

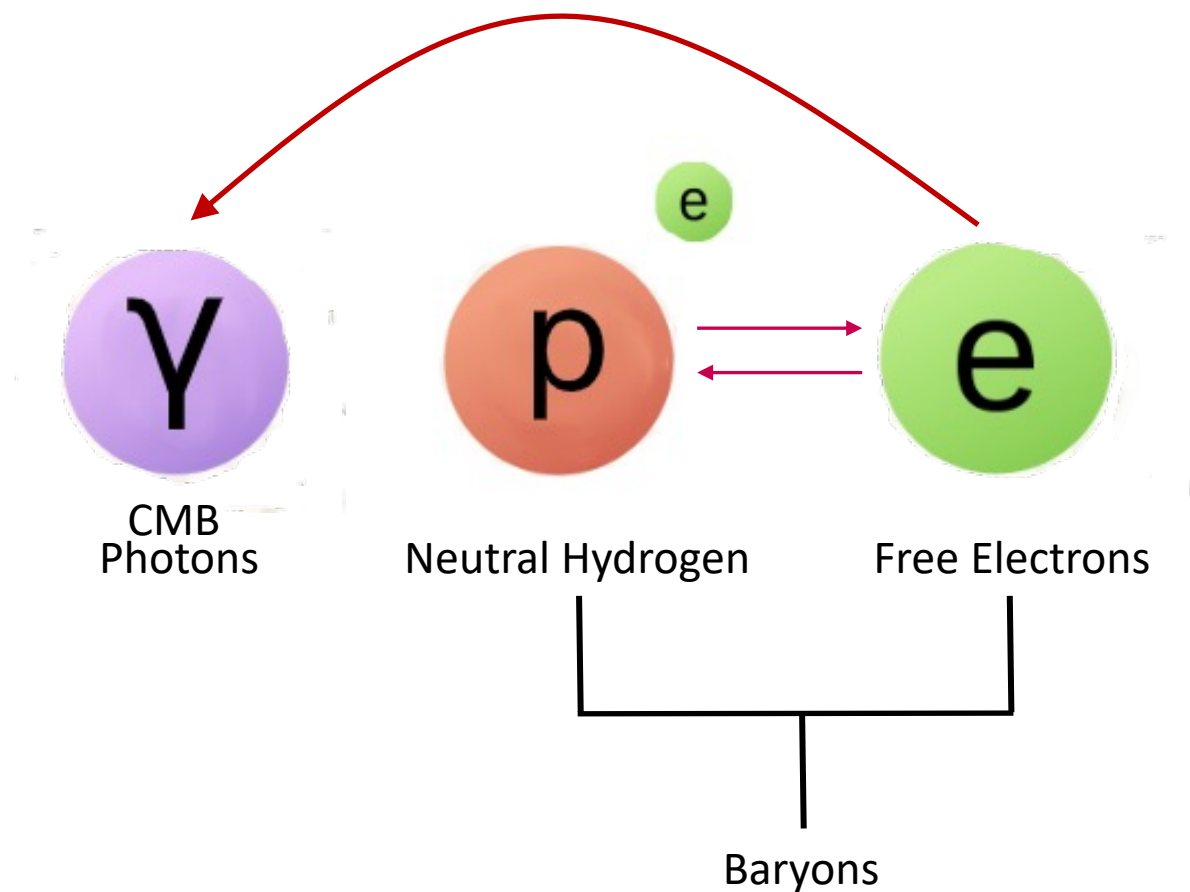
Direct Millicharged Dark Matter Cannot Explain the Anomalous EDGES Signal

