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Implications of magnetic field on IGM temperature and tSZ effect in presence of Baryon-DM interaction

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We investigate the combined effect of cosmic magnetic field and a possible non-standard interaction between baryons and dark matter (DM) on the thermal Sunyaev–Zel'dovich (tSZ) effect which depends on the temperature and the ionization state of the intergalactic medium. The drag force between the baryons and DM due to the relative velocity between them, and their temperature difference results in heat transfer between these two species. At the same time, the ambipolar diffusion and the decaying magnetic turbulence tends to heat up the baryons. This interplay of these two processes give rise to different evolution histories of the thermal and ionization state of the universe and hence influences the cosmic microwave background (CMB) spectrum at small scales through the tSZ effect. In this work, we have computed the evolution of the temperature, ionization fraction, and the y-parameter of the CMB for different strengths of the magnetic field and the interaction cross-section. We note that the y-parameter can be significantly enhanced with the inclusion of magnetic field and baryon–DM interaction as compared to the case when these are absent. The enhancement depends on the strength of the magnetic field.

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