.

A few examples contradicting paradigms on which current observations are made:

1) *Mark 205/NGC 4319.* Pictures of this famous quasar connected by a luminous filament to a low redshift galaxy have been published extensively[1]. When the Einstein X-ray satellite made a special observation of the pair which was capable of again confirming the connection it found emission between the quasar and the galaxy nucleus. But the observation then lay completely unreported for 11 years! I discovered it in the archives when I was preparing a proposal for the new ROSAT X-ray Telescope. With great difficulty I managed to get the challenge before the appropriate allocation committee to allocate about one thousandth of the available time to observe this connection with five times better signal and the better resolution of ROSAT. Almost everyone admits the existence of this connection would destroy the basis for quasar distances from redshift. Would the allocation committee for U.S. ROSAT time take the opportunity to resolve one of the most important pieces of discordant evidence in extragalactic astronomy? Predictably no. They rejected the observation!

Y. Kondo (ed.), Observatories in Earth Orbit and Beyond, 409–412.

2) *3C 232/NGC 3067.* In 1971 Burbidge, Burbidge, Solomon and Strittmatter showed that the brightest radio quasars fell so close to low redshift galaxies that the chance of being accidental was negligible. One of these quasars, 3C 232, had less than 2 1/2 chances out of 10,000 of not being associated with the bright galaxy NGC 3067. Because the quasar was so bright in apparent magnitude further optical and radio spectra were unavoidably taken of it by other investigators.

The new investigators insisted that the quasar was not associated with the galaxy but in order to account for absorption lines of the low redshift galaxy seen in the spectrum of the quasar they had to postulate an enormous halo around the galaxy through which the background quasar was shining! Moreover they assumed the galaxy was in equilibrium rotation and derived the astonishing result that 16 times the mass of visible matter was unseen ("dark matter"). But the pictures of the galaxy available at that time showed clearly that the galaxy was not in equilibrium rotation, that it was instead ejecting material[2]. Recent measures with the Very Large Array radio telescope in Socorro, New Mexico now reveal a hydrogen filament leading from the galaxy directly to the quasar! If this is not accepted as proof of the ejection of the quasar from the galaxy then what would be considered proof? And why did it take 18 years to make (for another purpose) this crucial observation? Is extragalactic astronomy a science?

In the above case it turns out that X-ray observations again lay unreported in the Einstein Laboratory archives. They show X-rays extending from NGC 3067 northward from the quasar in the direction of the HI filament[2]. In the other 3 quasars reported by Burbidge *et al.* there is also evidence of X-ray disturbances which would associate the quasar with the nearby low redshift galaxy. This evidence also went unreported. Proposals to reobserve these latter quasar/galaxy associations with the more powerful ROSAT have now been accepted by the German side but only on the lowest (C) priority basis.

Several other important morals can be drawn from the case of NGC 3067/3C 323:

- The existence of large halos around galaxies is not supported.
- It is a counter example to the hypothesis that lower redshift absorption lines in quasar spectra originate in intervening galaxies.
- It contradicts claims of proof of relative quasar distance from preferentially low z absorption lines in high z quasars.
- It is a vivid illustration of how missing mass calculations can be completely incorrect.

3) *Numerous Quasars Associated with NGC 1097.* The spectacular straight jets emerging from the active nucleus of NGC 1097 have been pictured in numerous publications. Coveys of X-ray cloudlets and quasars are seen streaming out of the complex central regions which surround the variable, point source nucleus[1]. A team of 7 experienced observers including the astronomers who had originally discovered and published these results submitted a carefully calculated, detailed observing proposal to the Hubble Space Telescope. The proposal called for spectrographic investigation of this central region and its central energy source. Puzzles like formation of young stars, temperature, chemical composition and apparently discontinuous

rotation curves were to be observed. Above all, some of the mysterious "hot spots" in the interior which were *also radio sources* would be revealed as new kinds of objects or confirmed as quasars. The figure illustrates the location and appearance with a low resolution ground based telescope of these objects in the interior of NGC 1097. At last we had a chance to peer into the innermost regions of this quasar factory and explore the creation processes of these objects. The proposal was turned down.