Cyril Creque-Sarbinowski

Bowdoin 2019

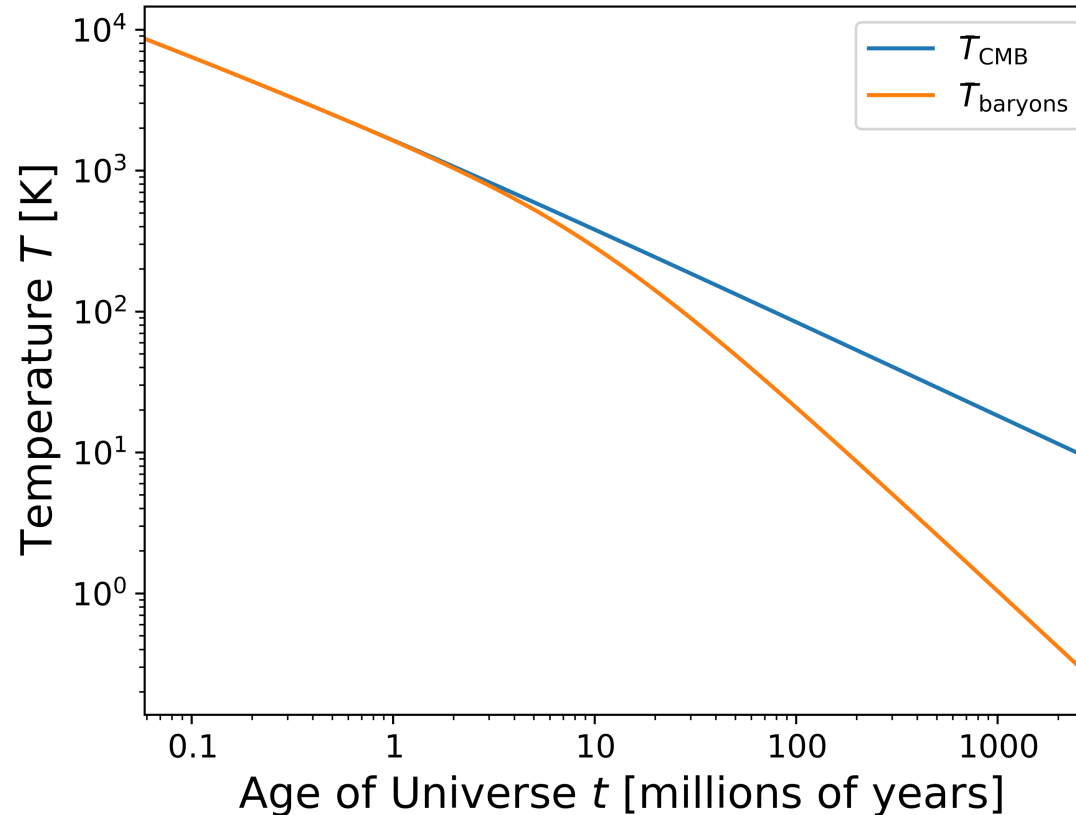
Enter the Dark Ages

Main Players:

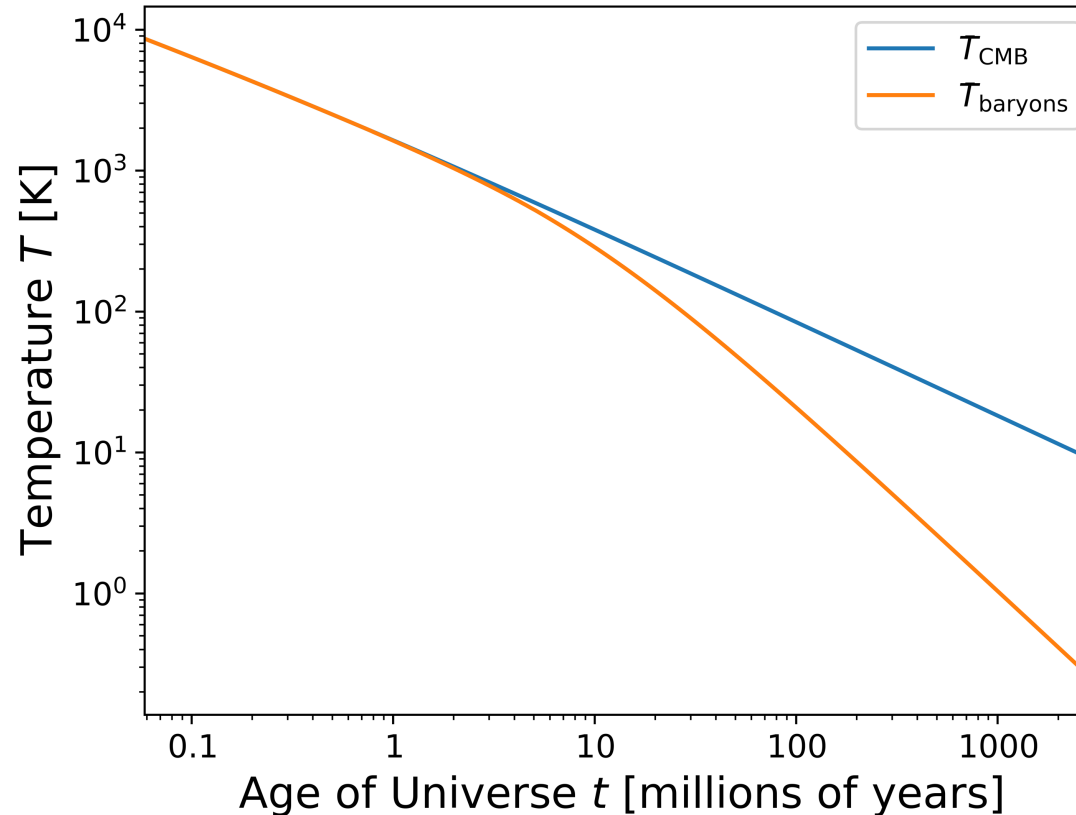
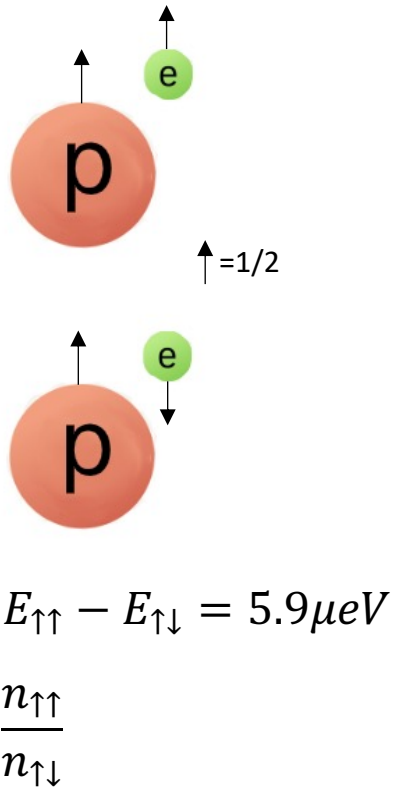


