

CFI

Direct Dark Matter Detection Summary

Snowmass on Mississippi
Minneapolis, MN
August 3, 2013

Cristiano Galbiati

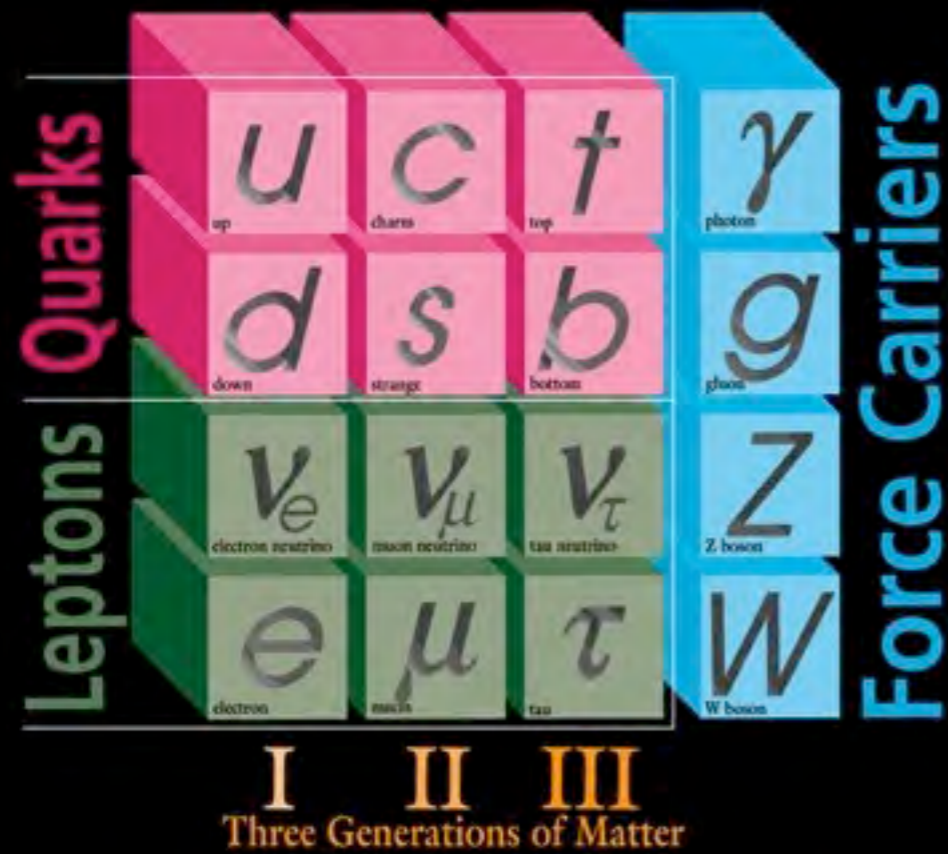
also on behalf of:

