

# Mac Principle Based Explanation for the Cosmological Red Shift and It's Evidence

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## Abstract

According to Mac's principle, 'mass', (Rather 'Energy) of any object is because of its 'cosmic gravitational potential energy'. So, total energy of the universe should be equal to total gravitational potential energy of the universe. That is:

$$G M_0 M_0 / R_0 = M_0 c^2$$

$$\text{i.e. } G M_0 m / R_0 = m c^2$$

That is the 'cosmic gravitational force experienced by every object is:

$$G M_0 m / R_0^2 = m c^2 / R_0$$

$$\text{i.e. } G M_0 m / R_0^2 = m ( H_0 c ), \quad \text{Because, } R_0 H_0 = c \quad \dots\dots\dots(1)$$

The expression-1 suggests that every object is expected to feel the acceleration :

$$H_0 c$$

Now, let express the 'cosmological red-shift' in terms of the 'deceleration' experienced by the photons:

The linear part of the cosmological red shift

$$z_c = ( h f_0 - h f ) / h f = H_0 D / c$$

So the loss in energy of the photon:

$$( h f_0 - h f ) = ( h f / c^2 ) ( H_0 c ) D \quad \dots\dots\dots(2)$$

That is, the loss in energy of the photon is equal to its mass ( $h f / c^2$ ) times the acceleration ( $H_0 c$ ) times the distance  $D$  traveled by it.

So the expression-2 shows that the photon does experience the deceleration expected from the expression-1.

Now, if our hypothesis is correct, then each and every linearly moving object should also experience the deceleration ( $H_0 c$ ). Strikingly, the carefully measured anomalous decelerations experienced by the Pioneer-10, 11, Galileo and Ulysses spacecrafts, match perfectly with the numerical value of  $H_0 c$ .

Thus we have four more readings supporting our hypothesis of Mac's principle based explanation for the 'cosmological red shift'.