$A \longrightarrow B = \text{„A scatters off B”} \neq \text{„B scatters off A”}$

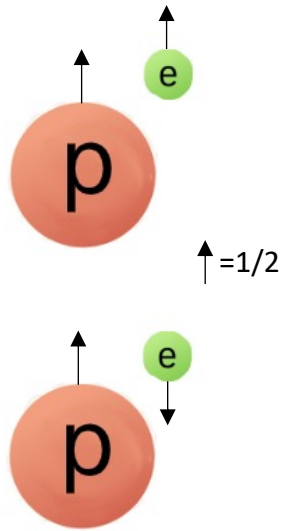
Temperature Evolution during Dark Ages



Temperature Evolution during Dark Ages

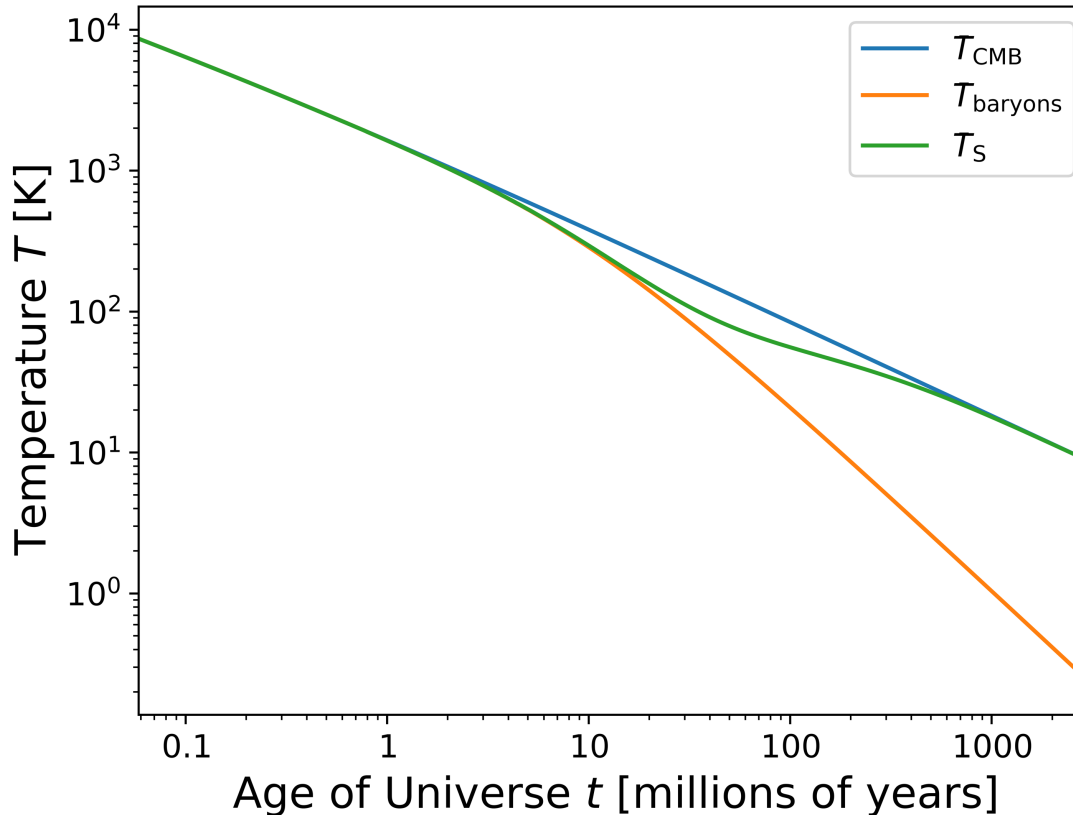


Temperature Evolution during Dark Ages



