15. COSMIC LUMINOUS PATH

15.1 INTERGALACTIC REDSHIFT

Intergalactic redshift is caused by the gradual loss of light energy over great distances, similar to the tired light concept Fritz Zwicky originally postulated. This is why the effect is linear with distance. The farther the source, the more energy is lost, and the greater the redshift. This is also why the structure of the universe looks so uniform; the only real motions in the heavens are the peculiar motions generated by differences in mass distributions. These tend to be no more than a few hundred km/s, not the significant fractions of c required by universal expansion.

The concept of tired light has never had much success in modern cosmology because it fails (at least in its original form) to explain why distant signals are *stretched* as well as redshifted. Supernovae provide the prima facie case for this. Their intensity/duration curves tend to broaden proportionately with distance. An event at a distance corresponding to ($z = 1$) has, on average, twice the duration of a local explosion. If photons are just losing energy by crossing space, why are they also being dispersed along their path? Efforts to resolve tired light's dispersion problem have proven ineffectual and it has been thoroughly trumped by the drama of the Big Bang, pushing cosmology away from the elegant truth Zwicky recognized.

Although Zwicky had the intuition to realize light was losing energy, he lacked the Null Axiom, thereby relegating tired light to just another untestable premise. Our approach suffers no such limitations. It expands the concept significantly beyond Zwicky's original idea, resolves the signal dispersion issues, and is buoyed by the fact that it is the *only possible explanation* for the effect. No changes can occur to the universe as a whole. It doesn't expand, it doesn't contract, and it won't grow old and die. If light acquires a spectral change after crossing billions of light years of deep space, this is the full extent of the phenomenon. It is not a commentary on the dynamics of reality.

Intergalactic redshift has some surprising ramifications that provide the basis for other global phenomena, including the material density of the universe, the CMB field, and dark matter. Even Zwicky would probably have been surprised to learn just how important this process is.

So why does light lose energy when traveling across broad gulfs of space? Why indeed. This phenomenon has some truly curious properties.

ANCIENT LIGHT

Intergalactic redshift is caused by photons' gradual loss of energy over immense distances. Cosmic equilibrium leaves no other alternative. It is a given and is just as certain as the conservation of energy it obeys. But what causes it?

Its characteristics are:

a) Proportional to distance for cosmically short distances. If light travels twice as far, it loses twice the energy.

b) Proportional to photon energy. Visible light and radio waves from the same source lose the same fraction of their energy.

c) No associated scattering. Light reaching us from distant spiral galaxies preserves exquisite details of their disks' structure.

d) Long-range and weak, requiring ~10 Gly to cause a 50% energy loss.

e) Uniform broadening. The duration of a transient signal grows in direct proportion to the increased wavelength of the individual redshifted photons within it.

f) No refractive frequency dispersion, as is typical of an interaction between light and matter. An ancient pulse's red component arrives at the same time as its blue component, although the pulse itself is broadened in accordance with e) above.

One of intergalactic redshift's more intriguing aspects is that light loses energy *without any observable scattering*. If it were caused by a photon-photon or photon-particle interaction, every incremental energy loss would have a corresponding change in direction. Scattering related to a 5% loss is enough to make celestial images unrecognizable, yet our instruments show galaxies in pristine detail even at energy reductions greater than 10%. Also, scattering is generally not linear with incident energy. It is rarely a situation where *energy loss is proportional to the incident energy*. Furthermore, scattering *requires* a change of direction in order to conserve momentum. Preservation of directional integrity with an energy loss proportional to energy has no precedent in known physical interactions.