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Change in the brightness of the cosmic X-ray, soft gamma-ray and radio background toward clusters of galaxies

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We show that Compton scattering by electrons of the hot intergalactic gas in galaxy clusters should lead to peculiar distortions of the cosmic background X-ray and soft gamma-ray radiation - an increase in its brightness at energies smaller than 60-100 keV and a drop at higher energies. In the cluster frame the maximum of the background decrease occurs at ˜500-600 keV due to the recoil effect. The photoionization of hydrogen- and helium-like iron and nickel ions leads to additional distortions in the background spectrum - a strong absorption line at ˜9 keV (and also to an absorption jump at ˜2 keV for cold clusters). Also, we explore the possibility of detecting the excess of the cosmic radio background toward galaxy clusters due to its scattering by electrons (which should replace the known decrement of the cosmic microwave background at higher frequencies). We note that in many cases the measurement of the excess will be hindered by the thermal (bremsstrahlung) radiation from the intergalactic gas and the scattered radio emission from cluster galaxies associated with their past activity (and the synchrotron radiation from ejected relativistic electrons). We show that hot ($kT > 8$ keV) clusters at high ($z > 0.5$) redshifts are most promising for such measurements.

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