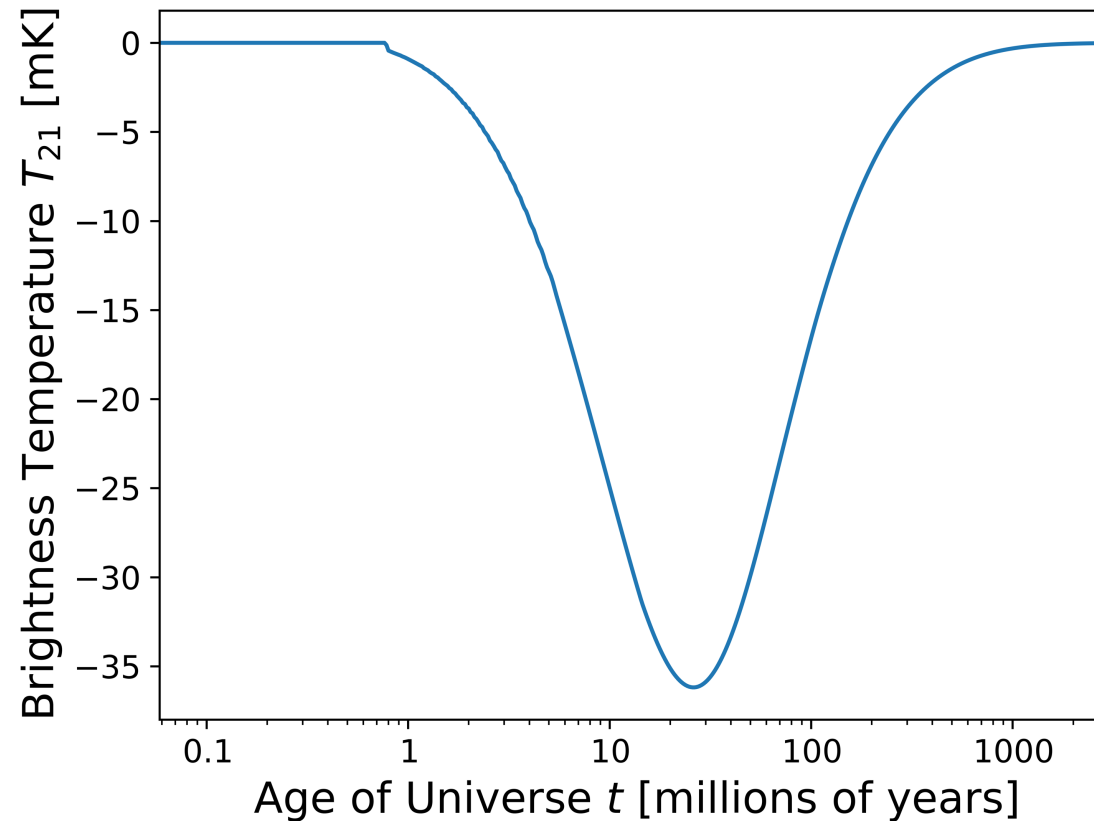
$$E_{\uparrow\uparrow} - E_{\uparrow\downarrow} = 5.9\mu\text{eV}$$

$$\frac{n_{\uparrow\uparrow}}{n_{\uparrow\downarrow}} = 3e^{-(E_{\uparrow\uparrow}-E_{\uparrow\downarrow})/(k_B T_S)}$$

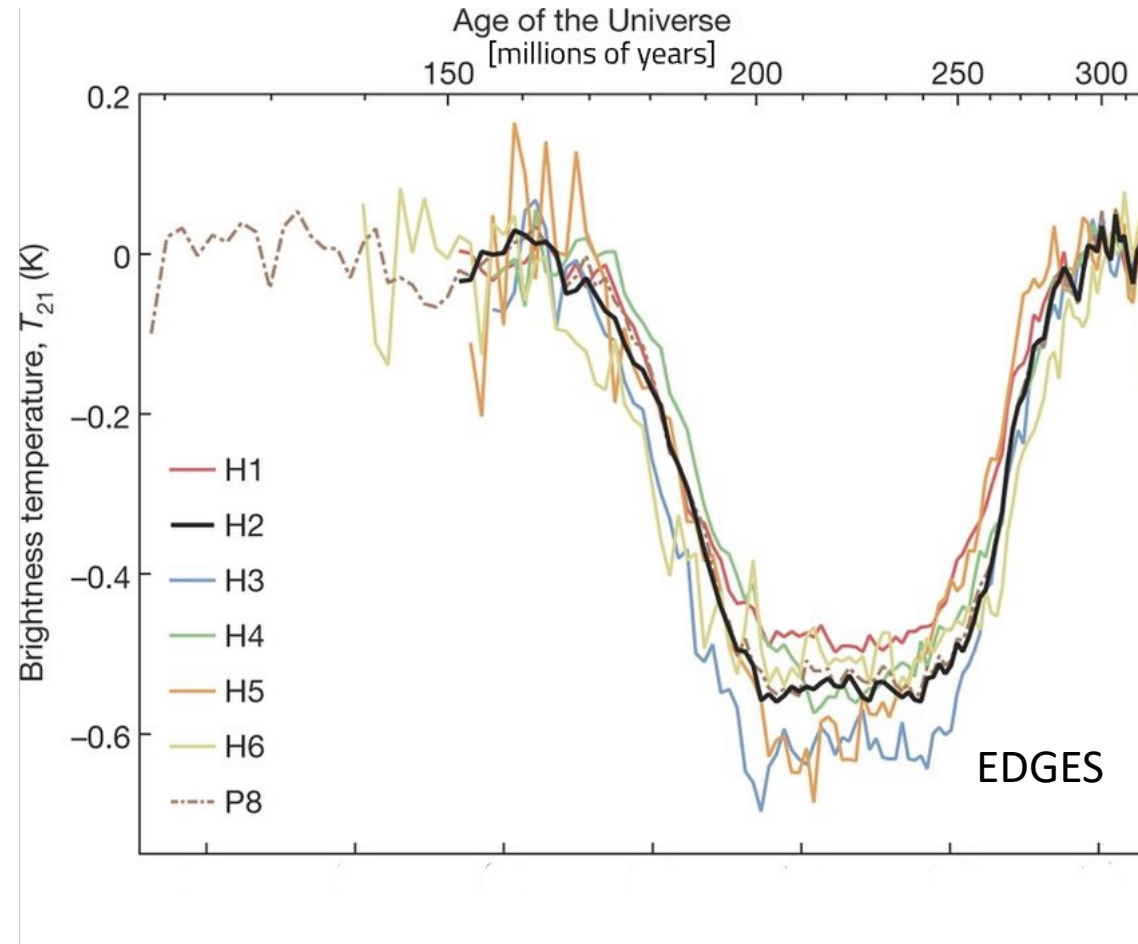


What do we observe?

