

ON HYPOTHETICAL PHOTON INTERACTIONS AND  
COSMOLOGICAL REDSHIFT

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It is a known experimental fact that the electromagnetic radiation of extragalactic objects (galaxies and quasars) shows relatively large values of redshift. From the point of view of cosmology it is very important to investigate all possible mechanisms which contribute to the observed redshift effect. Currently, only two mechanisms for redshift are generally accepted: Doppler kinematic effect (redshift depends on relative velocity of the source and the observer) and Einstein gravitational effect (redshift depends on the difference of gravitational potentials between the source and the observer). Analysis of Hubble's law on the basis of these two effects gives rise to a model for the expanding Universe. But, there have been many ways to introduce a new effect which could also contribute to the redshift. If any new mechanism, in fact, exists, then the standard model of the expanding Universe should be appropriately modified.

We will summarize some hypothetical photon interactions for a new possible redshift mechanism. We considered photon collisions with the hypothetical (pseudo) scalar particles. Photon collision model which might be part of redshift should satisfy at least the following three conditions! 1) the photon should exhibit strong forward scattering to agree with the observed point-like structure of distant sources; 2) fractional photon energy loss per collision should be constant, i.e. independent of the incident photon energy;

3) the new photon effects should be compatible with Quantum Electrodynamics.

Chastel <sup>1</sup> critically analyzed the work in this field up to 1975. He showed that the photon-photon interaction, as well as photon-scalar particle collision mediated by photon or scalar particle, does not satisfy the desired conditions. In all these cases, photon and scalar particle are treated as particles with very small masses ( $m_\gamma < 4 \cdot 10^{-48}$  g).

Dragovič, Marič and Popovič <sup>2</sup> analyzed the photon-scalar particle collisions mediated by scalar particles. The analysis is given in the Duffin-Kemmer formalism for both scalar and photon fields. Calculations made for scalar and vector coupling. Photon and scalar particles are treated as particles with very small masses. Differential cross sections are obtained, but do not agree with above mentioned three conditions for the redshift.

We also analyse the electromagnetic interaction of a photon with a charged massless scalar particle. Some preliminary calculations are made with the scalar particle in the Duffin-Kemmer formalism, but do not give a constant fractional photon energy loss. Thus, we conclude that, as of now there are no satisfactory quantum field models of photon-scalar particle interaction which could be candidates for a new redshift mechanism.

#### REFERENCES

- <sup>1</sup> A.A.Chastel, *Astronomy and Astrophysics*, 53 (1976) 67-82.
- <sup>2</sup> B.Dragovič, Z.Marič and D.Popovič, *Fizika* 9 (1977) 97-100.