Priscilla Cushman, Daniel McKinsey,
Hamish Robertson, Tim Tait

Dark Matter

Dark Matter

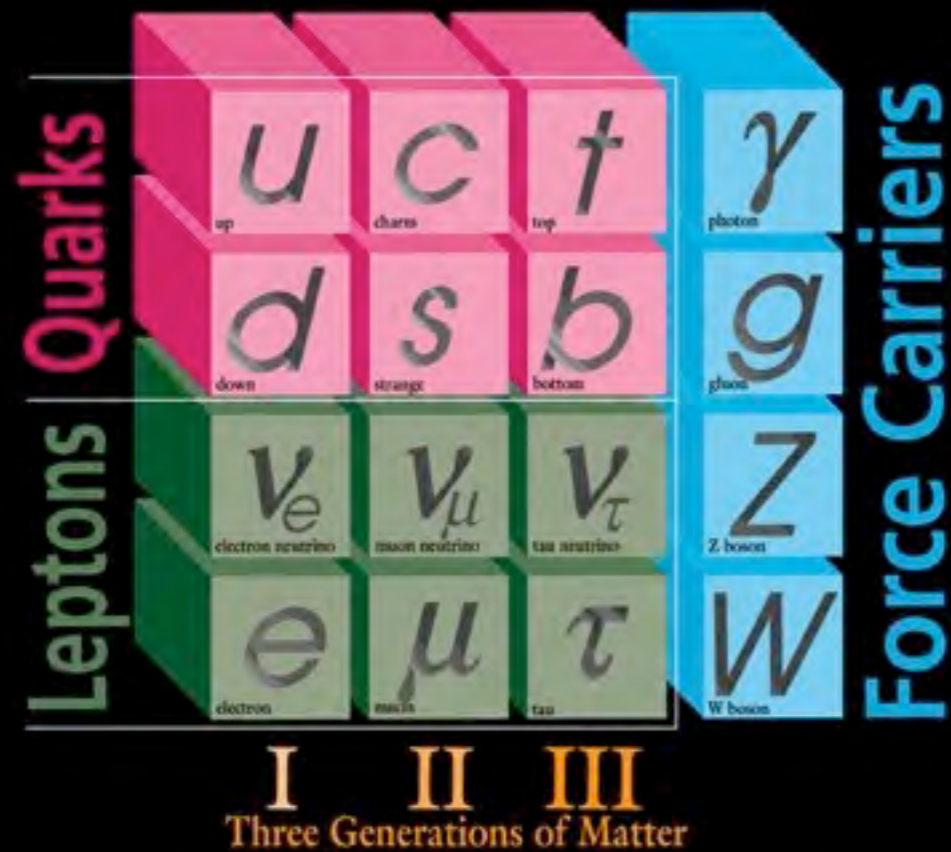
ELEMENTARY PARTICLES



Dark Matter

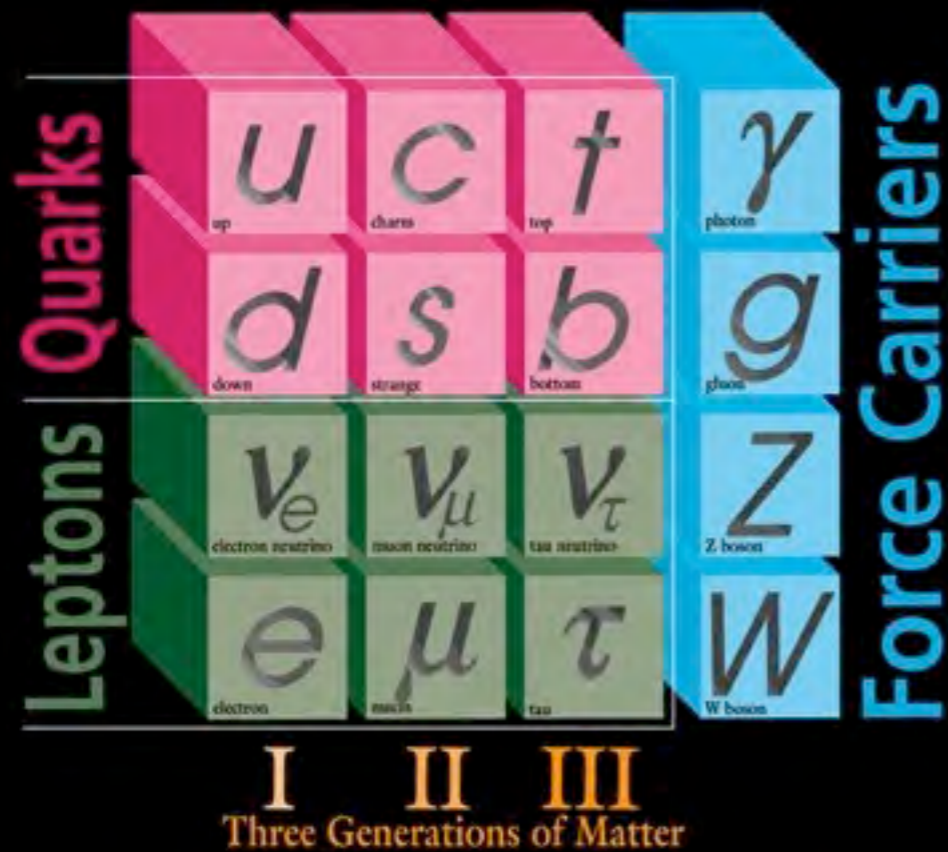
ELEMENTARY PARTICLES

Known DM properties



