FORMATION MODELS FOR COSMIC RAY ANTINUCLEI

Based on M. Kachelrieß, S. Ostapchenko and JT
arXiv:[1905.01192, 2002.10481, 2012.04352]

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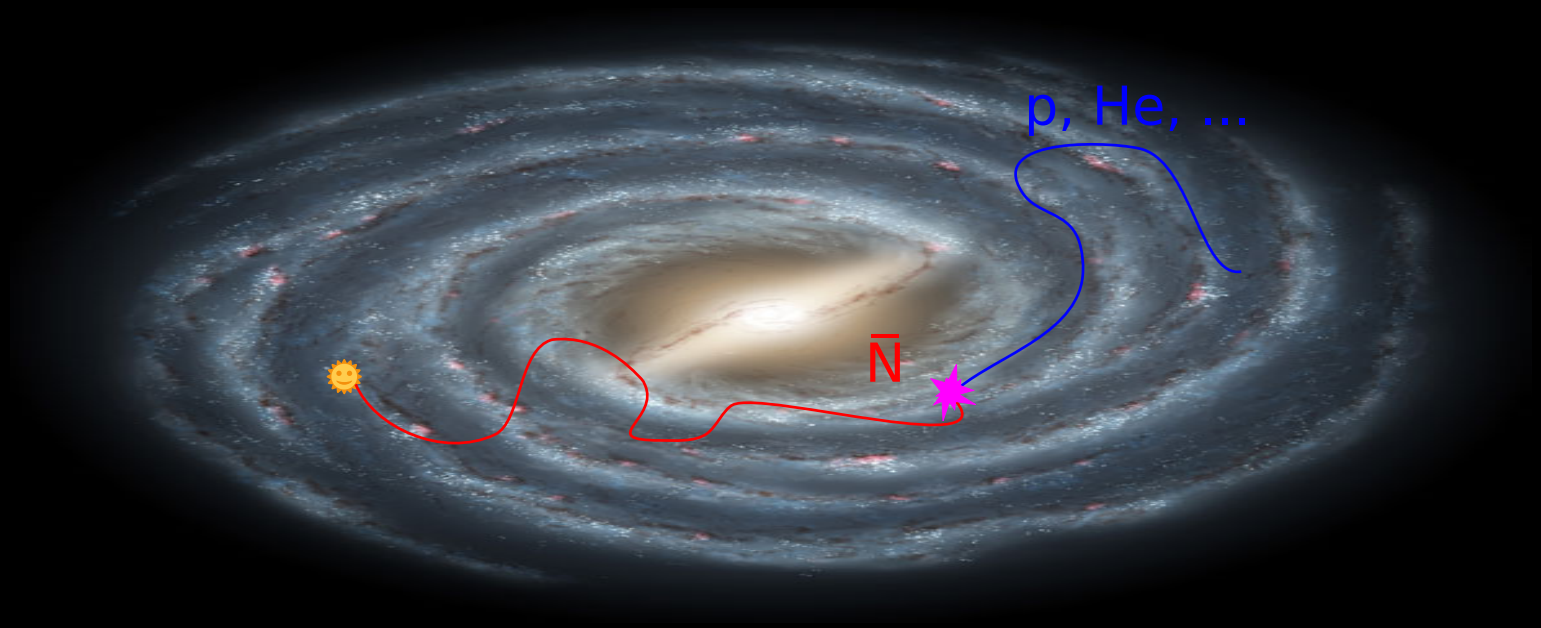
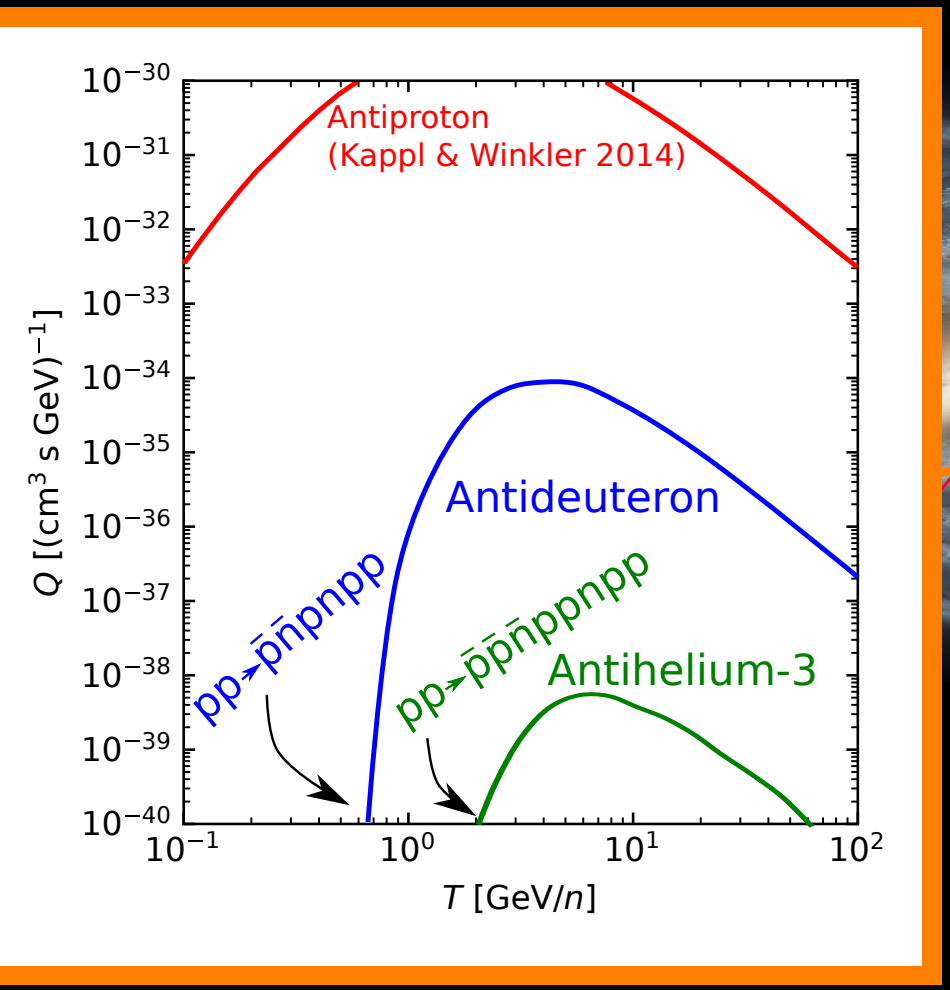
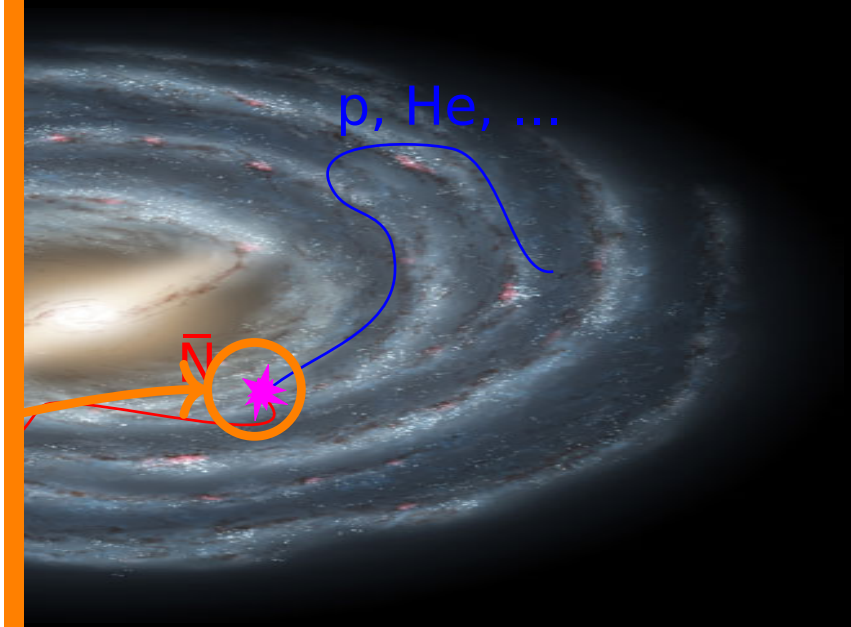


