1)

Notes for Section 3 of Paper 49

These notes are based on the ideas by Assis, who also derives the red shift from the Beer - Lambert law:

$$\frac{I}{I_0} = e^{-\alpha Z} \quad -(1)$$

where I_0 is the power density of light in a source, and I is the power density at the telescope. Here Z is the distance from the source to the telescope and α is the power absorption coefficient. The power density I is related to the total electromagnetic energy density U as follows:

$$I = cU. \quad -(2)$$

Thus:

$$\frac{U}{U_0} = e^{-\alpha Z}. \quad -(3)$$

Assis now assumes that:

$$U = \hbar\omega / V \quad -(4)$$

so the red shift is given by:

$$\frac{\omega}{\omega_0} = e^{-\alpha Z}. \quad -(5)$$

The units of U are joules per cubic metre, and V is a volume of radiation.

The assumption (4) is true for one photon, or for monochromatic radiation, but not for black body radiation.

2) For black body radiation (Atkins page 7) the Planck distribution must be used, so:

$$\frac{dU}{dN} = \frac{8\pi\hbar\omega^3}{c^3}\left(\frac{e^{-\hbar\omega/kT}}{1-e^{-\hbar\omega/kT}}\right)d\omega \quad -(6)$$

The total electromagnetic energy density of a black body such as the 2.7 K background radiation is obtained by integrating eq. (6) over all frequencies. Thus:

$$\bar{U} = \int_0^\infty \frac{8\pi\hbar\omega^3}{c^3}\left(\frac{e^{-\hbar\omega/kT}}{1-e^{-\hbar\omega/kT}}\right)d\omega \quad -(7)$$

$$= \left(\frac{\pi^2}{15}\frac{k^4}{c^3\hbar^3}\right)T^4$$

$$= \frac{4\sigma T^4}{c}$$

where $\sigma = \frac{2\pi^5 k^4}{15c^2\hbar^3} = \frac{1}{4}\left(\frac{\pi^2 k^4}{15c^2\hbar^3}\right)$

$= 5.67032 \times 10^{-8}\ Wm^{-2}K^{-4}$

is the Stefan - Boltzmann constant.

Therefore: $\boxed{I = cU = 4\sigma T^4}$ $-(8)$

3) which is the Stefan Boltzmann law for black body radiation made up of a Planck distribution of photons.

At 2.7K,

$$\boxed{u = 4.02 \times 10^{-14} \ J m^{-3}} \quad -(9)$$

The Assis equation (5) is true if there is only one photon. Assis then further assumes that:

$$\alpha = \frac{H}{c} \quad -(10)$$

where H is the Hubble constant. So he assumes that the Hubble law is valid.

These two assumptions are not true in general. In particular, Assis appears to have confused black body radiation (eqn. (8)) with monochromatic or single photon radiation (eqn. (4)). The tired light model (10) is valid for one photon only and assumes the Hubble law. It is known from Arp's data etc. that the Hubble law is not true in general.

Therefore only parts of Assis' analysis are correct.

4) I agree with his fundamental assumption:

$$I = \frac{L}{4\pi Z^2} e^{-\alpha Z}, \quad — (11)$$

$$I_0 = \frac{L}{4\pi Z^2}, \quad — (12)$$

where L is the intrinsic luminosity or emitted bolometric power in watts. Assis now calculates the average $\langle F \rangle$ for n cosmological objects per unit volume, from an assumed average $\langle L \rangle$ for the whole universe.

$$\langle F \rangle = \int_0^\infty \frac{\langle L \rangle}{4\pi Z^2} \cdot 4\pi Z^2 n \, dZ$$

$$\boxed{\langle F \rangle = \frac{\langle L \rangle n}{\alpha}} \quad — (13)$$

The quantity $\langle F \rangle$ is equated with the total flux of the Universe, in watts m. This is correct.

Therefore $\langle F \rangle$ is the total emitted bolometric power of the universe times metres, in watts m. This can be measured experimentally.

However the argument on page 19 of Assis is restricted only to monochromatic radiation assuming the Hubble law is correct.