Dark Matter

ELEMENTARY PARTICLES

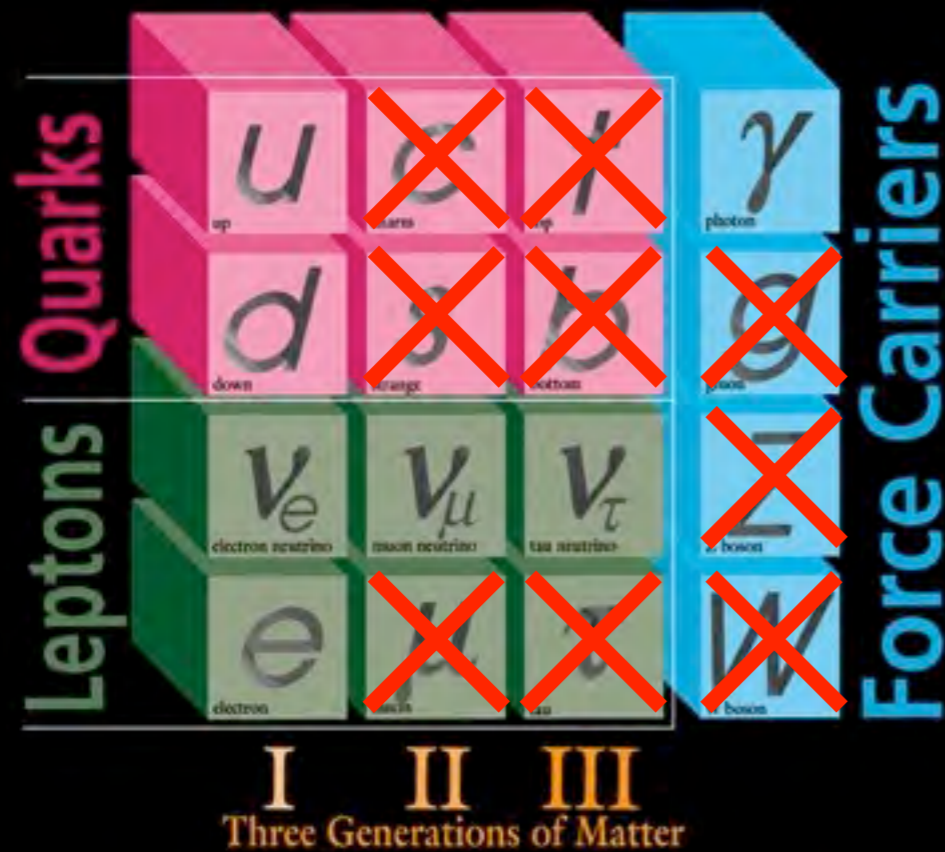


Known DM properties

- Gravitationally interacting

Dark Matter

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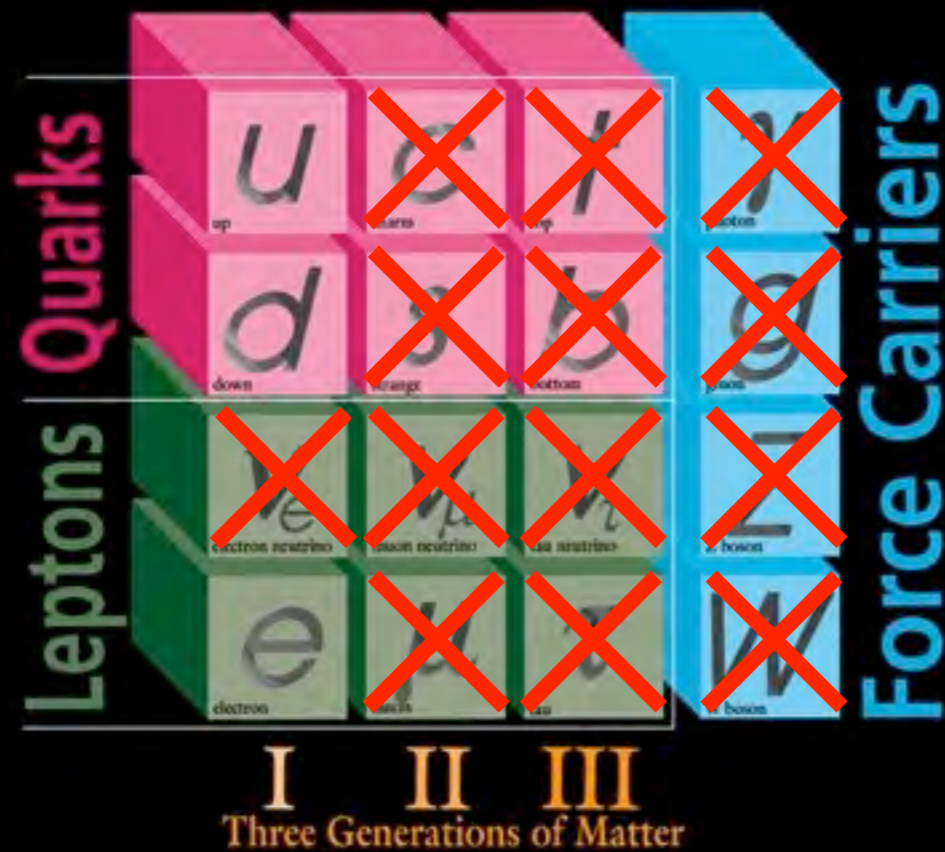


