Sexaquark Dark Matter

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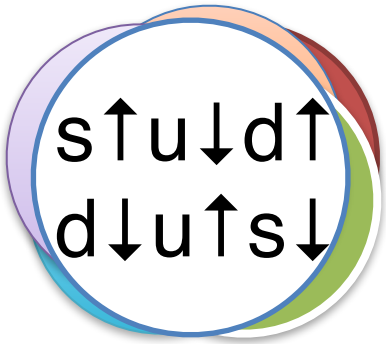
6-quark, Q=0, B=2
Spin-0, scalar
Flavor singlet



S

Uniquely among hadrons, Fermi statistics is compatible with being symmetric in space and totally antisymmetric (singlet) in:

color
flavor **(Most-Attractive Channel)^3**
spin

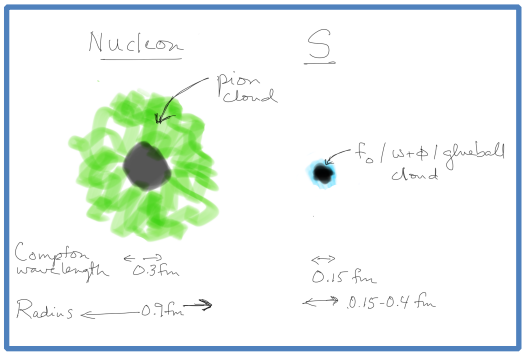
Hypothesis: S is *stable and spatially compact*
M_S <~ 2 m_p

This is compatible with all experiments and theory. *GRF 1708.08951*

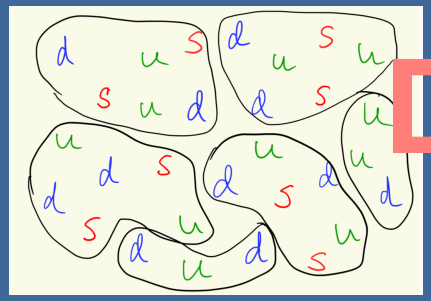
Eludes detection in accelerators because:

- neutrons are similar and 10^6 x more abundant
- small wfn overlap => hard to produce or destroy.

OK with direct detection expts *Mahdawi+GF1804.03073*

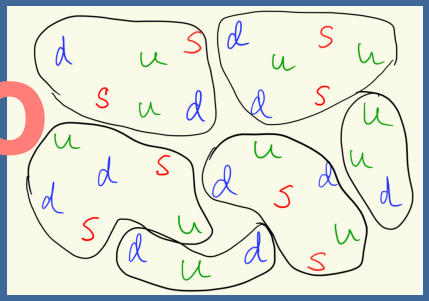


Same quark content as H-dibaryon* (Jaffe 1977), but different physics:
not a loosely bound di-Λ! *mass ~ 2150 MeV in bag model — decays in 10^{-10} s



DM to baryon ratio

follows from stat mech , quark masses & temperature of QGP-hadronization transition

