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GOLDEN OLDIE EDITORIAL

Editorial note to: A. G. Doroshkevich and I. D. Novikov, Mean density of radiation in the metagalaxy and certain problems in relativistic cosmology

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In this paper the authors estimate the cosmological radiation from galaxies over the frequency range of 10^8Hz to 10^{15}Hz. Using different models they study its dependence on the assumed model of galaxy evolution and on cosmology. They consider three cosmological models: one is a low density model, $\Omega_m \simeq 0.05$, the other two are spatially flat models, $\Omega = 1$ where the energy density is dominated either by galaxies ($P = 0$) or by massless neutrinos ($P = \rho/3$). They model galactic radiation by the superposition of two thermal spectra in the optical and a power law spectrum, that may or may not evolve with redshift, in the radio regime. The models shown in Fig. 1 are compared with only 2 data points which determine the amplitudes. But this is not the most important result of the paper.

The first important result is Fig. 2, where it is shown that a model with non-evolving galaxies in an expanding Universe is in excellent agreement with data on intergalactic energy flux as a function of redshift. This can be considered as an independent confirmation of the expansion of the Universe, which, however was well accepted at the time.

The second, much more important, point is the finding that a Planck spectrum with temperature $T = (1 - 10)$K, i.e. the Cosmic Microwave Background (CMB), significantly exceeds the galactic radiation in the frequency interval of 10^9Hz to about 10^{11}Hz. The CMB is actually $4-5$ orders of magnitude more intense in this frequency

The republication of the original paper can be found in this issue following the editorial note and online via https://doi.org/10.1007/s10714-018-2441-x.

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range. They show a CMB spectrum with $T = 1$K superimposed on the galactic emission in panel C of Fig. 1.

The authors name the search for this radiation an important test of "Gamow's theory" [1]. They are therefore well aware of Gamow's prediction which is not mentioned at all a year later when this radiation was actually discovered by Penzias and Wilson [2] and interpreted by Dicke et al. [3]. Surprisingly, Soviet physicists seem to have had a better knowledge of the American literature than the Americans themselves ([1] was published in Rev. Mod. Phys., a journal of the American Physical Society). However, the authors also mention a measurement of (2.3 ± 0.2)K, which coincides with the estimated 'atmospheric noise' level of $T \simeq 2.4$K [4]. They therefore recommend a satellite experiment to detect 'Gamow's' radiation. With [4] they cite measurements performed with the Bell Lab 20-ft Horn reflector, which in the meantime had been improved to reduce the noise and, in the very year they published their paper, was actually used to (accidentally) *detect* the CMB!

In his recollection of Soviet cosmology in the 1960s [5], Novikov remembers having called up several Soviet radio astronomers to ask whether they had detected a cosmic background radiation in the millimeter to centimeter wavelength range, but did not obtain any positive response. Only much later (in 1983) did the radio astronomer Tigran A. Shmaonov remember that he had actually reported a background radiation of $T = 4 \pm 3$K, which he had measured with an antenna similar to the Horn reflector during his PhD thesis published in 1957.

In order to appreciate this pioneering paper, the modern reader might need some translation: The expanding Universe is called the 'Metagalaxy' and the unit Hz is denoted as 'cps' (cycles per second).

Andrei Georgievich Doroshkevich – a brief biography

By A. G. Doroshkevich

I was born on 22nd January 1937 in Moscow. In 1960 I graduated from Moscow State University and until 1997 I worked (with Ya.B. Zel'dovich) in the Institute of Applied Mathematics as scientist, senior and leading scientist. In 1995 – 2005 I worked as a professor in the Astro Space Center of the Niels Bohr Institute, Copenhagen, Denmark. Since 2005 I have been leading scientist and head of department in the P.N. Lebedev Physical Institute of the Russian Academy of Sciences. I am a Doctor habilitatus (1980). My main scientific interests are concentrated in cosmology and General Relativity. I have published 185 scientific papers.

Note by the Golden Oldies editor

A brief biography of Igor D. Novikov was published with the editorial note to Golden Oldie number 23, Gen. Relativ. Gravit. **33**, 2255-2258 (2001). Novikov's remarks on the work republished here are cited above [5]. Remarks on this paper by Doroshkevich appear in the same volume.

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