Known DM properties

- Gravitationally interacting
- Not short-lived

Dark Matter

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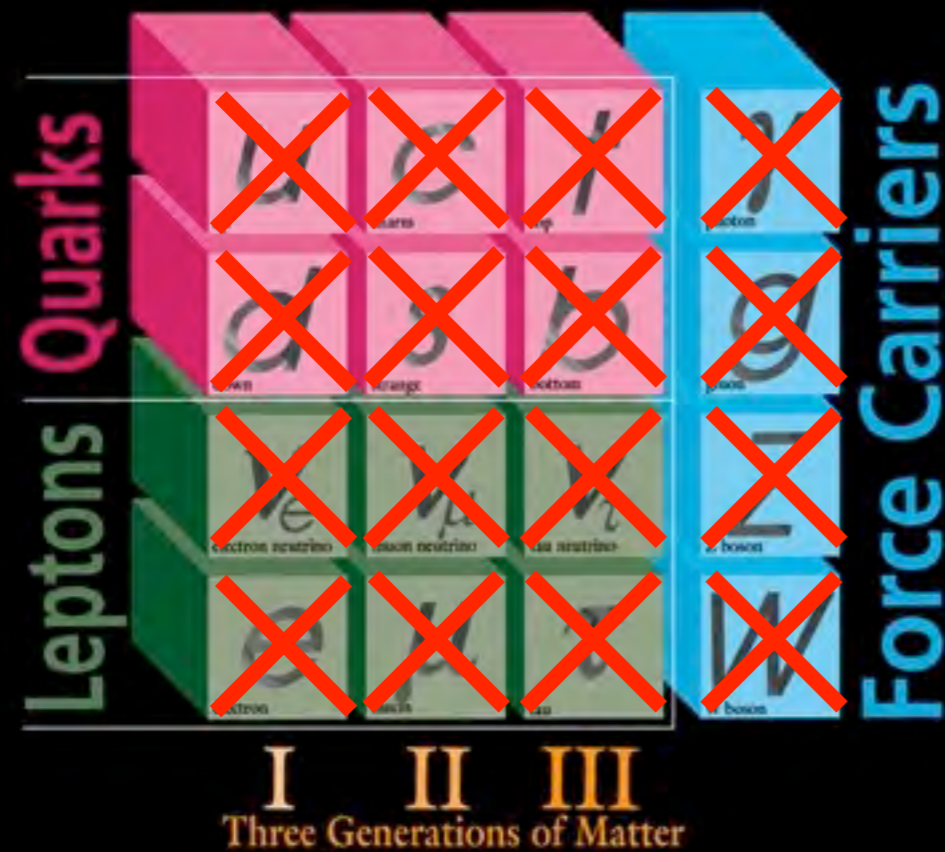


Known DM properties

- Gravitationally interacting
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Dark Matter

