Coherent Raman scattering in a low pressure gas.
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Summary.
Karlsson’s redshifts show that “cosmological” redshifts of stars rays stop when absorbed lines reach Lyman alpha frequency of hydrogen atom. A very large number of coherent Raman redshifts of quanta of star light by ~ GHz resonance frequencies in 2P states of H atom explain quasars redshifts, Lyman forests. Correcting Hubble’s rule which exaggerates redshifts close to hot stars, reduced spiral galaxies are stable without dark matter, ...

1. Introduction.
Historic Raman effect studies frequencies of light scattered by an homogeneous medium. Coherent Raman effect (CRS), studies interactions with matter of two known frequencies lights [1]. Here, we suppose that these frequencies are temporally incoherent frequencies in the same light ray. The Raman coherent effect studied here differs from usual coherent Raman in microscopy [1] by the use of a very low pressure gas, interactions of which with light are spatially coherent. Collision of molecules and selection rules needed for light emissions in historic Raman, are replaced by a need of an incident, fully incoherent ray which is amplified at frequencies lower than incident ones.

2. Coherent Raman effect.
Before Einstein’s discovery of coherence of interactions of light with low pressure gases, the study of scattering of light by gases showed that it requires collisions: for example, the sky changes from blue to black in stratosphere, because the density of atoms excited by collision, thus able to scatter light, becomes negligible.

In the upper atmosphere of polar regions, accidental collisions of molecules excited by the “solar wind” of protons and electrons, switch amplifications that start flares up. Can we increase entropy by a coherent Raman excitation of atoms by a stellar ray, excitation which absorbs a quantum from the ray at any frequency and returns a quantum at a lower frequency ?

3. Geometry of light scattering by identical atoms of a low pressure gas.

Let’s remind the propagation of a stellar ray in a large volume very distant from stars.

At any frequency F, the wave surfaces of light emitted by a far star are plane and parallel.

The Huygens wavelets of frequency F-f, (where f is a natural frequency of atoms), induced by atoms located on a wave surface, have, as envelopes, planes parallel to incident wave planes. These emissions are possible because the stellar rays are temporally perfectly incoherent, therefore contain the frequency F-f, thus amplified.

In ray, a quantum hF is replaced, by a quantum h(F-f), temporally incoherently. Atoms get rid of hf energy for the benefit of thermal radiation. Entropy grows.

While the incoherent Raman interactions dissipate much radiated energy into all directions, the
coherent Raman interaction only removes from a ray the energy absorbed by molecules. If this energy is low, of the order of 1GHz noise quanta, a chopping frequency of thermal light, a very large number of interactions can modify, redshift each frequency F without observation of individual quanta. This geometry of quanta transfers from atoms to light is similar to this which generates rays of gas lasers.

4. Atoms involved in cosmic redshifts.

The Lamb shift (1.06 GHz) and fine structure (11 GHz) frequencies of the H atom in 2P state are suitable. The probability of interactions is slightly higher at high optical frequencies F, closer to one GHz resonance. This produces the chromatic dispersion of redshifts. A whole visible spectrum is redshifted with this single chromatic distortion if the number of interactions with the atoms is very large. Show that this source of redshifts works in space.

The study of redshifts of stars and interstellar filaments showed existence of remarkable redshifts [2] leading to Karlsson’s law [3,4], well verified for low redshifts by superposition of lines having different redshifts [5]:

\[ \nu(n) = nK \text{ with } n = 3, 4, 6, \ldots \text{ and Karlsson’s constant } K = 0.062. \]

This result for \( n = 3 \) and 4 shows, using Rydberg’s formula, that Lyman \( \beta \) and \( \gamma \) lines of H atom are shifted to \( \alpha \):

\[
Z(\beta, \alpha) = (\nu \beta - \nu \alpha) / \nu \alpha = \left[ (1 - 1/3^2) - (1 - 1/2^2) \right] / (1 - 1/2^2) \approx 5/27 \approx 0.1852 \approx 3 \times 0.0617.
\]

\[
Z(\gamma, \alpha) = (\nu \gamma - \nu \alpha) / \nu \alpha = \left[ (1 - 1/4^2) - (1 - 1/2^2) \right] / (1 - 1/2^2) = 1/4 = 0.25 = 4 \times 0.0625.
\]

Thus, redshifts stop if an absorbed line reaches Lyman alpha frequency, so that gas lines are visibly absorbed at new positions. This interpretation is confirmed by many coincidences, in spectra of quasars, of lines having different redshifts [5].

A restart of redshifts requires initially a weak redshift possible if energy in light at Lyman beta frequency pumps atoms to high states.

We conclude that redshifts require first a pumping of H atoms to 2P (or higher levels). In \( H_{2P} \), fine structure (11 GHz) or Lamb shift (1.06 GHz).

5. Applications.

5.1 Lyman alpha forest of quasars.

Using bigbang theory rules, for instance a variation of fine structure constant, many pages are needed to explain the “Lyman forests” of quasars. With coherent Raman, it requires only following lines:

Temporal cycle:

In low pressure hydrogen surrounding a quasar, absorption of Lyman alpha lines pumps atoms to 2P states, generating a redshift of observed exciting ray and an increase of amplification at Lyman alpha frequencies. As in an aurora borealis, very accidental collisions of atoms initiate few light rays which are strongly amplified as a flare. This coherent super-emission produces super-absorptions of most light rays, in particular of star-observed ray, writing a very dark ray in spectrum.

This cycle restarts if absorption of light at Lyman beta frequency is strong enough to produce a redshift able to shift absorbed frequencies out Lyman alpha.
5.2 *Hubble's law does not evaluate distances, but the column densities of H$_2$P atoms.*

Thus, close to hot stars, distances on the maps of galaxies are exaggerated by Hubble’s law, inflating bubbles. The distance, thus the size of spiral galaxies is reduced. Smaller, these galaxies are stable without dark matter. Fine structure constant remains constant because involved Raman produces the observed chromatic dispersion.

6. Conclusion.
Astrophysicists should remember spatial coherence of light interactions with low pressure gas.

7. References.


