QGD Interpretations of Redshift Effects

A consequence of QGD's axiom of discreteness of space implies that all electromagnetic radiations are singularly corpuscular emissions and, as we have seen earlier in this section, the wave-like behaviour of light emerges from interactions between photons and structures which fundamentally are all discrete. Because of its corpuscular nature, the properties of a photon do not change between its emission and detection (unless it interacts with matter along its trajectory), hence the apparent redshift of the emission spectrum occurs either at the source of emission (intrinsic redshift) or during its detection. The redshift therefore does not result from a shift in the momenta of photons along their trajectories between emission and detection but, as explained below, is simply a measurement of the difference between the momenta of photons of the emission spectrum of electrons of a given element from two distinct sources, one the observed source and the other the reference source.

Intrinsic Redshift

We have seen that changes in momentum of electrons obey the law

[1] $\Delta\vec{P}_{e^-} = \alpha m_{e^-}$

which imposes that only photons such that

[2] $\vec{P}_{\gamma} = \alpha m_{e^-}$ can be absorbed or emitted.

Equation [1] governs not only changes in momentum that are induced by the absorption of emission of a photon, but also momentum changes resulting from variations in gravity or the electromagnetic field effect, the latter resulting from a variation in the preonic density. Hence taking gravity and the electromagnetic effect into account we get:

[3] $\Delta\vec{P}_{e^-} = \vec{P}_{\gamma} + \Delta\vec{G} + \Delta\vec{\Theta} = \alpha m_{e^-}$ where $\Delta\vec{G}$ is the variation in gravity and $\Delta\vec{\Theta}$ is the variation in the magnitude of electromagnetic interaction of the atomic electron is subjected to.

Since the law of momentum [1] must be obeyed then from equation [3] we see that an increase in gravity or the preonic density or both proportionally decreases the permitted momentum of photons an electron can absorb or emit. Conversely, if gravity and/or the preonic density decrease(s) then the permitted momentum for photons to be absorbed or emitted increases proportionally since

[4] $\vec{P}_{\gamma} = \alpha m_{e^-} - \Delta\vec{G} - \Delta\vec{\Theta}$.

An increase in gravity will therefore reduce the momentum necessary for photons to be absorbed or emitted by the source and as a consequence, the absorption and emission spectrum of the source atoms will be redshifted.

The law of momentum and its corrolaries describe all possible redshifts effects and implies that all are intrinsic. However, though the redshifts of emission and absorption spectrum are intrinsic, measurements of redshifts are relative, thus depend on the emitting sources and choice of reference sources.

Predictions for Observed Gravitational Redshift

An observed redshift corresponds to the difference between the magnitudes of the momentum vectors of a photon from an observed source and a photon from a reference source. That is, the observed redshift is given by

[5] $z = \left\| \vec{P}_{\gamma_0} \right\| - \left\| \vec{P}_{y_1} \right\|$

where $\vec{P}_{\gamma_1}$ is the momentum of a photon from an observed source and $\vec{P}_{\gamma_0}$ is the momentum of a photon from within the corresponding emission band of a reference source. Or, since for any photon we know that $\left\| \vec{P}_{\gamma} \right\| = \left\| \sum_{i=1}^{m_\gamma} \vec{c}_i \right\| = \sum_{i=1}^{m_\gamma} \left\| \vec{c}_i \right\| = E_\gamma$ then we equation [5] is equivalent to

[6] $z = E_{\gamma_1} - E_{\gamma_0}$.

What the Redshift Tells Us

From $\Delta\vec{P}_{e^-} = \vec{P}_\gamma + \Delta\vec{G} + \Delta\vec{\Theta}$, we know that the gravitational acceleration of the electron is given by $\Delta\vec{v}_{e^-} = \dfrac{\Delta\vec{G}}{m_{e^-}}$. From the equivalence principle we find that the gravitational acceleration of the source system s is:

[7] $\Delta\vec{v}_s = \dfrac{\Delta\vec{G}_s}{m_s} = \dfrac{\Delta\vec{G}_{e^-}}{m_{e^-}}$.

So, if the mass of the system is known, we can derive its gravitational acceleration at the time of emission of the observed photons from its redshift and the intrinsic mass of the electron. However, since we are limited to observations of the relative redshift and since all photons sources in the universe are relatively redshifted or blueshifted, we need to choose a reference source with an intrinsic redshift is as close to zero as possible.