ELEMENTARY PARTICLES

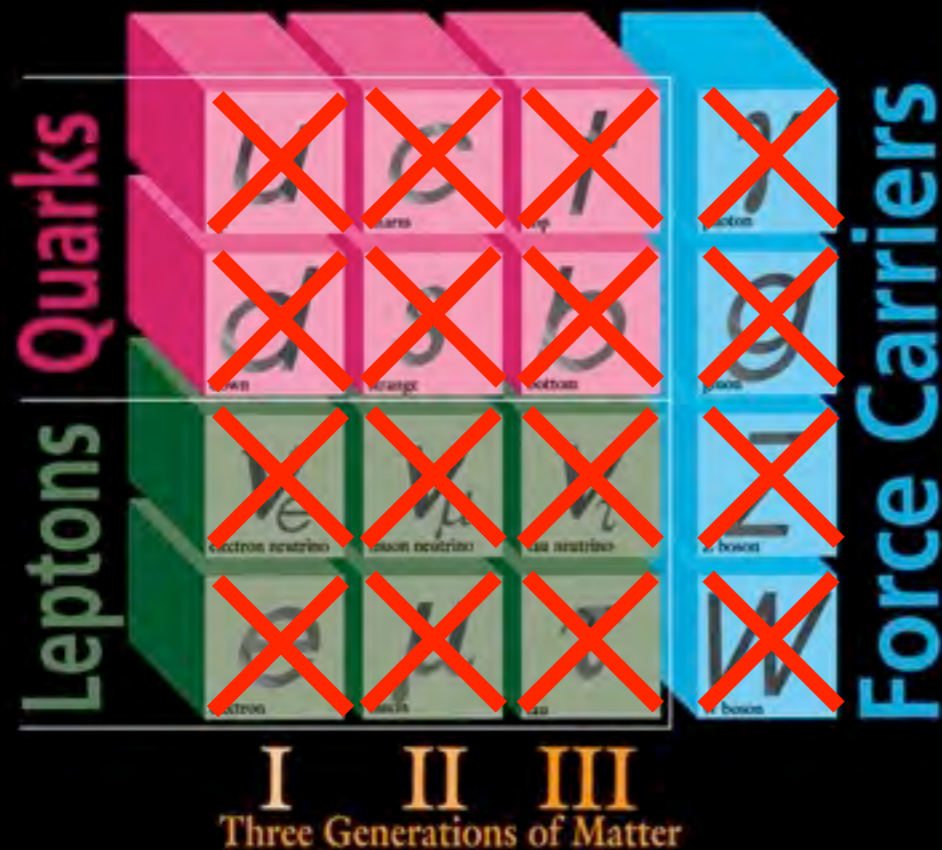


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Dark Matter

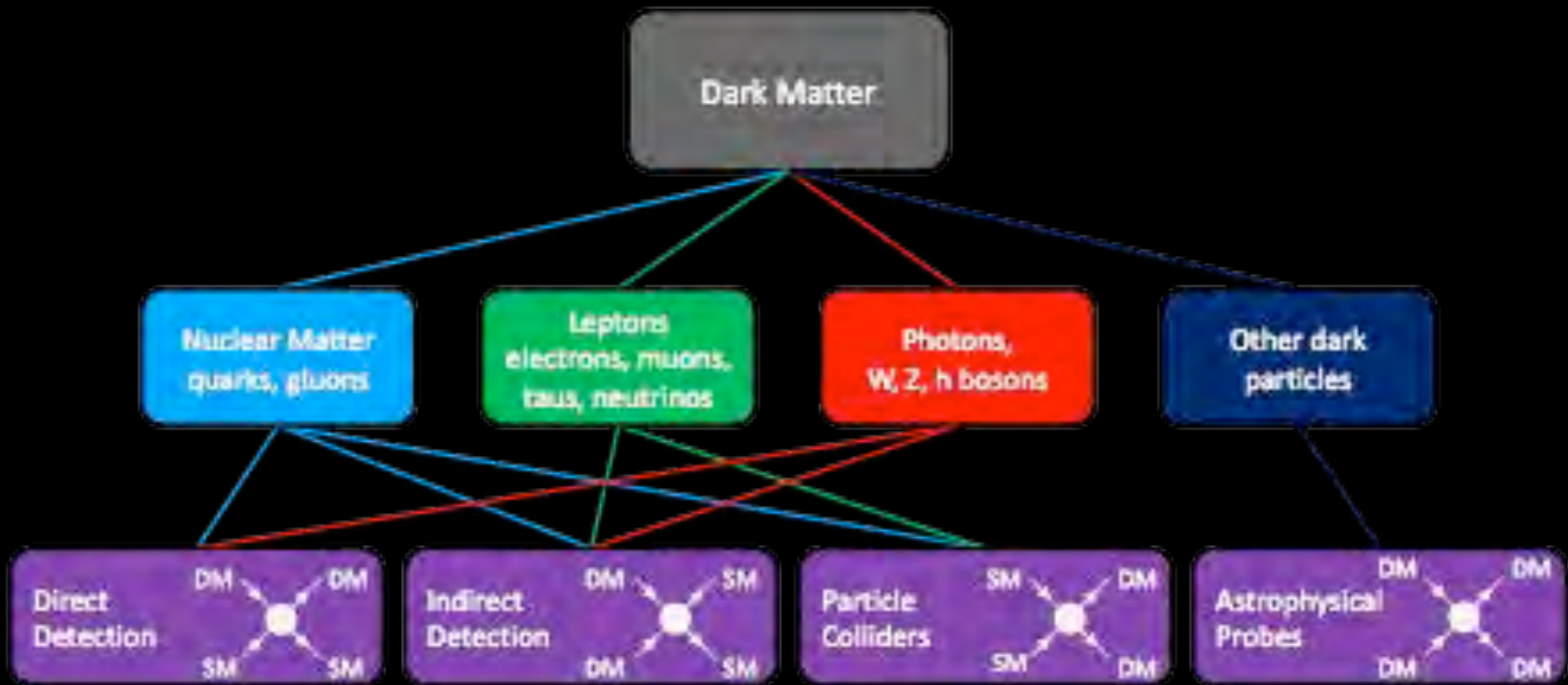
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There is Physics beyond SM!