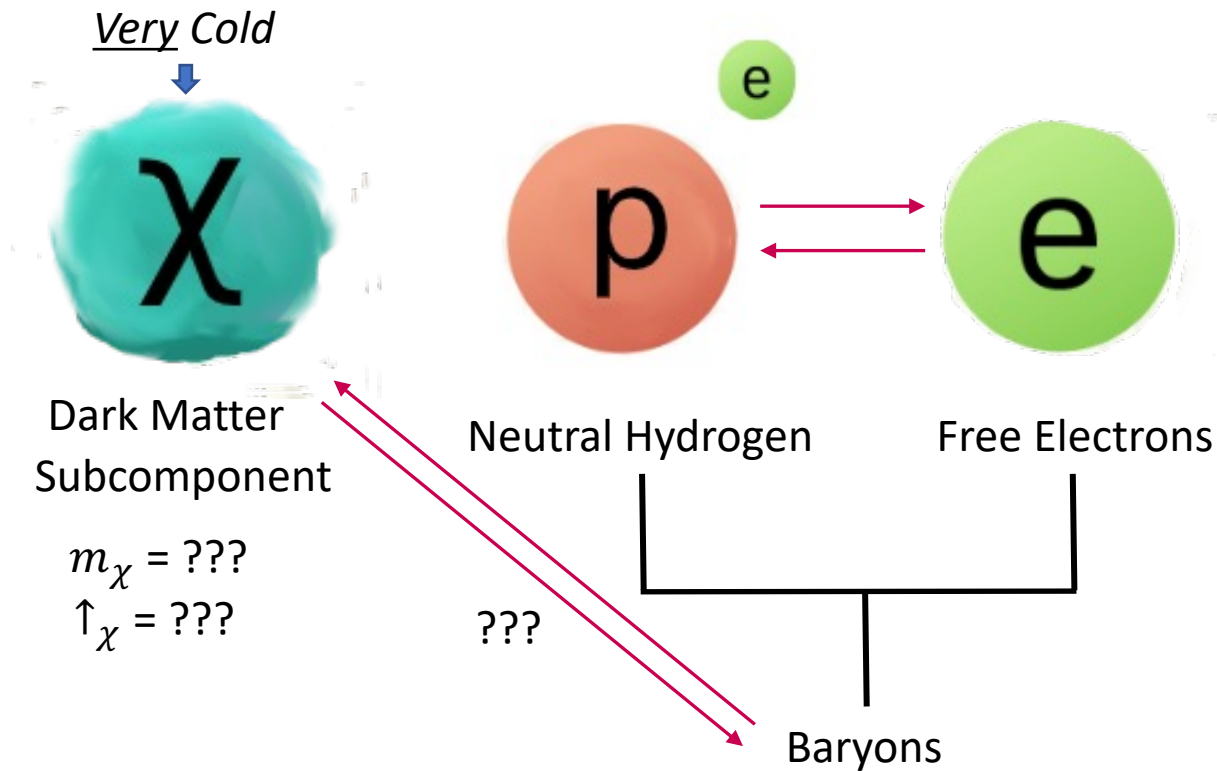
$$T_{21} \stackrel{?}{=} T_S$$



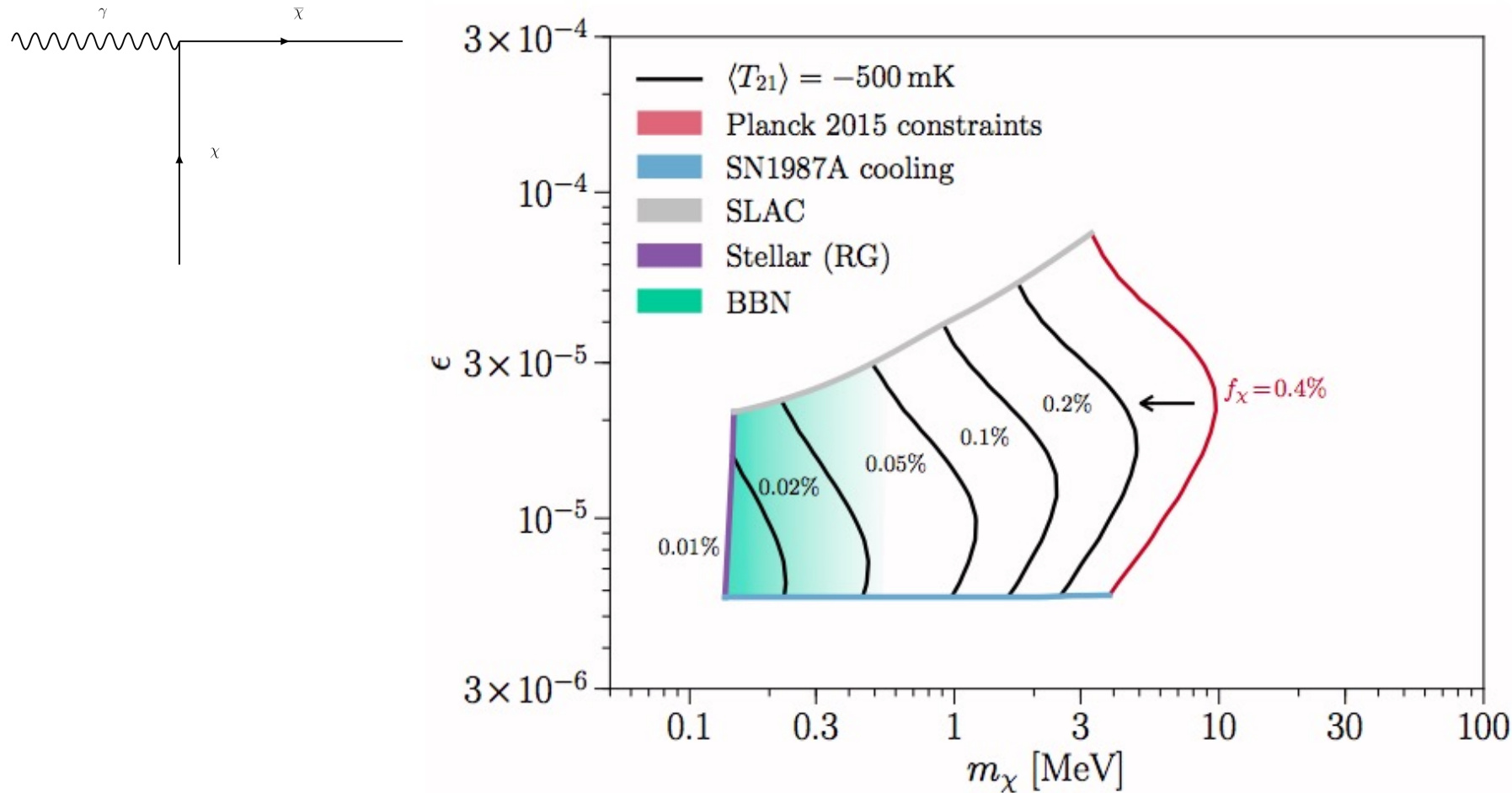
An Anomalous Temperature Signal from EDGES



