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Dipole Moment Bounds on Dark Matter Annihilation

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$g-2$ correction has been accurately measured in the E821 experiment at Brookhaven National Lab (BNL). Yet, there remains a 3 sigma difference between experiment and theory.

One way that this discrepancy can be interpreted is by new particles running in the loop. The smallness of this discrepancy provides a tight constraint on its coupling. This bound is then applied to constrain the annihilation cross section.

We find that the bound on annihilation to the electrons is $4.0 \times 10^{-7} \text{pb} + 8.8 \times 10^{-15} \text{pb}$ and the muons is $5.6 \times 10^{-4} \text{pb} + 180 \text{pb}$, in the limit where the mediator is much heavier than dark matter. The parentheses indicate the dipole moment used to obtain the values. It is interesting to note that only the annihilation to muons through a CP violating (EDM) coupling is not excluded.

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