Image credit: NASA JPL; NASA AMS





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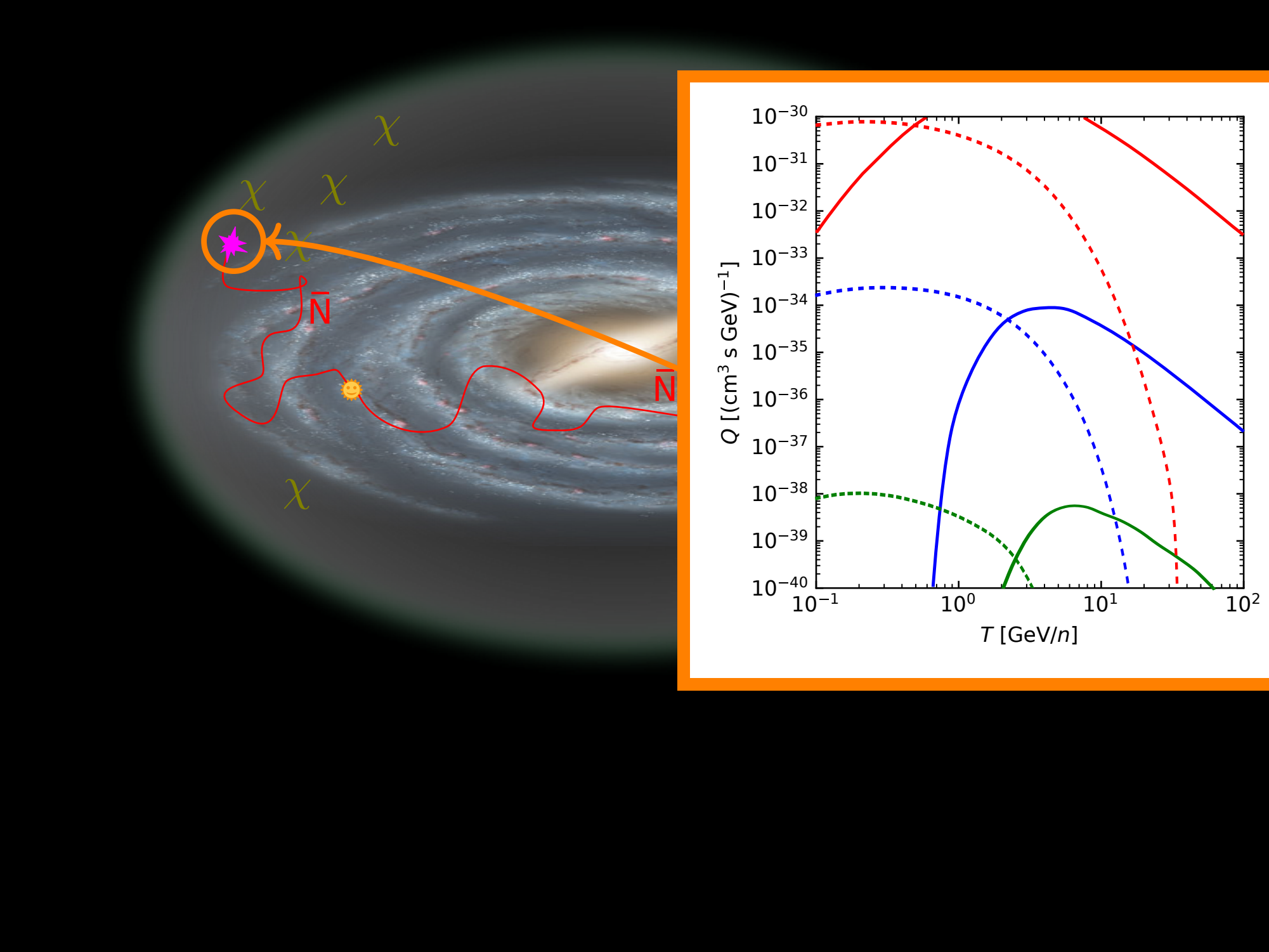
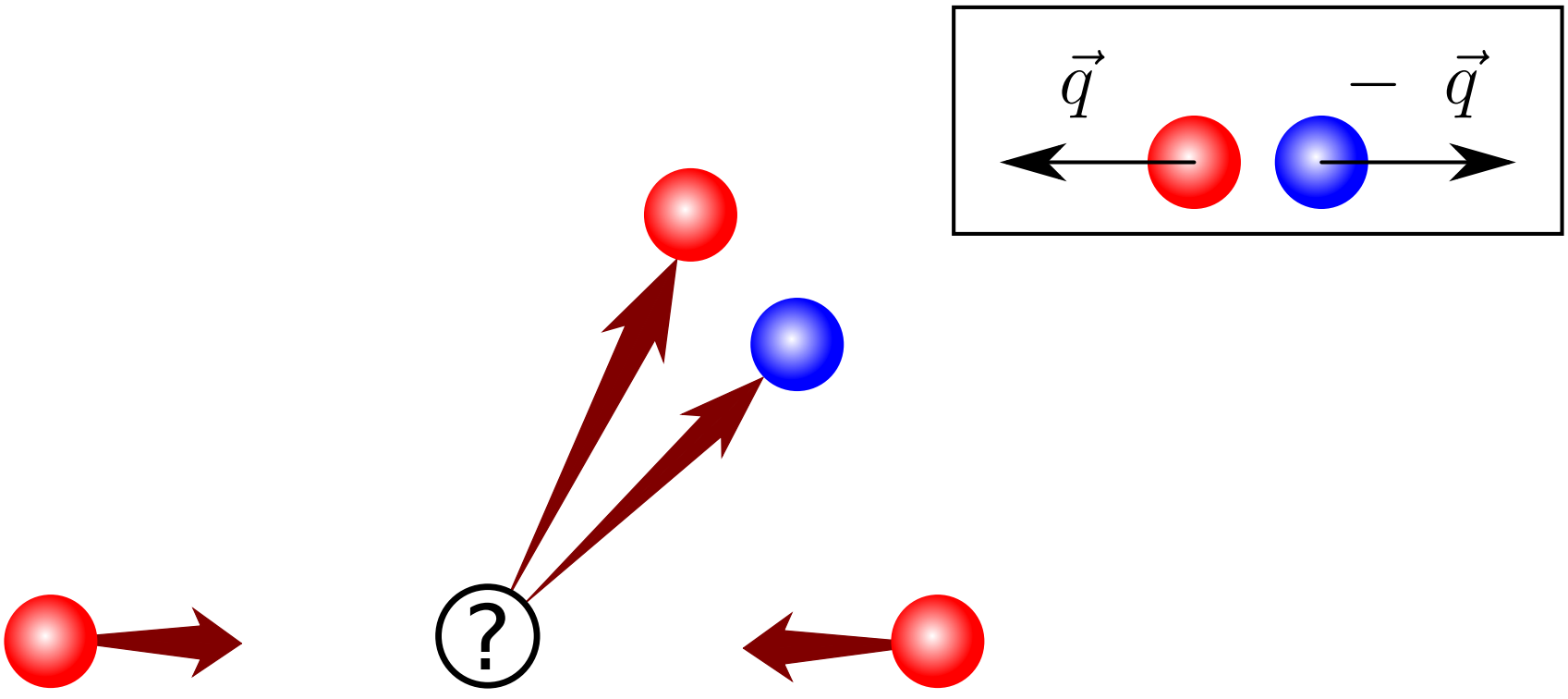