χ, n

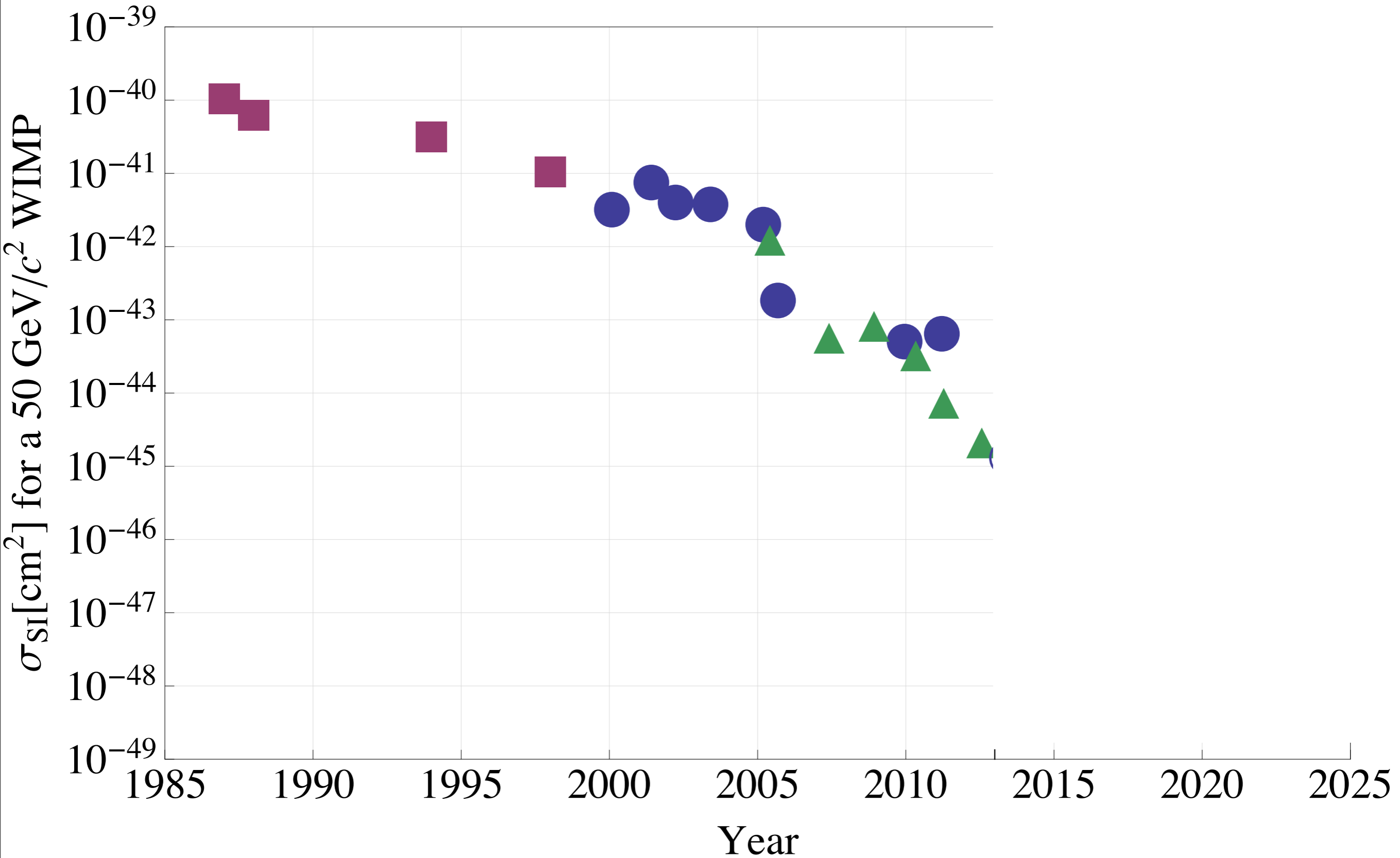
e, γ

WIMPs and Neutrons
scatter from the
Atomic Nucleus

