ANOMALOUS REDSHIFTS OF QSOs

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The evidence for association of high redshift QSOs with low redshift galaxies is subject to controversies. If it can be convincingly argued that the observed associations are accidental and could occur with reasonably high probabilities (say > 5%) then the cosmological interpretation of the redshifts of QSOs remains unaffected by the data. If, however, there is increasing evidence, either statistically or in direct physical terms, for these associations to be real, then the excess redshifts of the QSOs become anomalous. Taking the latter alternative seriously, a suggestion was made by Narlikar (Annals of Physics, 107, 325, 1977) that the anomalous redshift of the QSO in a typical QSO–galaxy pair could arise because the particle masses in the QSO were systematically smaller than those in the companion galaxy, as predicted by a theory of gravitation based on Mach's principle. One astrophysical consequence of this effect is that the QSO should appear younger than the galaxy.

If the QSO is ejected from the galaxy at some stage in its life, would it remain in the neighbourhood of the galaxy? The mass of the QSO is initially zero and grows with epoch. We have examined the dynamics of such a variable mass QSO ejected from the companion galaxy. In the specific case of the galaxy NGC 3067 and the QSO 3C 232, numerical integration of the dynamical equations shows that the effects of low mass and large velocity last for a very short time so that the QSO remains trapped within the gravitational field of the parent galaxy and its separation is in agreement with that observed. Other observable consequences of this idea are being investigated.

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DISCUSSION

Weymann: Do you not agree that the arguments that a significant fraction of QSOs are cosmological are compelling (i.e., the Green-Schmidt 8/mag increase; Stockton's results)? Thus, if Arp's objects are local, should they not show some quite different properties (e.g., in different properties of the absorption spectra shortward of Lyα) from the "real" cosmological QSOs? This is certainly testable!

Narlikar: The numbers in the Green-Schmidt survey are still too small to convince me that the steep slope has any significance. Regarding Stockton's quasars, as far as I can make out some have $z_Q = z_G$, whereas some have $z_Q \neq z_G$. If we concentrate only on the former, we can assume that the redshifts of these quasars are cosmological, although they are small. The Arp-quasars are of course considerably closer than these Stockton quasars, and any effect or test which makes use of the column density of the intergalactic medium should be able to distinguish between the two.

Davis: It seems to me that your theory makes a very specific prediction of a strong correlation between the redshift of a QSO and its proximity to a bright galaxy of low redshift.

Narlikar: Yes. It is possible to calculate the maximum angular separation as a function of the redshifts of the galaxy and the QSO.

Green: In your theory, would a particle new to the Universe, for instance, created by pair production in the laboratory, start out with 0 mass and then grow in mass as its own horizon expands?

Narlikar: There is a difference between pair creation in the laboratory and the type of creation envisaged here. In the former, e.g., in e^-e^+ creation, we have in the Feynman diagram a world line which first goes backward in time and then turns round (at the creation event) and goes forward in time. In the latter we have creation as in a big bang (only delayed and on a smaller scale) so that the world lines have a genuine beginning at the creation event. The rule of mass growth with epoch applies from the epoch of such genuine beginnings.

Scheuer: How does the incidence of "delayed big bang" depend on the surrounding density in your theory? Would it only happen in the centers of galaxies?

Narlikar: I expect it to occur more often near places of high density such as in the nuclei of galaxies.

Peebles: Does your theory not predict the number-magnitude relation $N \propto 10^{0.6m}$ for quasars?

Narlikar: If the galaxies are distributed uniformly out to distances of ~ 30-100 Mpc, I expect the QSO population to follow the same rule. However, there are fluctuations in the luminosities of QSOs and one has to take into account the $(Hz)^2$ factor in the denominator for optical flux. In a large enough sample, these effects would be ironed out and one would get a $N \propto 10^{+0.6m}$ dependence. But in small samples such as the one discussed by M. Schmidt yesterday, these fluctuations as well as any local inhomogeneities will be important. For this reason I do not consider the observed steepness of the quasar number count to be significant.

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