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Gas-rich dwarf galaxies as powerful sub-GeV dark matter detectors

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Dwarf galaxies are relatively pristine objects for testing dark matter microphysics due to weak baryonic feedback in them. We use a particular class of dwarfs which are gas-rich to probe DM interactions with ordinary matter. We require the rate of heat exchange between DM and gas to not exceed the low radiative cooling rate of the gas. This gives strong constraints on popular DM models: our constraints on axion like particles (ALPs), millicharged DM and magnetic PBHs are complementary and comparable to other probes, while they are the strongest to date for dark photon DM for $10^{-20} < m_{\rm DM} < 10^{-14} eV$. We therefore show that observations of gas-rich dwarfs from current and upcoming optical and 21cm surveys open a new way to probe physics beyond the standard model.

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