4) *Galaxies as the Framework of the Universe.* Quasars might be peculiar but galaxies define the universe – and we know all about them. Don't we? If we think about the question we realize the following: If the quasars are nearby their redshifts are not a measure of their distance. It is just this redshift which is used to estimate the distance of the overwhelming majority of galaxies. Their luminosities, masses and everything else depend on their assumed distances.

Is there something wrong with our knowledge of galaxies? There certainly is, and it is inescapably, catastrophically wrong. Consider the spiral galaxies with the best defined arms of luminous stars, gas and dust. These are called ScI galaxies. They deviate very strongly from the Hubble relation (redshift proportional to apparent magnitude) for Sc's. But obeying a Hubble relation is the only basis for assigning them distances from their redshifts. When these galaxies are assigned to the groups which they belong they turn out to have excess (non velocity) redshifts of hundreds to thousands of km s^{-1}. Moreover, when the only other independent method of estimating distance (from rotation-mass relations) is applied these same galaxies exhibit distance discrepancies of up to 33 mega parsecs![3] Their redshift distances are up to 70% in excess. The final absurdity is that when these systems are put at their redshift distances they are so large they would completely swallow up any giant systems of which we have accurate knowledge (like M31 and M81, the Sb spirals which dominate our own Local Group and the nearby M81 group.) Such monstrous galaxies would be so voluminous that we should see of the order of one supernova per year in them! Every astronomer knows this is a complete *reductio ad absurdum* nevertheless most continue on in the belief that these galaxies actually are so big and so far away.

Where does this leave the science of extragalactic astronomy at the moment? The technology of astronomical observatories advances very rapidly. Billions of dollars are spent on orbiting ever more sophisticated optical telescopes, X-ray and infrared telescopes. The Hubble Space Telescope by itself costs $ 1.6 billion. Huge new optical telescopes are being built on high mountains in Chile and Hawaii. But it all comes down to nothing if the objects that are observed are assumed to be something that they are not.

We see strong evidence which shows extragalactic objects are not what they are supposed. Until this evidence is thoroughly investigated astronomy risks wasting almost totally its resources and misinforming itself and the public which supports it. My conclusion comes not from what some would claim is *interpretation* of available evidence but is the verdict of the evidence itself – namely, that current theory is violated by numerous straightforward observations at an overwhelming probability level.

Everyone has the responsibility individually to look at this evidence and make

up their own mind about it. This becomes necessary because human organizations rarely reform themselves from within. External pressure is needed to effect change. I am no longer naive enough to expect consensus leaders in astronomy to ever say: "This evidence is now too strong, we will change our paradigm". Our only faintly realistic hope is that under enough outside pressure people in control might be reluctantly *forced* to say: "We will apply 90% of our facilities to "respectable" science but allow 10% to be used in innovative observations or testing of apparent contradictions of fundamental assumptions." Everyone who is part of a large telescope facility should insist that time be set aside for this most important end result.

It is clear that maintaining 90% of the present kind of programs will not harm the main thrust of astronomy. Assigning of the order of 10% of available time, however, will be life or death to innovative proposals which are the source of really significant breakthroughs. On the recently published space telescope assignments for example, it is not just that the majority are uninteresting – it's that all the crucially important objects have been deliberately left out.

From what has been said it is clear that I feel the solution must be along the lines of minorities taking some power. A tangible step in the direction would be to insist that all publicly funded research be given minority representation. While not disturbing what is considered main stream research this would enable new directions to be explored, some of which will ultimately become the main stream of the future. The alternative is to have various branches of science wander off into complete delusion and irrelevance. Do you think that science cannot possibly go on for a long time without self correcting? Consider that in 300 B.C. Aristarchus of Samos had quite a true picture of the sun and its family of planets. By 200 A.D. Ptolmy had replaced it with earth centered epicycles. More than 1300 years elapsed before Copernicus, Kepler and Galileo restored the sun as the center. It could have been longer.

References

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3. Arp, H.: 1990, *Astrophysics and Space Science*, **167**, 183