Good candidates would be atoms in in the void the middle of a cluster of galaxies at distances near the threshold distance d_Λ since for $d = d_\Lambda$ we have $\vec{G} = 0$ and the relative redshift would then be close to the intrinsic redshift of the observed source that is $\vec{z} \approx \Delta\vec{G}_{e^-}$ and $\Delta\vec{v}_s \approx \dfrac{\vec{z}}{m_{e^-}}$.

Ideal however would be photons near the center of the universes[9]. From [3], such ideal reference photon sources would also be recognizable as sources of the most energetic photons, which in conventional terms with the most highly blueshifted source.

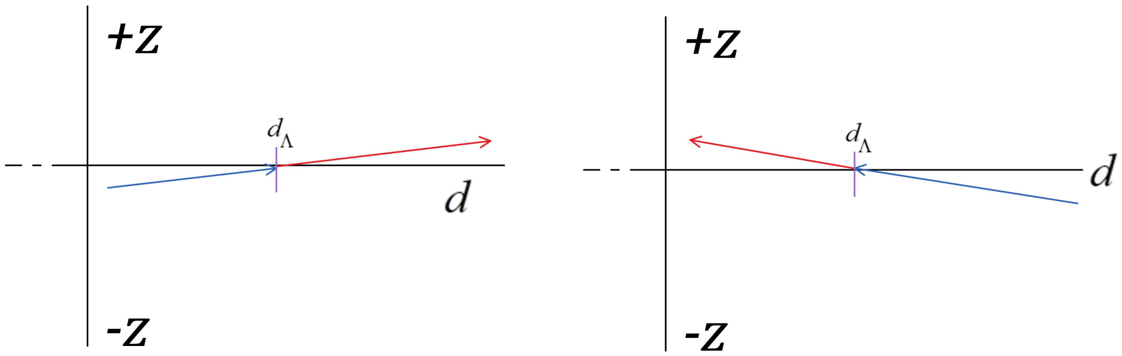
From [1] , [2] and [3] we find:

[8] $\Delta\vec{P}_{\gamma_1} - \Delta\vec{P}_{\gamma_0} = \Delta\vec{G}$ where γ_1 is a photon emitted by the observed source and γ_0 is a photon emitted by the reference source. Therefore from QGD's equation for gravity (assuming for now that $\Delta\vec{\Theta} \approx 0$) the redshift (or blueshift) we find that:

- for $d < d_\Lambda$, d_Λ being the threshold distance below with gravity is attractive, objects moving away from us will be blueshifted while objects moving towards us will be redshifted and,
- for $d > d_\Lambda$, lights emitted by objects moving away from us will be redshifted while light emitted by objects moving towards us will be blueshifted.

The graphics below compare the distinct predictions of QGD and standard cosmology.