χ
χ
χ
χ
χ
N̄
N̄
10^{-30}
10^{-31}
10^{-32}
10^{-33}
10^{-34}
10^{-35}
10^{-36}
10^{-37}
10^{-38}
10^{-39}
10^{-40}
Q [(cm^3 s GeV)$^{-1}$]
10^{-1}
10^{0}
10^{1}
10^{2}
T [GeV/n]

The coalescence model in momentum space



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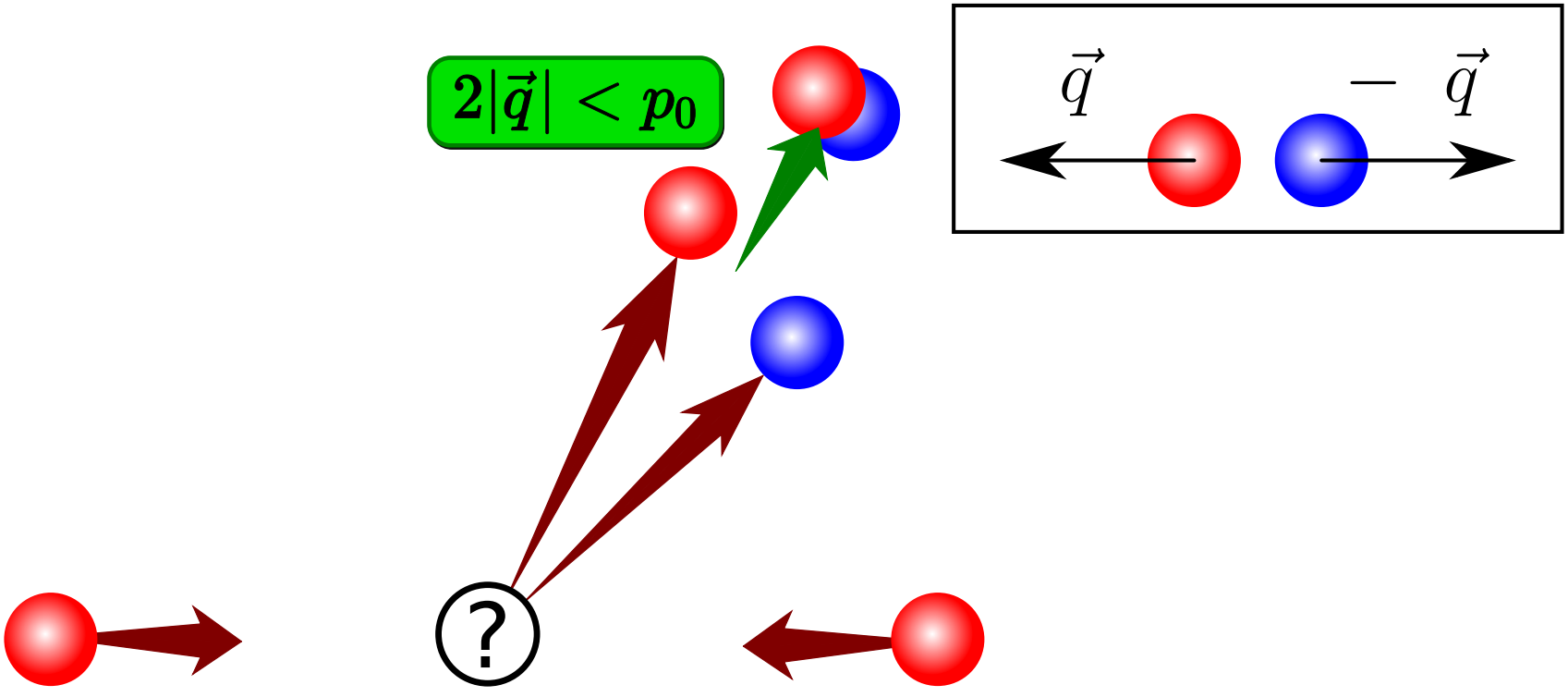