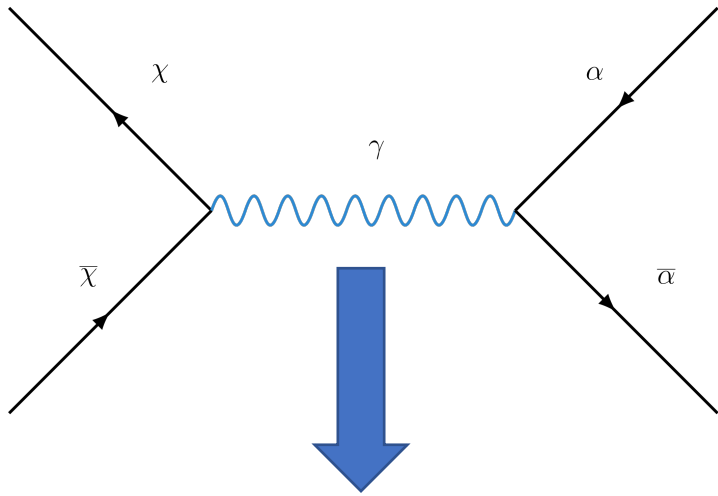
Proposed Solution to Anomalous Signal



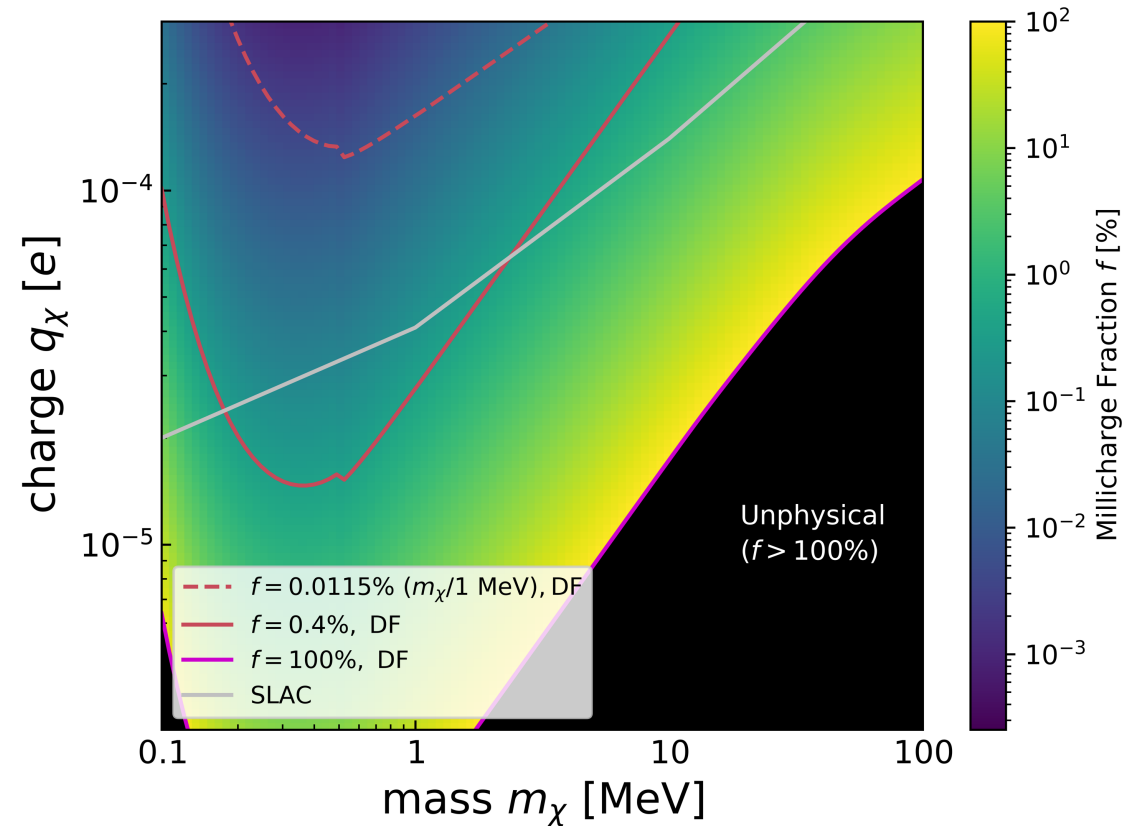