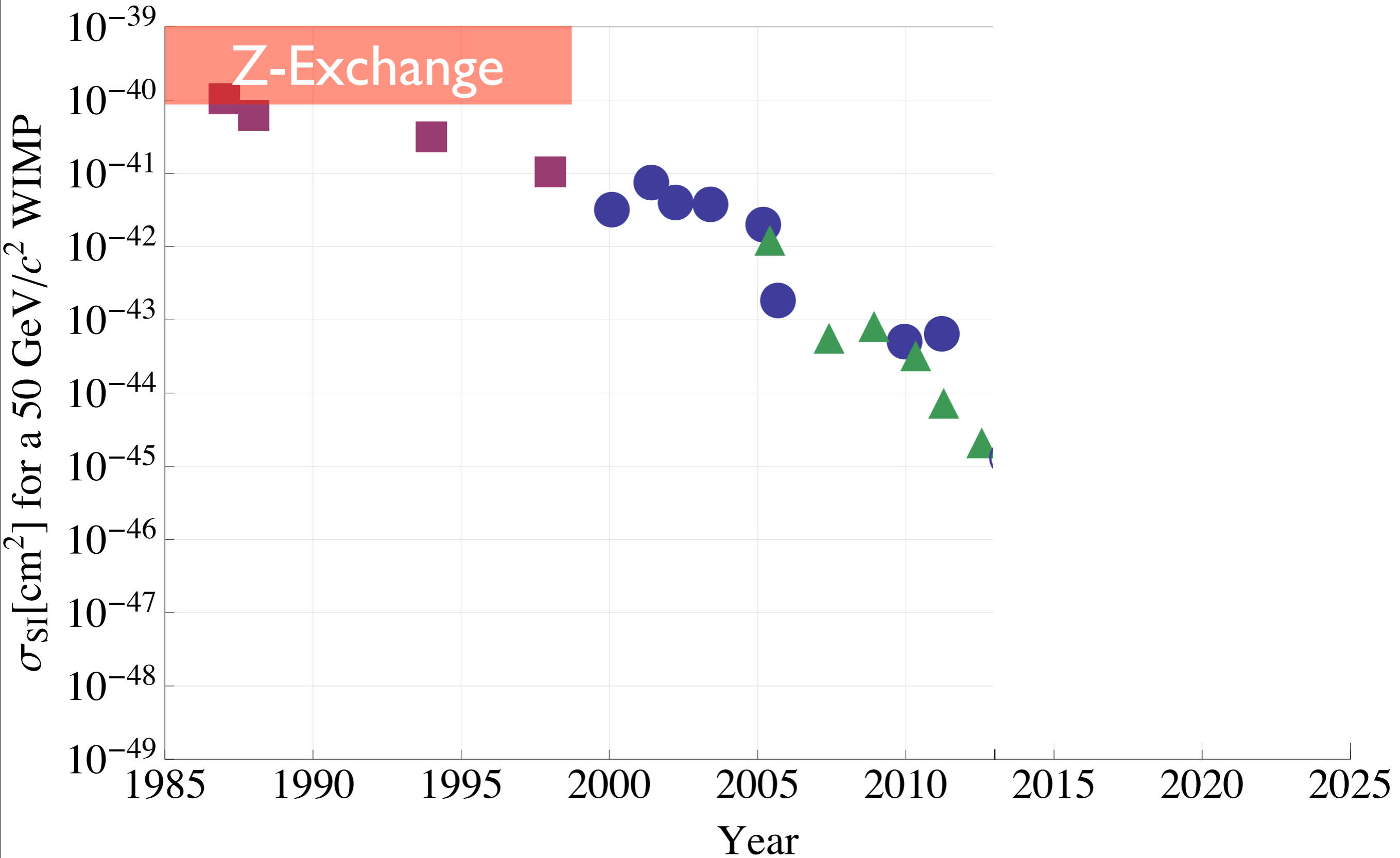
Photons and Electrons
scatter from the
Atomic Electrons

