Theory of spectra of quasars.

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Abstract

We extend our theory of spectra of sharp saturated lines of quasars to include high redshift spectral regions, and Gunn-Peterson effect. This theory requires only laboratory-verified physical laws, using coherent interactions of light with matter.

Keywords: Line:formation. Radiative transfer. Scattering.

98.62.Ra Intergalactic matter; quasar absorption and emission-line systems; Lyman forest

290.5910 Scattering, stimulated Raman

190.2640 Nonlinear optics : Stimulated scattering, modulation, etc.

1 Introduction.

Usual studies of spectra of quasars use the hypothesis of "Big Bang", founded on a particular, but discussed application of general relativity, Λ-CDM. We use only well verified experimentally, standard physics including coherent interactions of light with matter.

A previous paper [1] explains sharp, saturated absorption lines of H atom in quasar spectra by propagation of light in very low pressure, 1S atomic hydrogen surrounding a star, down to a distance R_3 from center of star, where pressure is too high for "Impulsive Stimulated Raman Scatterings"(ISRS):

Redshifts result from a parametric effect (CREIL: Coherent Raman Effect on Incoherent Lights) made up of several ISRS bound by hyperfine resonances in excited states of very low pressure hydrogen atom which plays the role of catalyst. Need of such physical state of hydrogen results from conditions of coherence written by G. L. Lamb [2]: Light must be made of pulses "shorter

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than all involved time constants ". Ordinary, temporally incoherent light is made of pulses around 1 nanosecond long, so that pressure of atomic hydrogen must be very low; period of Raman (hyperfine) resonance is only longer than 1 ns in excited states of H atom.

Coherent transfers of energy by CREIL between light and cold electromagnetic background shift frequencies and increase entropy. Here, theory is extended to include light propagation in higher pressure regions, at verious distances R from center of the quasar.

2 Propagation of light for $R < R_3$.

In a gas, by Lamb's conditions, pressure must be very low, so that collisional time is larger than 1 nanoseconde. In very high pressure inside a star, atoms cannot move easily, medium is similar to an isotropic crystal. Thus condition of stability (no collision during a light pulse) is fulfilled, CREIL works. This is observed for the Sun where high energy UV-X lines emitted deeply are redshifted, while lower energy lines emitted closer to surface are blueshifted [3, 4].

Set r distances from center of studied quasar. For $r < R_1$, protons and electrons merge into neutrons. For $R_1 < r < R_2$, medium is dense and hot, X emission of spectral lines evolve from hard X from heavy atoms, to UV for light atoms. Thus, spectra of heavy atoms may be strongly redshifted, while spectrum of lighter atoms is blueshifted except if its path to surface (r = R_2) is negligible.

Between R_2 and R_3, the gas absorbs light, but there is no redshift, thus, absorption is strong, pressure may be large enough for absorption of very broad lines. It seems to be Gunn-Peterson effect.

3 Conclusion.

Redshifts in quasar spectra results from the sets of ISRS which make CREIL effect. An extension of CREIL to other problems provides a lot of simple explanations (see [1]). Negligence knocks not only ISRS but also another important coherent interaction of light with matter: superradiance which, for instance, shows the limbs of Strömgren spheres.

References

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