Current Bounds on Direct Millicharge DM



Abundance Constraint

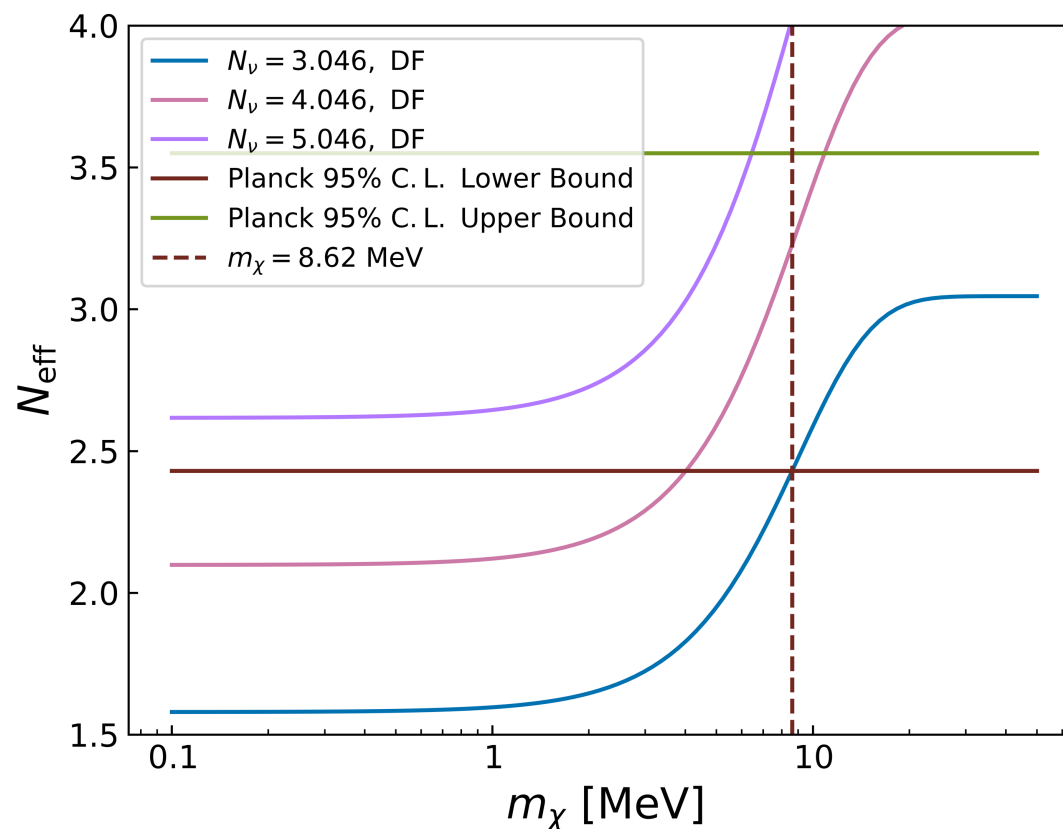
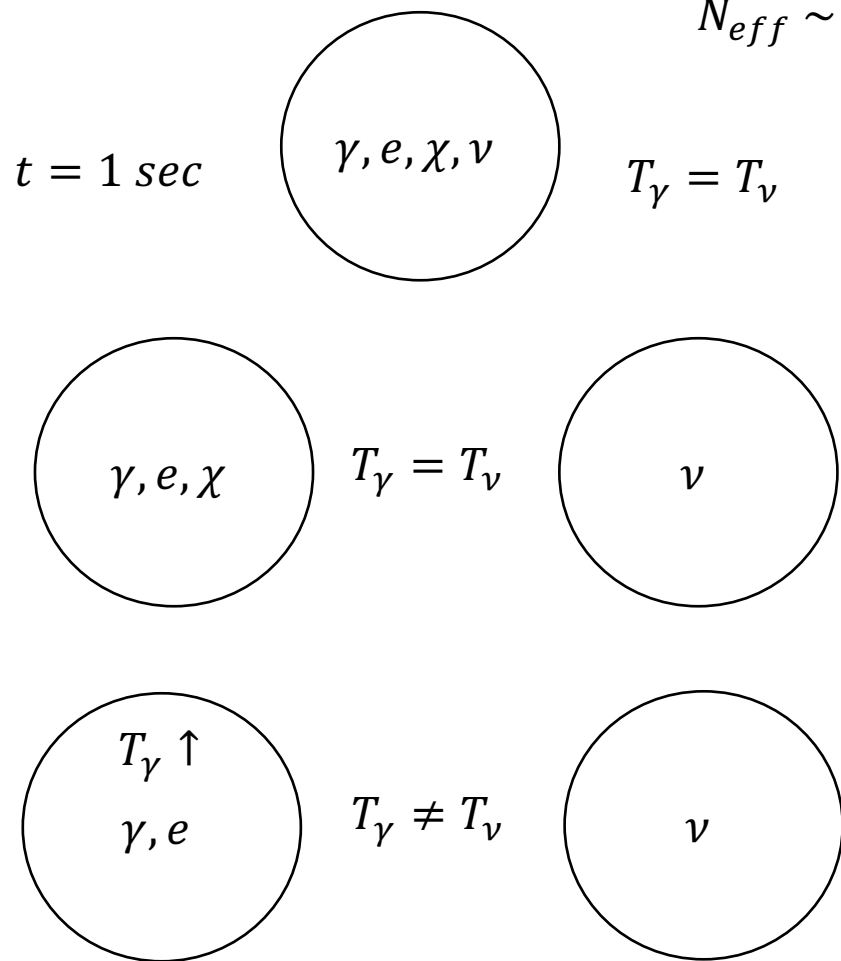


