Fundamental Observational Problems

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Almost all of cosmology and extragalactic astronomy are built on the assumption that redshifts are caused by recession velocities and hence measure distances. Evidence has been accumulating since 1966, however, that high redshift quasars and other active objects violate this assumption and are associated with nearby, relatively low redshift galaxies (For recent reviews see Arp 1987; 1992a, 1994a,b and the present conference).

Another recent confirmation of physical association of quasars with galaxies is shown in Fig.1. Two compact X-ray sources are conspicuously paired across the nucleus of the Seyfert galaxy NGC4258 ($z = .0017$). Since this galaxy is known to be ejecting radio and optical material in opposite directions, the authors of this data (Pietsch et al. 1994) conclude these two X-ray sources "may be bipolar ejecta from the nucleus". They report also that at the center of each X-ray source is a blue stellar object of about $m = 20mag$. Optical spectra of these two objects would determine their redshifts. Considering the large number of expensive new telescope facilities, it is astonishing that more than a year has passed, still without the completion of these two short, crucially

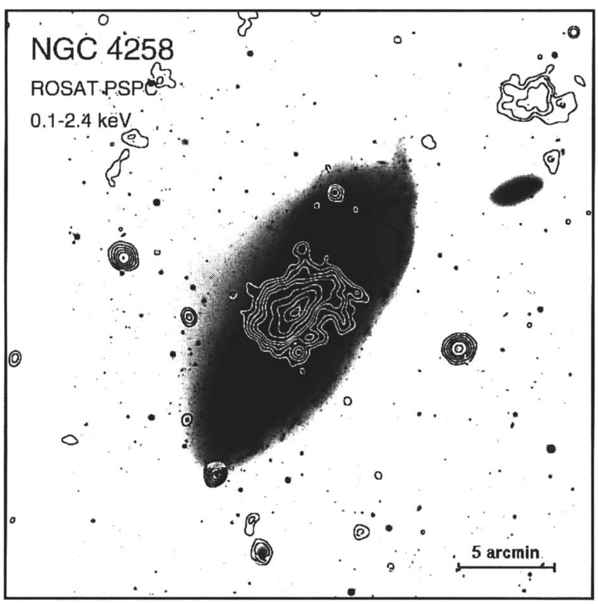

Fig.1. X-ray contours (by Pietsch et al. 1994) overlayed on photograph of NGC4258. Note two strong point-like X-ray sources, each centered on a blue stellar object across the active galaxy nucleus.

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important observations. I think, however, we can conclude that these are two quasars, probably ~~in the~~ redshift range $.3 < z < 1.4$, which have been ejected from this active galaxy.

Another recent result involves the first discovered, most famous quasar, 3C273. Fig.2 shows that this brightest apparent magnitude quasar falls in the largest, brightest cluster of galaxies near us, the Virgo Cluster. There are seven independent sets of evidence that 3C273, or quasars like it, fall in the Virgo Cluster. But the most compelling proof of all is evidenced by the X-ray filament in Fig.2 which connects the center of the Virgo Cluster (M49) in one direction to the powerful radio galaxy 3C274 (M87) and in the other direction to the radio galaxy 3C270 ($z = .007$) a QSO ($z = .334$) and 3C273 ($z = .158$). The luminosity weighted mean of the glaxies conventionally supposed to comprise the Virgo Cluster is $z = .003$.

The importance of this evidence can be judged by the fact that *Nature* published the upper part of the Virgo Cluster X-ray survey but refused to publish the lower part that showed the conspicuous physical connection to the famous quasar. One might draw the conclusion from this that the observations are only photons as a function of x and y – but the conventional theory of distant quasars is knowledge of such higher certainty that is unimpeachable by mere observations.

It is interesting to further note that another famous quasar, 3C279, lies further south and a little east of 3C273. Both 3C273 and 3C279 are strong X-ray sources (0.1 to 2.4 keV) but 3C279 ($z = .538$) becomes stronger than 3C273 in the highest energy gamma rays ($\sim 100 < Mev <\sim 1000$). A picture of 3C279 in gamma rays was published in *Sky and Telescope* (Dec. 1992 p. 634). Closeby, and joined to it by an obvious extension of luminous gamma ray material was 3C273. But by joining a quasar of $z = .158$ to a quasar of $z = .538$ the observations violate the fundamental assumption that redshifts mean distances. Still for practical reasons some observations must be published. The solution: 3C273 was simply not identified in the picture!