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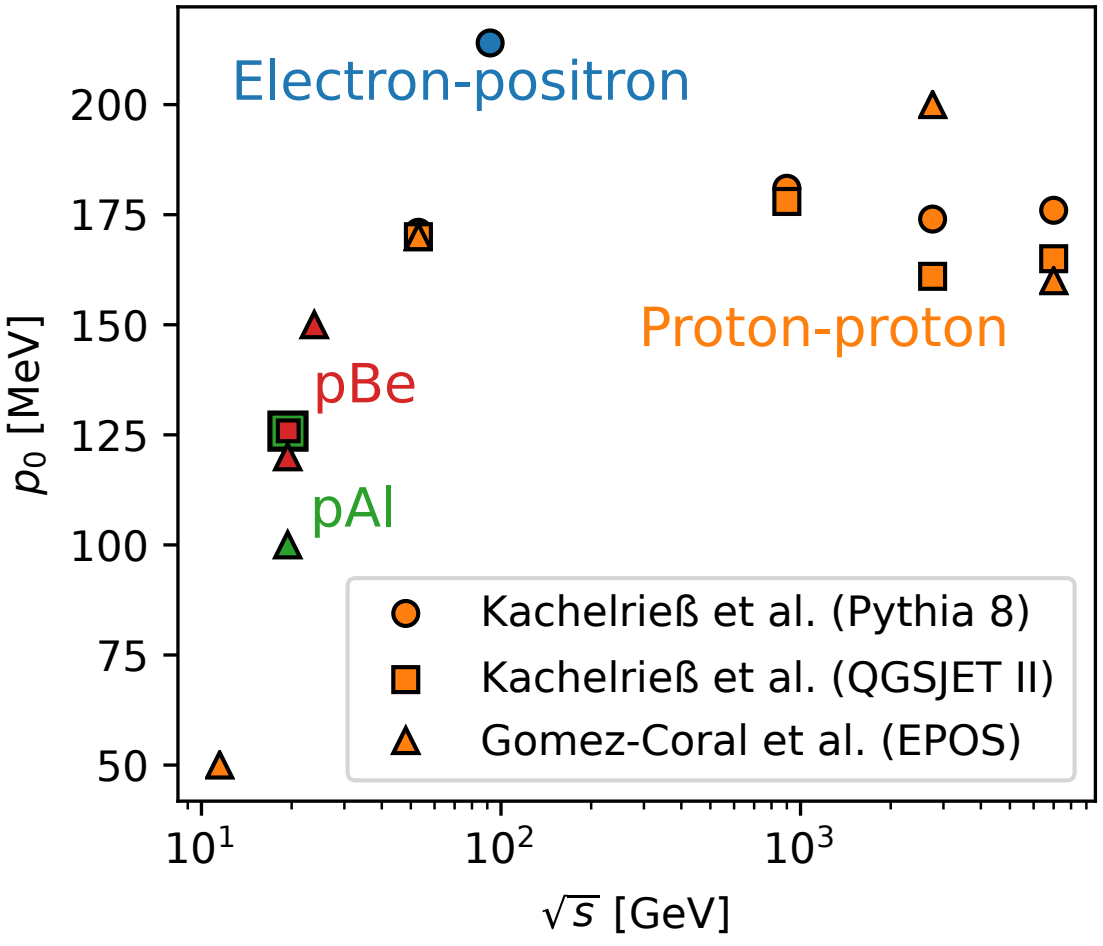
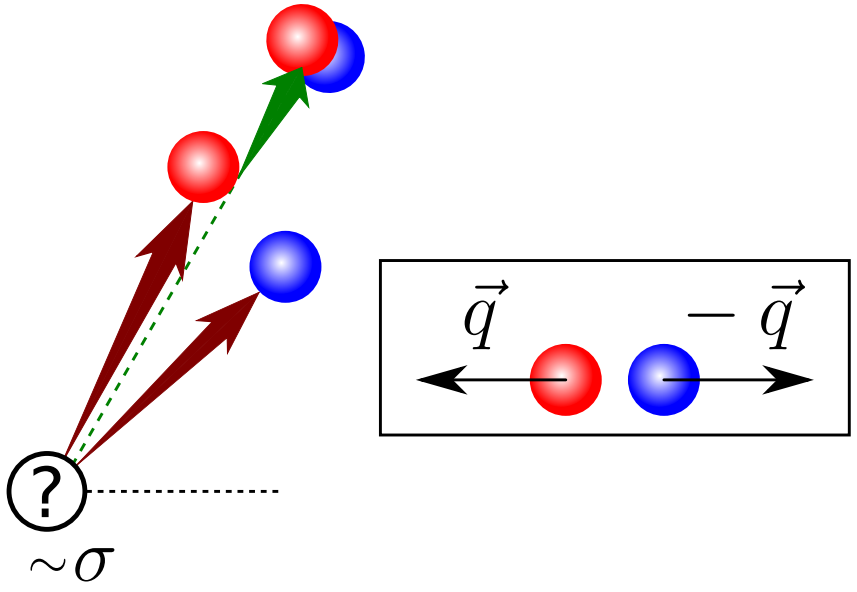


