A. Ya. Kipper. *The Ambiguity of the Quasar Red Shift.*[1)] If the large red shift of quasars is of cosmological origin, quasars are the most distant objects in the Universe. The quasar red shift is determined in most cases by measurement of emission lines in the spectrum. However, absorption lines dominate even at $z = 1.9$, and at $z > 2.5$ the spectrum of the quasar resembles that of an ordinary star of the middle spectral classes with sharp absorption lines.

One of the remarkable features of the quasar spectrum is the fact that the red shift z_{abs} determined from absorption-line measurements is multivalued. Thus, a line that is a single line under normal conditions, e. g., the L_α line, may be observed in the quasar spectrum as a whole series of lines. The ambiguity of the red shift z_{abs} is also an interesting problem in that it may relate to more general problems of theoretical physics.

Most investigators explain the multivalued red shift z_{abs} by assuming the presence of several expanding gas clouds between the core of the quasar and the observer; these clouds are situated either around the core or at various distances between the object and observer.

However, Kipper has advanced a hypothesis according to which the ambiguity of the red shift z_{abs} results from the properties of the photon itself and is due to the long time spent by the photon in cosmological space. The photon is usually treated as a particle with practically infinite lifetime. In cosmological time intervals, however, we may expect the photon to disappear as a result of the continuous decrease in its energy owing to the red shift. This conclusion follows from quantization of the electromagnetic field in de Sitter's cosmology and from the presence of the so-called zero energy of the harmonic oscillator. Each monochromatic wave is regarded as energetically equivalent to a harmonic oscillator.

[1)]The views of the author are debatable. (Note by the office of the Division of General Physics and Astronomy, USSR Academy of Sciences.)

Owing to the finite lifetime of the oscillator, the red shift z of distant cosmological objects is no longer single-valued. This pertains first of all to z_{abs}. The corresponding formula is given in the paper. A diagram (Fig. 1) has been plotted to clarify the correspondence of the formula to observations.

Because of the ambiguity of the red shift z_{abs}, a whole series of lines is formed from one line, and their wavelengths λ can be calculated from appropriate formulas, The quasar 4C 05.34 is chosen as an example; both L_α and L_β are observed in its spectrum. The ambiguity of the lines in the violet region of the spectrum of this quasar is indeed striking for objects whose spectra are usually poor in absorption lines. The drawing (Fig. 2) designates lines belonging to the various series generated by the lines L_α and L_β.

The finite lifetime of the oscillator implies that single photons vanish after certain intervals of time. This process can be interpreted as absorption of the photon's energy by cosmological space. Kipper suggested that the cosmological red shift is an effect of

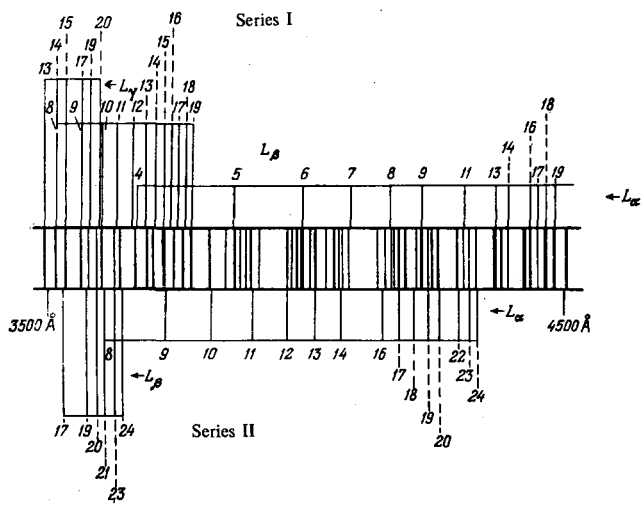

FIG. 1.

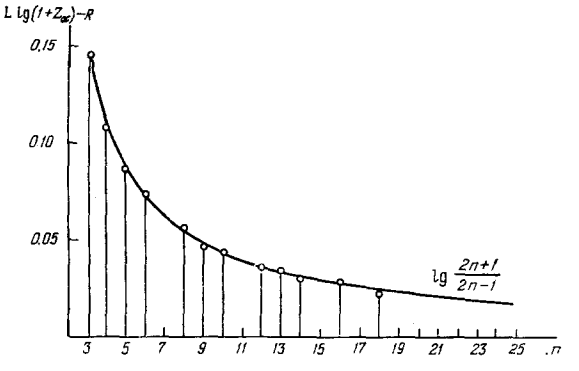

FIG. 2.

this absorption. But then the question arises: how to reconcile the proposition that the cosmological red shift is a Doppler effect of receding galaxies with the proposition that the energy of the photon is absorbed by cosmological space? Reconciliation is quite possible, and the theory of the expanding Universe does not contradict the hypothesis advanced in this paper. A rigorous proof of this agreement has been carried through on the basis of the de Sitter cosmology, but has not yet been published. Other statements have been published in: Astrofizika **10** (2) (May 1974); Publ. Tart. Astrofiz. Observ. **40**, 12, 74 (1972); 41 (1973).

A paper on the use of the most recent measurements of quasar spectra is in press. Figures 1 and 2 have been taken from this paper.

I. G. Burbidge and M. Burbidge, Quasi-Stellar Objects. W. H. Freeman, 1967.

Ya. B. Zel'dovich and I. D. Novikov, Stroenie i ėvolyutsiya Vselennoĭ (The Structure and Evolution of the Universe) Nauka, Moscow, 1975.