Some of these gamma ray pictures are shown and discussed in Arp 1994a. It can be seen there that as one proceeds from the center of the Virgo cluster $\sim$ southward the X-radiation becomes harder, turns into gamma radiation and then ends on the highest gamma radiation of all, going

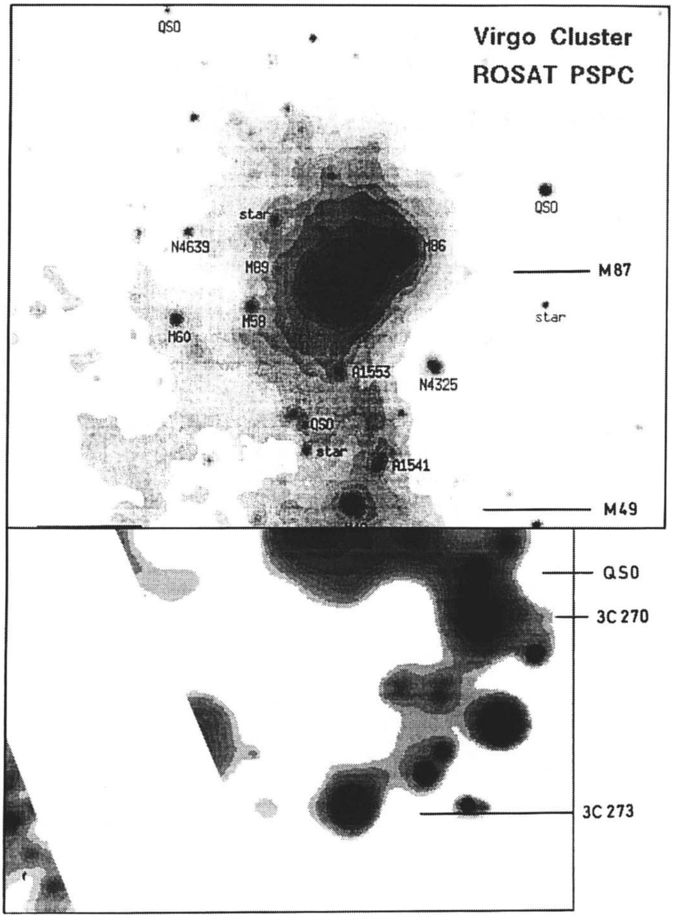

Fig.2 Map of Virgo Cluster in X-rays from ROSAT survey. Upper frame from Böhringer et al. (1994) and lower frame Arp (1994a). Center of Virgo is at M49. In the southern extension 3C273 has $z = .158$ and QSO has $z = .334$.

up to 20,000 Mev at 3C279. The redshifts steadily get higher along this sequence and it is difficult to escape the implication that this is a time sequence of creation of new matter with the youngest object having the highest redshifts (Narlikar and Arp 1993).

Shifting to another case, four quasars ($z = 1.7$) associated so closely ($\lesssim 1''$) with a galaxy ($z = .04$) that no one has dared to call it an accident, we show a photograph of the "Einstein Cross" in Fig. 3. The photograph represents high resolution Hubble Space Telescope images added together and processed with a Lucy image restoration algorithm. Since the images are near the wavelength of Lyman alpha at the redshift of the quasars, the connection from the quasar on the right (D) to the elongated nucleus of the galaxy is indicated to be Lyman alpha in emission. A spectrum between quasars B and A shows the Lyman alpha emission line becoming *narrow* confirming this is a low density gaseous filament connecting the high redshift quasar and the low redshift central galaxy (Arp and Crane 1992). In Fig.3 the theoretical predictions of gravitational lens theory are shown on the right

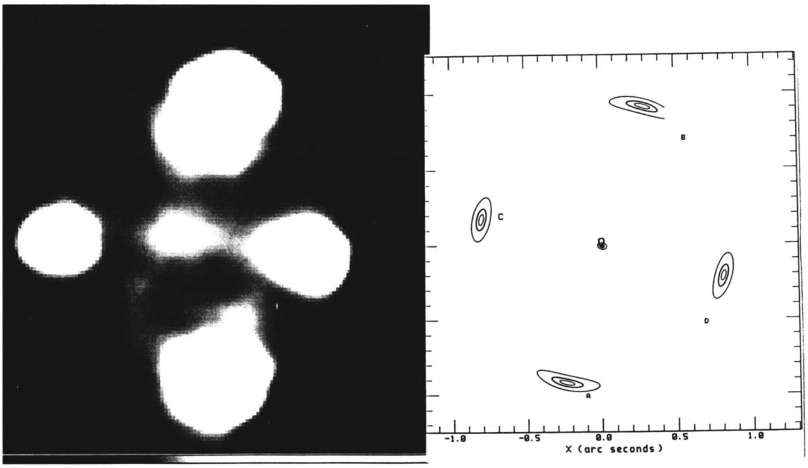

Fig.3 Space Telescope image of Einstein Cross (left) predictions of gravitational lens (right).

and are seen to be exactly orthogonal to the observations. In fact it should have been seen long ago that resolved quasars (as many must be in the conventional picture of a magnified host galaxy) should be drawn into arclets on a circumference in contradiction to the observations. Observations from this, the world's most expensive telescope, are routinely published in Ap.J.Lett. These observations were rejected.

