So-called "cosmological redshifts" by coherent spectroscopy.

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Abstract

Karlsson's 3K or 4K redshifts push Lyman beta or gamma absorbed lines of H atom, to alpha line. In space, during this shift, Lyman alpha absorption excites H atoms to 2P states. In these atoms, coherent Raman exchanges hyperfine quanta of energy between $2P\frac{1}{2}$ and $2P\frac{3}{2}$ levels, producing small frequency jumps of exciting light, sums of which may be observed or lost in background light. To increase entropy, observed frequencies decrease. Thus Hubble's redshifts evaluate column densities of excited H. No need of dark matter, variation of fine structure constant, and so on.

1 Introduction

It was very difficult to study redshifts of light emitted by stars because many theories were set using an expansion of Universe. But dominating theories are founded on Einstein drafts and do not have serious relations with laboratory experiments. Astronomical observations, in particular of quasars show strange periodicities. Should astrophysicists use theory of optical coherence to explain these periodicities?

Coherent optical effects; 030.5620 Radiative transfers

2 Frequency shifts in interstellar, low pressure atomic hydrogen, without coherent spectroscopy.

2.1 Observation of redshifts.

Burbidge[1] and Karlsson [2] studied redshifts (relative frequency shifts) of light emitted by stars. Karlsson's formula shows that redshifts are often quantized, with values given by formula Z(n)= nK, where n is an integer of serie 3, 4, ..., and K Karlsson's constant 0.062. This result for n=3 or 4 is verified using Rydberg's formula:

$Z_{(\beta,\alpha)} = (\nu_\beta - \nu_\alpha)/\nu_\alpha = [(1 - 1/3^2 - (1 - 1/2^2)]/(1 - 1/2^2)] \approx 5/27 \approx 0.1852 \approx 3 * 0.0617$;

$Z_{(\gamma,\alpha)} = (\nu_\gamma - \nu_\alpha)/\nu_\alpha = [(1 - 1/4^2 - (1 - 1/2^2)]/(1 - 1/2^2)] = 1/4 = 0,25 = 4 * 0.0625$;

But formula works well only for n = 3 or 4 !

2.2 Interpretation of Karlsson's formula: Origin of redshifts.

Redshifted Lyman beta line is not observed because it is exactly shifted on alpha line. Many such coincidences shows that absence of alpha absorption stops redshifts: redshifts require a Lyman alpha absorption generating H atoms in 2P state .

2.3 Improvement of Karlsson's formula.

Karlsson's formula does not work well for $n > 4$ because successve redshifts do not add units to n in Karlsson's formula. Assuming that redshifts add as successive Doppler redshifts, better redshifts, thus good spectra, are obtained. However, at low frequencies it appears a systematic error which may show that redshifts have a chromatic dispersion. This should be verified with very good spectra.

3 Redshift mechanism.

3.1 Structure of ordinary, thermal origin light.

Self interference of ordinary light in a Michelson interferometer works if difference of paths corresponds to less than 1 nanosecond propagation time, so that this light may be represented by 1 nanosecond pulses. Thus Fourier spectrum of thermal light is over 1 GHz.

3.2 Recall of coherent interactions of light and matter.

Optical coherence allows large interactions of light with matter without a geometric dispersion of rays.

Usual rules do not work for coherent interactions: lasers use often forbidden lines. Incoherent emissions are replaced by amplification of exciting rays, becoming often superradiant, while most other rays are strongly absorbed: For instance, in light pumped lasers (pink ruby, neodyme YAG, dye, ...) exciting light is strongly absorbed when laser beam switches on.

3.3 Role of spin-orbit energy in mechanism of redshifts.

Coincidence of shifted beta line with unshifted alpha in quasar spectra suggests that **alpha absorption produces redshifts until an absorbed line stops**

redshift by this coincidence. That is atoms in 2P states produce redshifts. How ?

State 2P is split by two values of the total angular momentum j=1/2 or 3/2: State $2P_{3/2}$ is higher than state $2P_{1/2}$ by 12 kHz , while Lambshift 1S-2P is 1,057 MHz.

A Raman interaction using both transitions of doublet Lyman alpha is coherent because initial and shifted frequencies are in the Fourier spectrum of pulses. Thus a quantum of hyperfine energy is transferred between the total angular mementum of atom and observed ray. A similar transfer of energy may involve the spin-orbit momentum of atom and a background ray. As background radiation is very cold, it absorbs energy lost by the ray, to increase entropy.

4 Applications.

4.1 Quasar spectra.

Suppose that a very hot source is surrounded by low pressure, relatively cold atomic hydrogen.

Atoms are excited to 2P state until a coherent, superradiant flare bursts at Lyman alpha. During the flare, absorption of gas at superradiant frequency becomes very large, so that a sharp, dark line of a "Lyman alpha forest" appears. After the flare, de-excited gas is pumped, preparing a new flare, a new, shifted forest line, and so on, until a shifted absorbed line (for instance Lyman beta) reaches Lyman alpha frequency. Then redshift stops and spectrum of local gas is written into light.

If shifted emission spectrum is bright at Lyman beta frequency, a weak redshift by beta excited atoms pushes absorbed line off Lyman alpha frequency, so that redshifts by 2P atoms restart.

The process stops if total redshift pushes to beta frequency a spectral region off light emission of quasar.

4.2 New Hubble law.

This mechanism may be added to cosmological redshift, or replace it. It shows that Hubbles law exaggerates distances where density of excited atoms is large, in particular close to hot stars. Thus:

- Spiral galaxies are closer, smaller so that their stability does not require dark matter.
- Bubbles inflate maps of galaxies.
- For generation of spectra of H atoms in quasars, see previous subsection.

4.3 Anomalous accelerations.

- Outside Strömgren sphere of the Sun, protons and electrons of solar wind are cool enough to combine into excited hydrogen. This hydrogen is able to transfer energy from Sunlight to microwaves used to evaluate distance and speed of Pioneer probes. Thus they seem have an anomalous acceleration.

5 Conclusion.

Find other applications !

Bibliography

[1] Burbidge, G. The Distribution of Redshifts in Quasi-Stellar Objects, N-Systems and Some Radio and Compact Galaxies. ApJ. 154, L41-L48 (1968).

[2] Karlsson, K. G. Quasar redshifts and nearby galaxies. Astron. Astrophys. 239, 50-56 (1990).