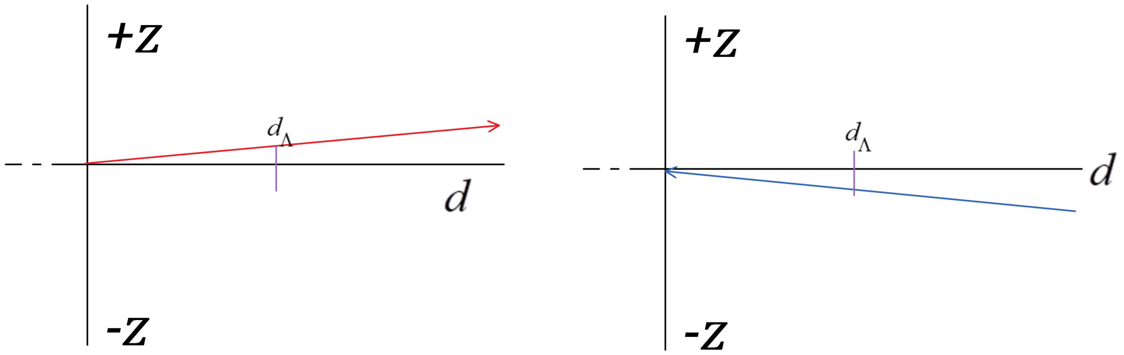
QGD Cosmology



The arrows indicate the direction of motion of the observed object

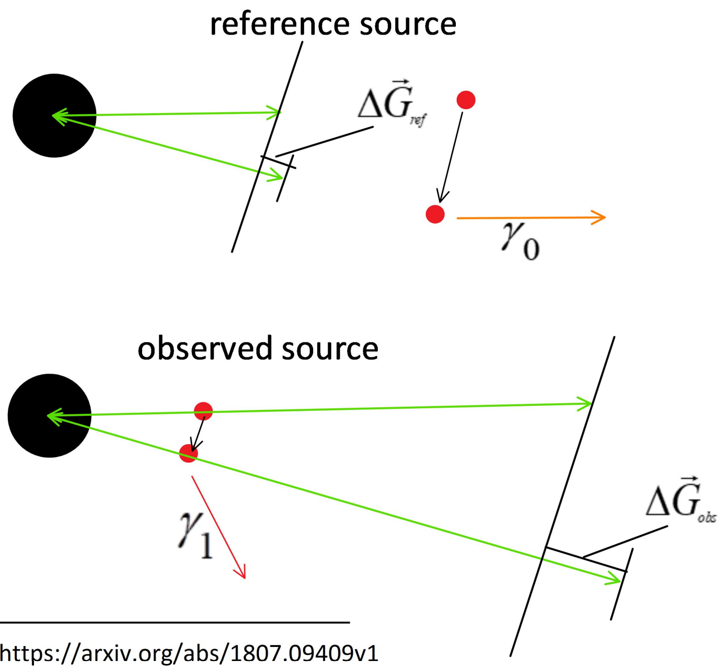
[9] The cosmology derived from QGD implies that the universe is finite and has a center.

Standard Cosmology



Noteworthy is that, contrary to standard cosmology, the gravitational redshift and blueshift mechanisms which QGD describe do not violate the laws of conservation of energy. Also, the redshift equation takes into account what is referred to as dark energy (which is caused by gravity becoming repulsive for $d > d_\Lambda$); predicting different behaviour of the redshifts and blueshifts for $d < d_\Lambda$ and $d > d_\Lambda$.

From [3] and [5], we understand that the greater $z \propto \Delta\vec{G}$, thus the effect will be most noticeable when a star moves close to a high density object such as a black hole. The redshift of a the spectrum of a star near a black hole has been recently observed[10] and though it is taken as confirmation of the [gravitational redshift] predicted by general relativity, the observation is also consistent with the predictions of QGD as shown in the figure below where the light from a star orbiting a black hole will redshifted relative to a reference source orbiting at a larger distance.



The length of the green arrows represents the magnitude of the gravitational interaction between a black hole and a reference star orbiting it (top) compared to an observed star in the same system (bottom).

It is interesting to note that all redshift effects are described by a single equation (equation [5])) while several different mechanisms are required for the Doppler cosmological redshift, the redshift and the gravitational redshift, but most importantly, the relation expressed in [3] relates the dark energy effect (repulsive

[10] https://arxiv.org/abs/1807.09409v1

gravity for $d > d_\Lambda$), but as we will see in the section on QGD cosmology, it also links dark matter and the electromagnetic interactions between particles (since $\vec{\Theta} \propto preonic\_density$, hence proportional to the density of the dark matter halo).

Mapping the Universe

In order to map the universe using observational data, we must take into account the state the universe in which each source of either gravitational signals or light. For electromagnetic signal, taking into account the distance allows us to establish the position of the emission on a state line. For gravitational signals, assuming that gravity is instantaneous, all signals describe the changes of state the objects as they occur which implies that all simultaneous gravitational signals correspond to simultaneous events. Therefore, gravitational signals may help us create a map of the universe in "real time."

Different cosmologies give different interpretations of observational data. As we will see in the section on QGD cosmology, QGD predicts that the universe is finite thus it must have a center and an edge. If that is correct, then at any given state, the gravitational acceleration of an object is proportional to its distance from the center of universe. This also implies that the universe was homogeneous over large distances and that the closest an object is to the center, the lower it gravitational acceleration will be and be equal to zero at the center, since gravitational interactions with the rest of the universe with cancel out, leaving inner gravitational interactions dominate (inner meaning within a radius of $r = d_{\Lambda}$ from the centre of the structure).

We will continue this discussion in the QGD Cosmology section after we have introduced the necessary notions necessary to tie all that has been discussed until now.