5)

Unfortunately eqn. (5) of Assis is also incorrect because its units are incorrect.

However, I agree with Assis' basic idea that the mean temperature of matter in the whole universe is 2.7 K. This means that the whole universe is considered as a black body radiating at all frequencies. The mean temperature of the night sky is then 2.7 K. Assis then quotes:

$$\boxed{\text{E. Regener, Z. Phys. } \underline{80}, 666 \ (1933)},$$

as having measured experimentally the value $\langle F \rangle$ due to light and heat, cosmic radiation, etc. In order to convert $\langle F \rangle$ to a temperature we need a volume:

$$\langle \underline{I} \rangle = \frac{\langle F \rangle}{V} = 4\sigma T^4 \quad -(14)$$

where $\langle F \rangle$ is given by eqn. (13). The volume V is missing in Assis' eqn. (5), left hand side.

I assume that V is known experimentally and was used correctly by Regener in 1933. It was probably defined by a photographic plate and telescope aperture. However I will have to study the source paper by Regener to find how $\langle \underline{I} \rangle$ was measured.

6)

At this point I will revert to the notes Part two for paper 49, and use the ECE theory, because there are serious errors in the Assis paper.

The basic assumption of Assis is transformed into a new idea: that there exists a residual gravitational field in the universe. Light reaching a telescope is absorbed by this field through the homogeneous current of ECE field theory. In the simplest case this causes the red shift:

$$\omega \rightarrow \omega / \mu_r , \quad -(15)$$

where μ_r is the relative permeability. Therefore there is a residual or background permeability in the universe. In general:

$$\mu_r = \mu_r' + i \mu_r'' \quad -(16)$$

and the power absorption coefficient is:

$$\alpha(\omega) = \frac{\sqrt{2}\, \omega \mu_r''(\omega)}{c \left(\mu_r' + \left(\mu_r'^2 + \mu_r''^2 \right)^{1/2} \right)^{1/2}} \quad -(17)$$

at a given frequency ω.

The origin of μ_r is the interaction of light with gravity, as defined by ECE field theory. From eqn. (13) it is found that:

7)

$$\alpha = n \frac{\langle L \rangle}{\langle F \rangle}, \qquad -(15)$$

$$\boxed{\alpha = \frac{n \langle L \rangle}{4\sigma V T^4}} \qquad -(15)$$

From ~~the~~ Planck law, we know from eqn (9) ~~that~~:

$$\langle u \rangle = \frac{\langle I \rangle}{c} = 4.02 \times 10^{-14}\ \mathrm{J\,m^{-3}} \qquad -(16)$$

for black body radiation at 2.7 K, therefore:

$$\langle I \rangle = c \langle u \rangle = 1.205 \times 10^{-5}\ \text{watts m}^{-2}$$

$$= \langle I_0 \rangle e^{-\alpha Z} \qquad -(17)$$

$$= \frac{\langle L \rangle}{4\pi Z^2} e^{-\alpha Z} \qquad -(18)$$

From eqns (18) and (15):

$$\langle I \rangle = \frac{4\sigma V T^4 \alpha e^{-\alpha Z}}{4\pi n Z^2} \qquad -(19)$$

$$= 4.02 \times 10^{-14}\ \mathrm{J\,m^{-3}}$$

at 2.7 K.

Now assume a spherical volume:

$$\bar{V} = \frac{4}{3}\pi Z^3 \quad -(20)$$

so:

$$\boxed{\langle I \rangle = \frac{4\alpha}{3}\left(\frac{\sigma Z T^4}{n}\right) e^{-\alpha Z}} \quad -(21)$$

This is an expression for the mean intensity of irradiation by the universe, regarded as a black body radiator.

It is seen from eq. (21) that if there is no absorption then there is no $\langle I \rangle$:

$$\langle I \rangle = 0 \quad -(22)$$

for all Z if $\alpha = 0$. However, the source of α in ECE theory is the interaction of gravitation with light, so the existence of the 2.7 K background radiation is proof of this interaction.