The WiFunC model for (anti)deuteron

Coalescence probability

$$w = \zeta \mathrm{e}^{-d^2 q^2}$$

$$\zeta = \left(\frac{d^2}{d^2 + 4\sigma^2} \right)^{3/2}$$



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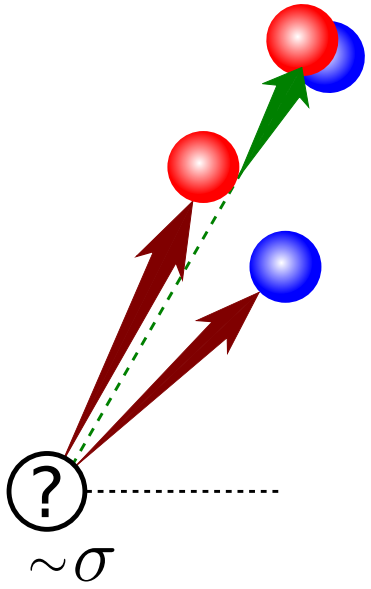
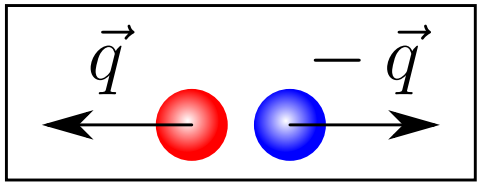
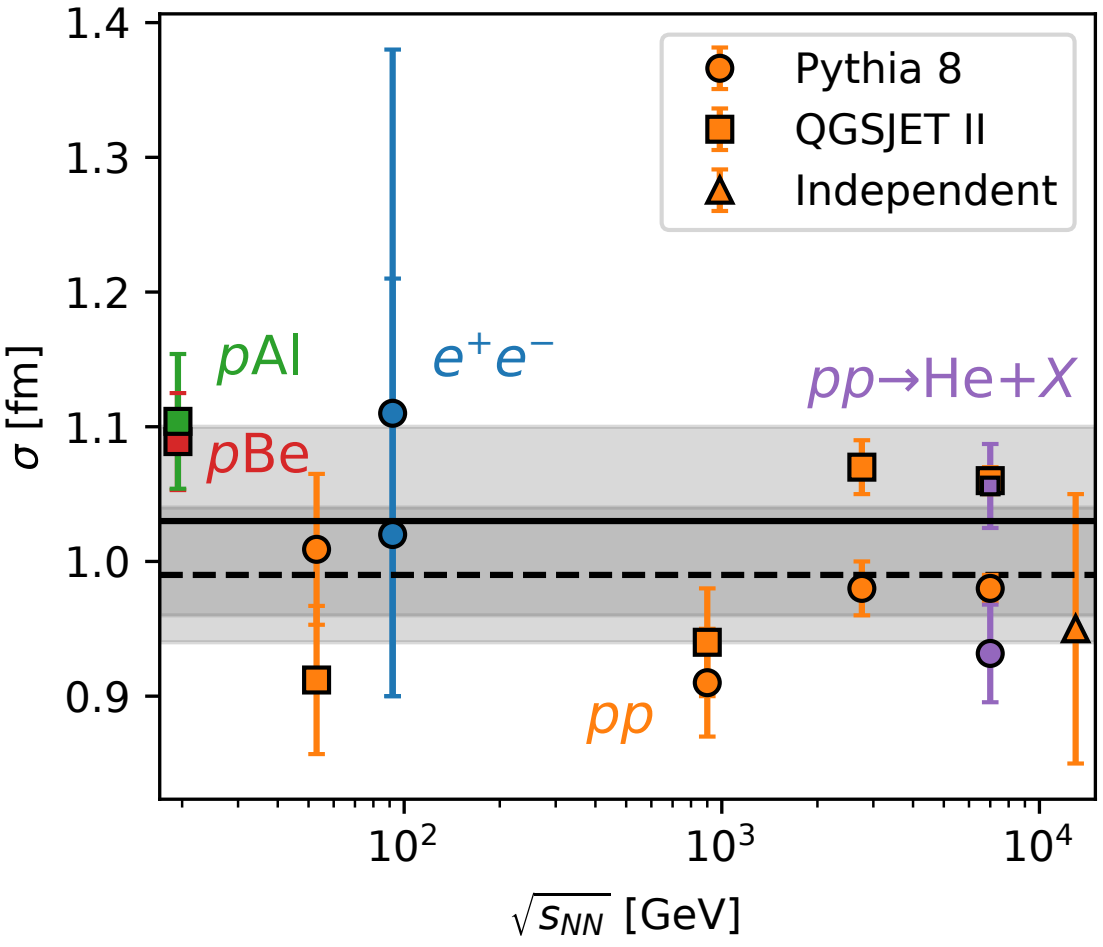


