The Origin of the 3° K Radiation

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It is recalled that one of the most fundamental laws of physics leads to the prediction that all matter emits electromagnetic radiation. That radiation, called Planck radiation, covers an electromagnetic spectrum that is characterized by the absolute temperature of the emitting matter. From astronomical observations, we know that most matter in the universe is in the gaseous phase at 3° K. Stars, of course, are much hotter. The characteristic Planck spectrum, corresponding to 3° K, is actually observed in the universe exactly as required.

However, in the standard model of the universe, the simple fundamental Planck law has been ignored. It is claimed that the observed radiation comes from a combination of complicated hypotheses, involving an elaborate creation event called the Big Bang. After this event, the radiation would have been emitted at a single instant when matter became decoupled from radiation. Finally, that radiation would have been shifted, increasing its wavelength about 1000 times. We show that the 3° K radiation observed is simply the Planck radiation emitted by gaseous matter at 3° K.

Usual Interpretation of the 3° K Radiation

One of the most frequently used arguments in favor of the Big Bang hypothesis is the observation of the 3°K radiation from space. In this hypothesis it is considered that the universe started as an expanding mass of matter at an extremely high temperature. The density of that very dense matter was originally so high as to be opaque, and light could not pass through it. During the expansion, the temperature and the density of the universe gradually decreased, so that the universe became more and more transparent. When the temperature of this young universe reached about 3000°K, about 15 billion years ago, the universe became sufficiently transparent so that the radiation emitted could move across cosmological distances without being absorbed significantly. It is said that radiation then became decoupled from matter. It is that radiation, still traveling through space today, which we allegedly observe in the form of 3°K radiation.

It must be noted that nothing in the description given above has ever been witnessed directly. It is more like fiction. The Big Bang hypothesis must be submitted to tests. Many examples of failures of those tests have been shown (Marmet 1988, 1992; Marmet and Reber 1989). For example, if the universe started as an infinitely dense concentration of matter, it must presumably have been a Black Hole. However, relativity shows that Black Holes cannot expand. The Big Bang is therefore incompatible with the early expansion of the universe when relativity is taken into account (Marmet 1990). As mentioned previously, the Big Bang hypothesis is another creationist theory; the only difference from the usual theory, which claims that the universe started in 4000 B.C., is the change of the creation date to 12 billion years ago.

Structure of Atomic H and Molecular Hydrogen H_2

Before we can understand the origin of the 3°K radiation observed in space, we need to know the properties of matter filling space. Astronomical observations show that there is a very large quantity of atomic hydrogen (H) in the universe. Atomic hydrogen is composed of one electron bound to a proton, forming a neutral hydrogen atom. Protons, like electrons, have a fundamental property called “spin”. In a hydrogen atom, the spins are coupled either parallel or anti parallel. The interesting point is that a transition from a parallel to an anti-parallel coupling of spins in hydrogen (and *vice versa*) takes place when hydrogen emits (or absorbs) electromagnetic radiation at a wavelength of 21 cm. Consequently, one can determine the amount of atomic hydrogen H in the universe by measuring the amount of radiation absorbed (or emitted) at 21 cm. Actual observations of the 21 cm line prove that there is a very large amount of atomic hydrogen in the universe.

It is well known in basic physics and chemistry that atomic hydrogen H is quite unstable. Spectroscopy reveals that when there is a given quantity of atomic hydrogen in a given volume, the atoms react with one another to form molecular hydrogen (H_2). This is unlike helium and other inert gases, which remain mono-atomic. Atomic hydrogen reacts so readily that it is impossible to buy or keep any quantity of stable atomic hydrogen, because atoms of atomic hydrogen combine in pairs to produce very stable bound H_2 molecules. Molecular H_2 is extremely stable at normal pressure down to the most extreme vacuum. We can expect that, after billions of years, a significant fraction of atomic hydrogen H in the universe has combined to form the extremely stable molecular hydrogen (H_2). The recombination mechanisms will be discussed below. We might then ask why we do not detect a large amount of molecular hydrogen H_2 in space. The conventional answer is: because it does not exist. Such a naive answer requires closer examination.

Let us examine how molecular hydrogen H_2 can be detected in space. In molecular hydrogen, there are two protons and two electrons bound together. The binding of these particles is such that interaction with visible or infrared light cannot break or even excite that bond. The transition is forbidden for a dipole transition. Molecular H_2 is among the most transparent gases in the universe. Consequently, one cannot hope to detect free H_2 in space by usual spectroscopic means.

Absence of Optical Transitions in H_2

Since there are no optically allowed electronic transitions in H_2 in the currently observed range of frequencies, one might argue that one could make H_2 vibrate or rotate using the appropriate frequency of electromagnetic radiation. Such mechanisms do exist in principle, but they are forbidden in practice due to the absence of electric or magnetic dipole. We shall illustrate the extreme difficulty of detecting H_2.

