

Special Issue Comments

Comments on Tired-Light Mechanisms

HALTON ARP

Abstract—Observational proofs or disproofs of the hypothesis that light significantly redshifts on its propagation through intergalactic plasma appear possible.

I. INTRODUCTION

Over the more than 60 years in which galaxy redshifts have been known, it has seemed likely to many researchers that the shift was due to the loss of energy of the photons on their long voyage to us. Many years ago Findlay-Freundlich was well known for his advocacy of this effect. With this hypothesis Max Born actually computed a background temperature for the night sky which was not so different from the presently accepted value. This was *before* the well-publicized value computed by Gamow on the basis of a Big Bang universe.

To my personal knowledge, in the early 1970's an Argentine astronomer, Sistero, calculated the forward-scattering effects for electrons in order to redshift photons without blurring astronomical images. About this time, J. Kierein made similar calculations and interpreted redshift at the solar limb as being due to this effect. Recently, P. Marmet has advocated photon energy loss in the transmission through intergalactic spaces containing molecules of, for example, hydrogen. Previous to this the French physicist J.-P. Viller had proposed that light lost energy in an interaction with the material vacuum (or "false" vacuum) as it traveled through intergalactic space. These are only a few of the people, personally best known to me, of the many who have advocated some photon decay mechanism to account for redshifts.

II. OBSERVATIONAL EVIDENCE

It is clear that there is a great deal of interest in these, what we might lump together as "tired light," mechanisms to account for intergalactic redshifts. Since my own work has been for many years on the observational side of presenting examples of extragalactic redshifts that cannot be explained as Doppler velocity shifts, it may be useful to list the observational evidence which I believe the tired light theories must confront in order to become useful theories:

1) Optical observations of extragalactic objects show sharply resolved features as fine as 0.5 arc s, and radio interferometry shows structures unblurred to the level of 0.005 arc s. Any force or perturbation on the photon must leave the flight path undeviated to a very high degree of accuracy.

2) Within galaxies there are various clouds of hydrogen, molecular clouds, and ionized gas clouds. We can, and do, view more distant objects through various kinds and amounts of these clouds. To my knowledge there is never any redshifting of spectral features, even though we can view through optical thickness of these clouds, which go up to almost total optical extinction of the object. For example, in a star cluster imbedded in a gas cloud, it would be possible to examine the optical redshift of the observed stars with respect to the column density of gas in front of each star. If there

were a systematic correlation, this would prove Marmet's hypothesis, and if not, it would disprove it.

3) If we consider a different kind of redshifting medium, then the most general is Vigier's hypothesis that the material vacuum (essentially observationally undetectable) is responsible for intergalactic redshifting. But now we have to confront evidence that two galaxies can be at the same distance (for example, interacting) but have much different redshifts. If we accept this evidence, then they must have closely the same path length to the observer, and any redshifting medium must preferentially exist around the locality of one object more than around the other.

4) This now has the undesirable aspect that there must be a separate redshifting agency for each object. But what is more difficult, some objects with excess redshifts (such as spiral galaxies) have resolvable large apparent diameters. If imbedded in a redshifting medium, they should show a gradient of redshift from center to edge. My observational experience would lead me to rule out the possibility that this can occur.

5) We are forced then to postulate that the redshifting material is in the form of a spherical shell through which we view the whole object. But then I would maintain we should observe the effect of shell edges passing over more distant objects and causing severe redshift dislocations along the projection of these edges. If such redshift perturbations along silhouetted edges could be observed, then this observation would have the capability of proving such a theory. But in my experience with discordant redshift associations such as Stephan's Quintet, NGC 4319/Mark 205, and many others, I feel that we should have noticed such effects but have never seen any possibilities. At any rate I feel that the hypothesis is capable of being observationally proved or disproved.

III. DISCUSSION AND CONCLUSIONS

If we exclude the intervening medium as the agency for causing excess redshifts, then we are only left with the possibility that it is the intrinsic nature of the object itself which causes the excess redshift. I have suggested that one parameter, the age of the matter making up the galaxy or quasar, is directly responsible for the redshift we observe. (With theoretical justification by appeal to the Hoyle/Narlikar theory which states that masses of all particles can be a function of time.) If that were true observationally, we should expect that the younger the object, the greater the excess redshift (all parts of the object: Gas, stars, etc.). For many years I have argued that, observationally, the youngest objects are the most redshifted. Of course, one could argue that young objects are surrounded by a larger amount of the redshifting medium. But as stated in point 5, this becomes very difficult in a case like NGC 3067/3C 232, where the high redshift quasar is imbedded in the low redshift material of the parent galaxy [1].

In closing I would like to state that my postulate of the increasing redshift of lower mass matter is a kind of tired-light theory. It is in the sense that younger matter emits weaker photons. In infancy one becomes tired more easily. Perhaps that would satisfy what many of us feel is a more logical behavior for radiation in the universe than the currently accepted picture of only Doppler redshifts. But regardless of what seems intuitively probable, I would like to stress that I believe that there are observational proofs or disproofs possible of the hypothesis that light significantly redshifts on its way to us through the intergalactic medium.

REFERENCES

- [1] H. Arp, "The HI bridge between NGC 3067 and 3C 232," in *Proc. ESO Workshop on Extranuclear Activity in Galaxies* (Garching, FRG), May 16-18, 1989, E. Meurs and R. Fosbury, Eds., to be published.

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The author is with the Max-Planck-Institut für Astrophysik, Karl-Schwarzschild-Str.1, 8046 Garching bei München, Federal Republic of Germany.

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