$$f = F[\sigma(m_\chi, q_\chi)]$$

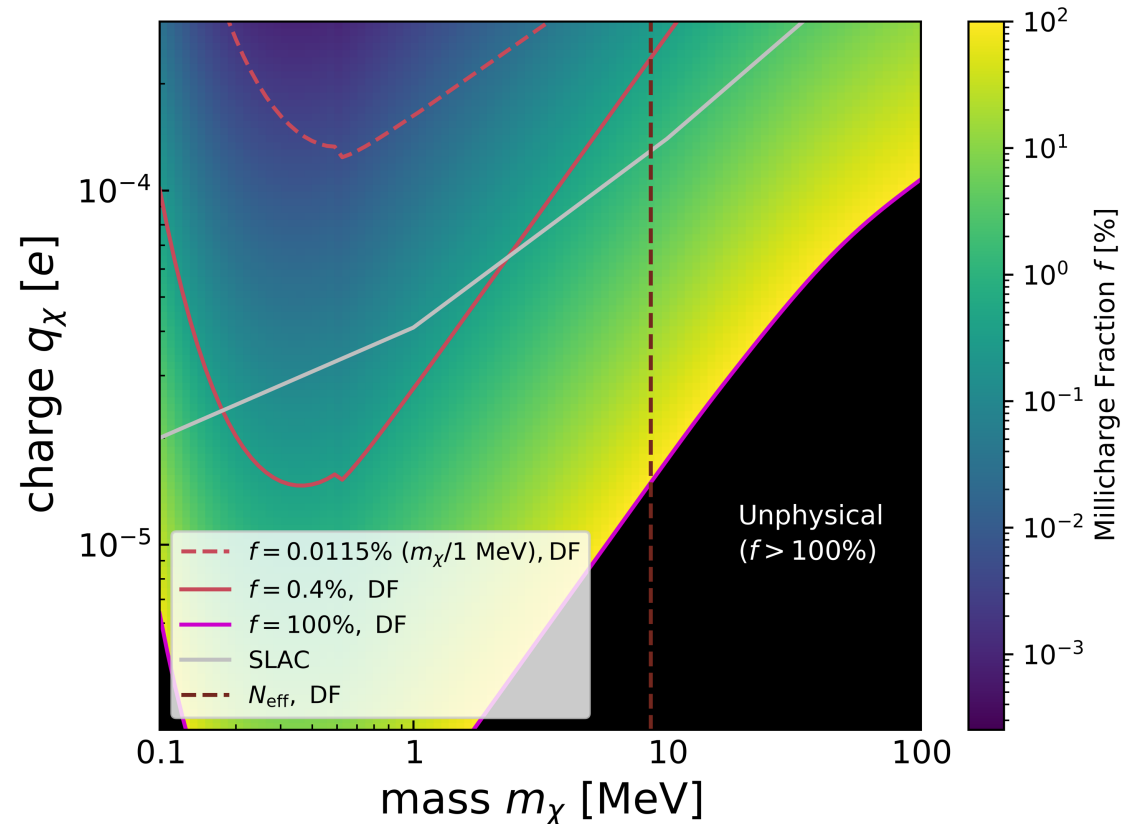


Effective # of Relativistic d.o.f Constraint

$$N_{eff} \sim \#particle\ d.o.f \times (T_{particle}/T_\gamma)$$



Effective # of Relativistic d.o.f Constraint



Back up slide