Rotational transitions of H_2 are located in the radio range, where we have close to the maximum sensitivity of detection of E-M radiation. In spectroscopy, we are used to dipole transitions that take place in about 10^{-8} sec. However, the lifetime of the first rotational state of hydrogen H_2 is so long that spontaneous emission is practically nonexistent. A transition from the second rotational state, which is relatively much more probable, would require about 25 billion seconds (1000 years). It is not until the sixth state that the transition time becomes 25 million seconds. This last transition is about 10 times less probable that a normal dipole transition. Different values are given on Table 1.

Table 1. Lifetimes of Transitions in Molecular H_2.

Nature of the Transition	Lifetime (in seconds) for Normal Dipole Transitions
Normal dipole transitions	$\approx 10^{8}$
H_2 from v = 1	$> 2.5 \times 10^{12}$
H_2 from v = 2	$> 2.5 \times 10^{10}$
H_2 from v = 6	$> 2.5 \times 10^{7}$

Transitions in hydrogen are millions of millions of times slower than normal transitions.

Stability of H_2 Due to Ionizing Radiation

We will now see that the presence of ionizing radiation cannot explain a sharp decrease in the concentration of H_2. It has been claimed that H_2 cannot exist in space, because it would dissociate due to radiation. Such an assertion is not acceptable without a serious evaluation of the probability of reaction by the H_2 molecule with the ionizing radiation of space.

Astrophysicists argue that, not long after the Big Bang, radiation was decoupled from matter and the density of the universe was so low that E-M radiation could travel through most of the universe without being absorbed. If this radiation is decoupled from matter, there is no reason why it should be able to ionize or dissociate so much H_2. The decoupling of radiation in the universe contradicts the hypothesis of dissociation or ionization of matter in space.

A second argument emerges when one compares the probability of ionizing H with H_2 due to the ionizing radiation in space. Ionizing radiation in space, can ionize atomic H at least as easily as it can ionize molecular hydrogen H_2. In fact, atomic H is somewhat easier to ionize than H_2, since it takes only 13.6 eV to ionize H and 15.4 eV to ionize H_2. All the photons in space between 13.6 and 15.4 eV can ionize H without ionizing H_2. This radiation leaves molecular hydrogen undisturbed.

We know that a large amount of atomic hydrogen H is actually observed in space. This proves that the amount of radiation in space is insufficient to ionize a very large proportion of H, an observation that is quite in agreement with the argument that radiation is decoupled from matter, as seen above. Since there is not enough radiation to ionize (destroy) atomic hydrogen H in space, we must conclude that this same radiation is insufficient to ionize (or dissociate) H_2.

Relative Recombining in H and H_2.

We know that the recombination of a proton and an electron is a two-body recombination, just as in the case of the binding of two atomic hydrogen atoms H form to H_2. In order to evaluate the relative importance between the recombination of a pair of H atoms into H_2 and the recombination of an electron and proton to form H, we

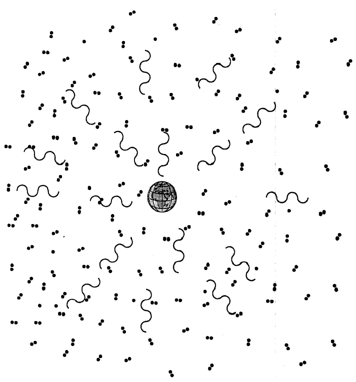

Figure 1 - Isotropic 3° K radiation from H_2 in space

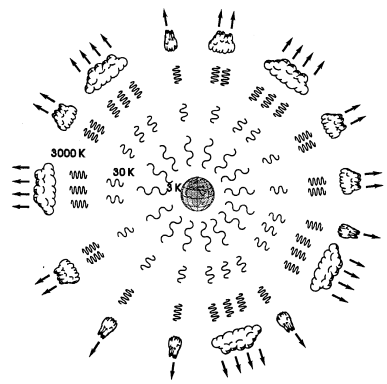

Figure 2 - Anisotropic 3° K radiation from the expanding primeval matter

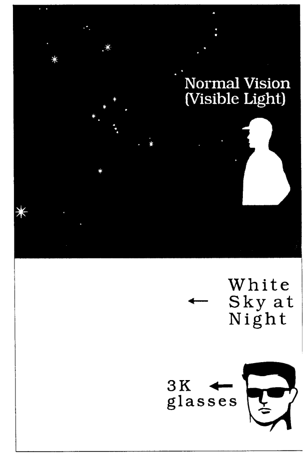

Figure 3 - Olbers' paradox

shall compare the two mechanisms. Since H is observed, this means that there is enough two-body recombination of $p^+ + e^-$ in space to produce H. Even if an electron attracts a proton, a collision does not lead to a recombination unless radiation is emitted. However, we can see that the recombination of a pair of H (into H_2) relies on the same two-body recombination mechanism as the electron-proton recombination (to form H).

We conclude from the above that, not only is there not enough radiation in space to destroy H_2 (since H is subject to the same radiation and is actually observed), but furthermore, H_2 can be recombined by a similar two-body mechanism as for H (from a proton plus an electron).