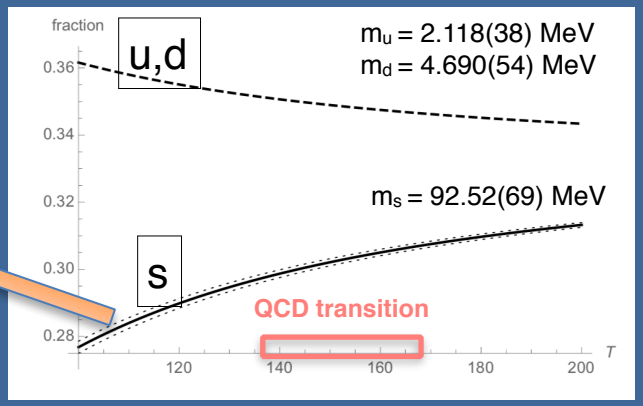


Prediction is correct AND accurate to ~20%, for entire range of M_S and T_{QCD}

GRF, hep-ph:1805.03723

$$\frac{\Omega_{DM}}{\Omega_b} = \frac{y_b\,\kappa_s\,3f_s}{1-\kappa_s\,3f_s}$$

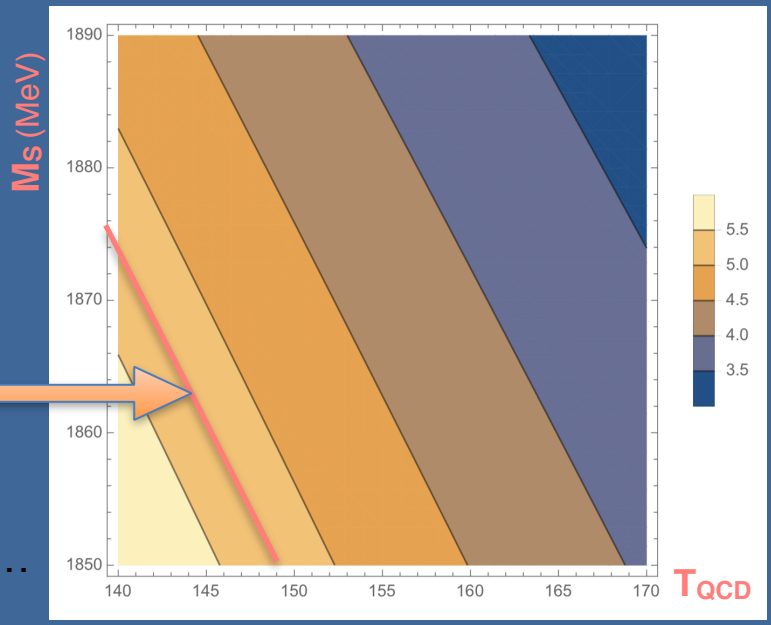
$m_S/(2m_p)$



$$\kappa_s(m_S,T) = \frac{1}{1+(r_{\Lambda,\Lambda}+r_{\Lambda,\Sigma}+2r_{\Sigma,\Sigma}+2r_{N,\Xi})}$$