If high red shift quasars and active galaxies have intrinsic redshifts what about more normal galaxies? Smaller companion galaxies in the completely studied nearest galaxy groups *all* show intrinsic redshifts of order of 150 kms^{-1} (Arp 1994b). They also show quantization at 72.4kms^{-1} (Arp 1986). So real velocity components must be less. But now Napier and Guthrie (1993) show that all the most accurately measured red-

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shifts, when differenced, show an enormously significant periodicity of $37.5 kms^{-1}$. Here real Doppler velocities must be less than about $20 kms^{-1}$ to avoid smearing out the periodicity shown in Fig.4.

Whatever the explanation for this periodicity turns out to be it seems that real motions in the universe must be drastically less than presently supposed. Hence the presently accepted distances, masses and luminosities must be hugely over estimated. Is this compatible with currently accepted physics? Surprisingly the answer is yes. If a solution of the Einstein field equation's more general than the current Friedmann solution is made then particle masses can vary with space and time, $m = m(t)$. This gives all physics as currently observed in the laboratory and in the galaxy for matter of our creation epoch (Narlikar and Arp 1993). It is only when we go extragalactic do we get redshifts as a function of age in an episodicaly creating, non-expanding universe.

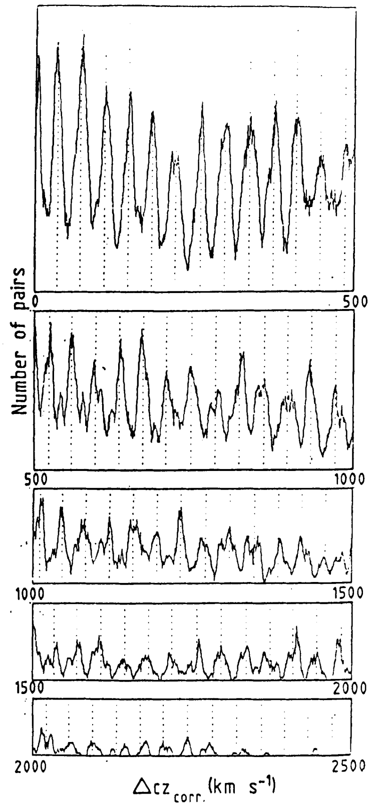

Fig.4 All accurate HI redshifts differenced (Napier and Guthrie 1993)

But again, regardless of whether this is the correct theory of how the universe works, it is clear that the present observations, of which only a small sample have been shown in this paper, inescapably contradict the current Big Bang hypothesis. In my opinion progress can only be turned from negative to positive in cosmology today by accepting that the current paradigm has been disproved.

At this point I would like to respond briefly to some of the remarks made by Martin Reese during this panel: First he presents the observed superluminal expansions as evidence for the conventional picture. Actually, the situation is the reverse. The observations as they stand violate the Einsteinian upper limit of signal velocity as c. One needs a highly contrived model of jets beamed almost exactly at the observer with quite implausible bulk motions in the $0.99c$ range. On the other hand if we accept the observations, the quasars are generally 10-100 times closer and their observed velocities of ejection are in a quite precedented range of physical velocity. For example, the "superluminal" 3C273 becomes quite reasonable when moved into the Virgo Cluster.

Secondly, it is particularly disturbing that he should say I do not believe in the age of our own galaxy. I was among the first to do the hard work of measuring globular cluster main sequences which lead to the current best age values. That is the age which requires the observed Hubble constant, $H_o = 50$, even in the non-expanding version of cosmology which I favor. What I do find unwarranted, however, is the extrapolation of this age of our own galaxy to every other galaxy in the universe. Demonstrably, other galaxies are younger and empirically it is this younger age which correlates with their intrinsic redshifts.

Finally, I would like to comment that the efforts to ban the observation of critical objects and to suppress the communication of discordant results is disasterous for science. I feel it is the primary responsibility of a scientist to face, and resolve, discrepant observations.

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