Perfect Isotropy of Planck Radiation

Since we are completely surrounded by the matter of the universe, it is well known that the Planck radiation observed from inside our local volume of space at 3° K(during the last billion years) must be perfectly isotropic. This is in perfect agreement with observational data.

It is inconceivable that the matter in space around us (a billion light year around us) should not emit Planck radiation. There is no reason why this matter should not have been emitting Planck radiation during the last billion years. Where is this radiation?

Figure 1 shows the region of the heaven around the earth filled with molecular H_2 at 3° K. Such a gas emits 3° K Planck radiation in all directions. This leads to the 3° K isotropic radiation, as observed in space. However, the primeval radiation has been calculated to be non isotropic.

In the Big Bang scenario, matter would have been scattered in the universe, and it should move away at a relativistic velocity. This matter is presumed to be moving in clumps, since galaxies had to have formed at some point. This is the reason why the Big Bang model leads to an anisotropic 3° K radiation in space. Yet such a high degree of anisotropy has never been observed in the sky.

The 3° K Radiation Explains Olbers' Paradox

The astronomer Heinrich Olbers was curious as to why the night sky should be dark. He conceived the following paradox. When an observer is looking in a particular direction toward an unlimited homogeneous universe, a star should always be visible in any direction, since there is no limit in the distance of observation and since the volume increases as the third power of the radius. Consequently, Olbers logically concluded that the night sky should be bright. Some excellent books (*e.g.* Harrison 1987) have discussed various aspects of this paradox.

If we adopt the view of the universe at 3°K described here, the Olbers paradox vanishes in the following way. We must recall that Olbers did not know Planck's law of radiation. He assumed that only the hottest bodies in the universe were emitting E-M radiation. Olbers did not realize that, at the temperature of the universe, radiation is also emitted at 3° K by all matter.

Figure 3 illustrates the Olbers' paradox. (Top) At Night, an observer sees only the hottest bodies (stars) because his eyes are not sensitive to very long wavelengths. (Bottom) At night, an observer using a special device (called 3° K glasses) would not see that the sky is quite bright when observed at the characteristic E-F frequency emitted at 21 cm.

When Olbers claimed that the night sky must be bright, he did not specify at which wavelength. It is an accident of nature that our eyes can see only in the range of wavelengths called visible light. Since the temperature of the universe is 3° K, Olbers was right to claim that the night sky should be bright, because it is actually very bright at a wavelength (about 1 mm) compatible with the temperature (3° K) of the universe. This solution of the Olbers' paradox was first proposed in 1988 by the author (Marmet 1988). There we showed that the 3°K radiation comes from all gases at 3°Kin the universe. The high degree of isotropy of the observed 3°K radiation proves the gaseous origin of the 3°K emitter of radiation. Thus, the solution of the Olbers' paradox is also the solution to the origin of the 3°K radiation in the universe, *i.e.* this radiation is the Planck radiation emitted by most of the interstellar gas in the universe.

Conclusion

Since we have seen that the normal chemical reaction in space strongly favors the recombination of H into H_2 (and not the reverse), we conclude that there has to be a large amount of H_2 in space.

The high degree of homogeneity of the 3°K radiation, the absolute need to have H_2 in space and the absence of the hypothetical anisotropic radiation expected from the Big Bang, showing the non-primeval origin of the background radiation observed from space, constitute experimental proof that the Big Bang never happened. More complete arguments in favor of the Planck radiation as the ultimate source of the 3°K radiation in the Universe were recently presented at an international meeting (Marmet 1994).

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UPCOMING CONFERENCE

SEVENTH LOMONOSOV CONFERENCE ON ELEMENTARY PARTICLE PHYSICS

"Problems of Fundamental Physics"

The Conference on "PROBLEMS OF FUNDAMENTAL PHYSICS" (the 7th Lomonosov Conference on Elementary Particle Physics) will be held from 24 to 30, August, 1995, at Moscow State University, Moscow, Russia.

The idea to organize this conference was put forward by the Interregional Centre for Advanced Studies in cooperation with the Nuclear Physics Institute and Department of Theoretical Physics of the Moscow State University and supported by the Joint Institute for Nuclear Research (Dubna), the Institute for High Energy Physics (Protvino) and the Institute for Nuclear Research (Moscow).

The year 1995 marks the ninetieth anniversary of the special theory of relativity (1905), the eightieth anniversary of the general theory of relativity (1915) and also seventy years after the foundations of quantum mechanics were formulated (1925-1926). The aim of the Conference is to review the present situation and results obtained to the end of the twentieth century and discuss perspectives for the future.

It is supposed that the Conference will include the following sets of questions:

1. Quantum mechanics and paradoxes (different interpretations in QM, realism, locality, hidden variables *etc.*);
2. Foundations of theory of space-time (developments of theory of relativity and gravitation);
3. Frontiers of particle physics (beyond the Standard Model, strings, particle astrophysics, neutrino mass and oscillations *etc.*).

An important feature of the Conference will be the discussions of fundamental problems of quantum and particle physics.

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