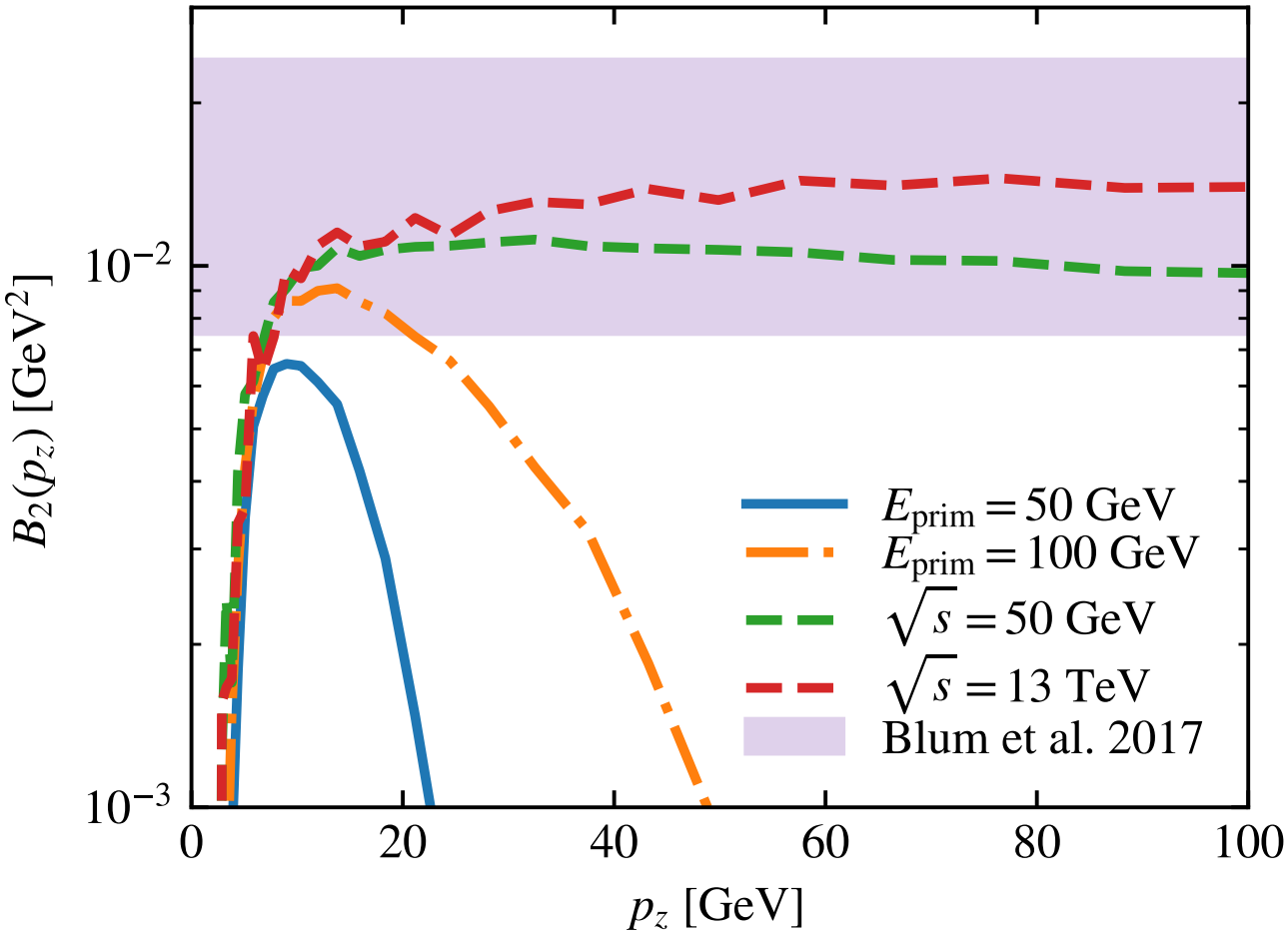


$$\sigma \equiv \sigma_{e^\pm} \simeq \sigma_{pp}/\sqrt{2} \simeq 1 \text{ fm}$$

Agreement with the physical interpretation!



Coalescence parameter, $B_2(p_z)$



Summary

- *The detection of cosmic ray antinuclei may be just around the corner!*
- A good description of the antinucleus production in cosmic ray processes is needed
- One should include both momentum correlations and the size of the formation region when estimating the production in small interacting systems
- The WiFunC model for antideuteron production

$$w = \zeta \mathrm{e}^{-d^2 q^2}$$