$$r_{1,2} \equiv \exp[-(m_1+m_2-m_S)/T]$$

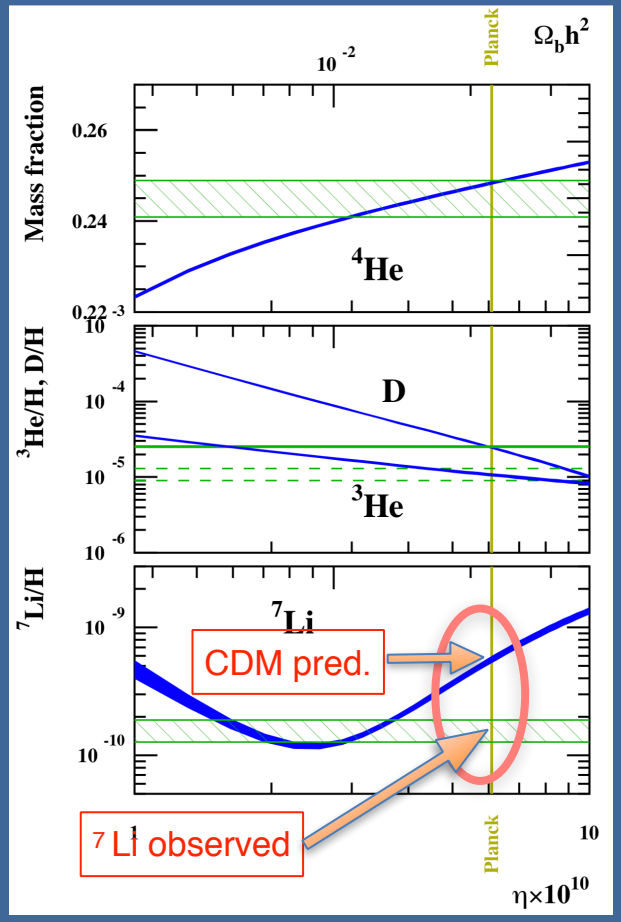
Ω_{DM} / $\Omega_{b\ obs}$ = 5.3 ± 0.1



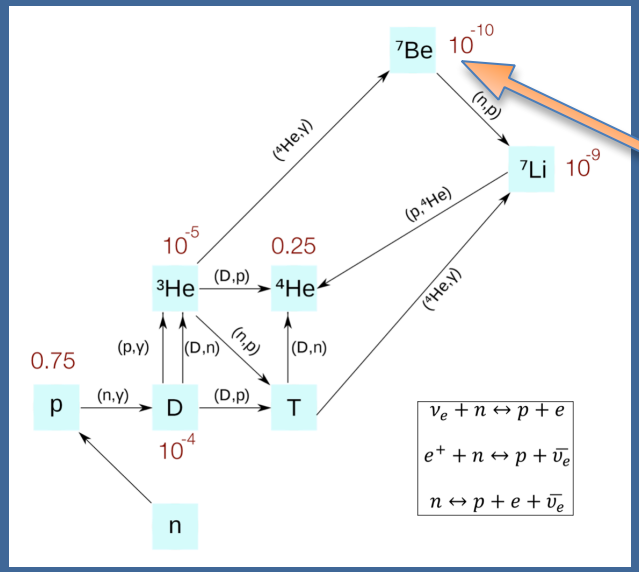
Prediction also applies to strange quark nuggets & PBH…

S dark matter explains primordial ^{7}Li

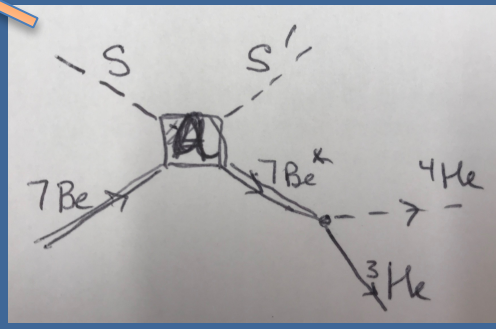
(GRF + R. Galvez, in preparation)



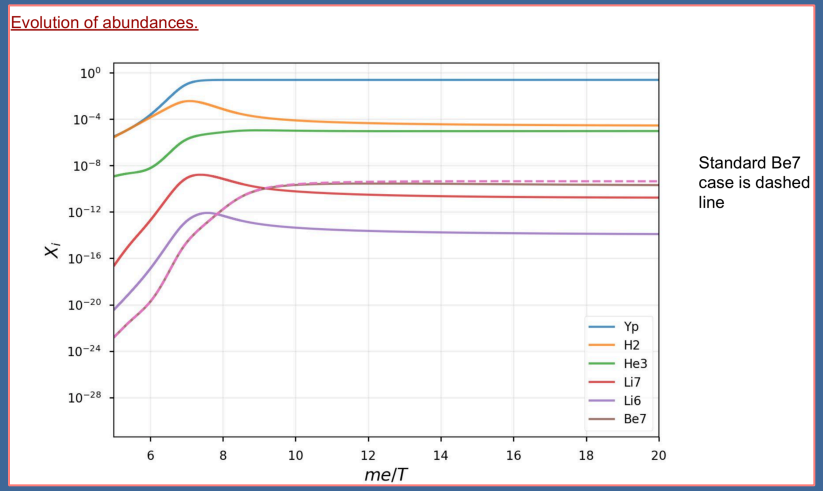
CDM prediction for 7Li is 10σ above obs.; destruction by S removes the excess



S breaks up ^{7}Li & ^{7}Be reducing predicted abundance



The "action" is at T~80 keV
=> only loosely bound 7Li & 7Be are affected



KE threshold for breakup

^{7}Be 1.58 MeV

^{7}Li 2.46 MeV

^{3}He 4.47 MeV

^{3}H 5.75 MeV

^{4}He 19.3 MeV

[d, 2.2 MeV, replenished]