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New Aspects of Millicharged Dark Matter at 21-cm

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If a component of dark matter is millicharged, dark matter-baryon scattering can induce large effects in the 21-cm global signal by cooling the baryons. This can be achieved without being excluded by other cosmological, astrophysical or terrestrial constraints. We point out two important effects which have been overlooked in previous analyses. First, introducing a dark interaction between the millicharged component and the neutral component of dark matter increases the heat capacity of the dark sector, making the cooling process more efficient at higher dark matter masses. Second, the scattering of millicharged dark matter off neutral hydrogen and helium is an important effect that may dominate the cooling of baryons during the cosmic dark ages. Due to a combination of these two effects, the anomalous 21-cm global signal observed by the EDGES collaboration can now be explained by a sub-percent millicharged component of dark matter with a mass as large as 50 GeV. Interestingly, the cross section required to fit this signal lies exactly in the allowed window for strongly interacting dark matter, in between the shielding regime of direct detection experiments and the current bounds from astrophysics and colliders.

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