[Attisha/Brown]

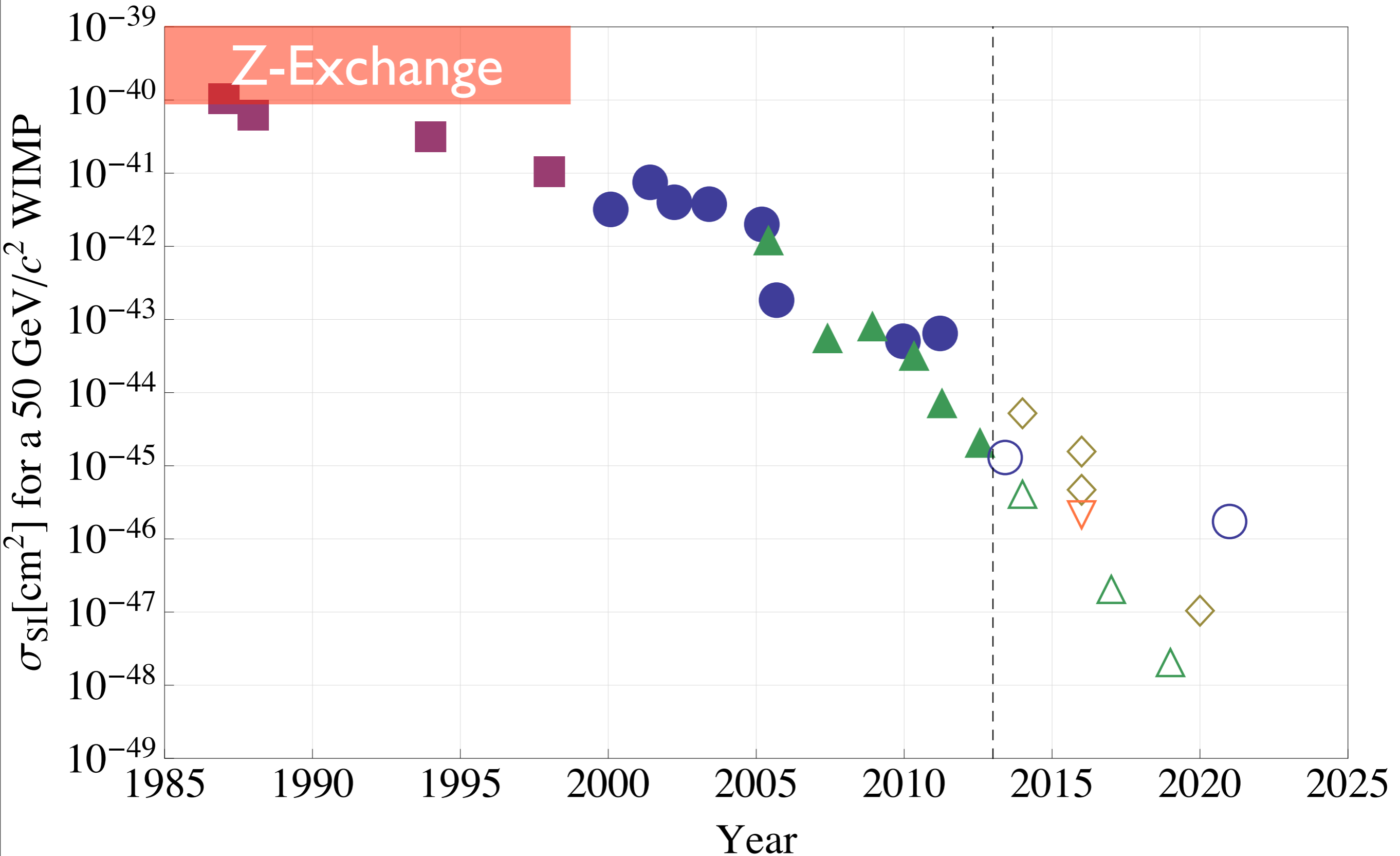
Evolution of the WIMP–Nucleon σ_{SI}



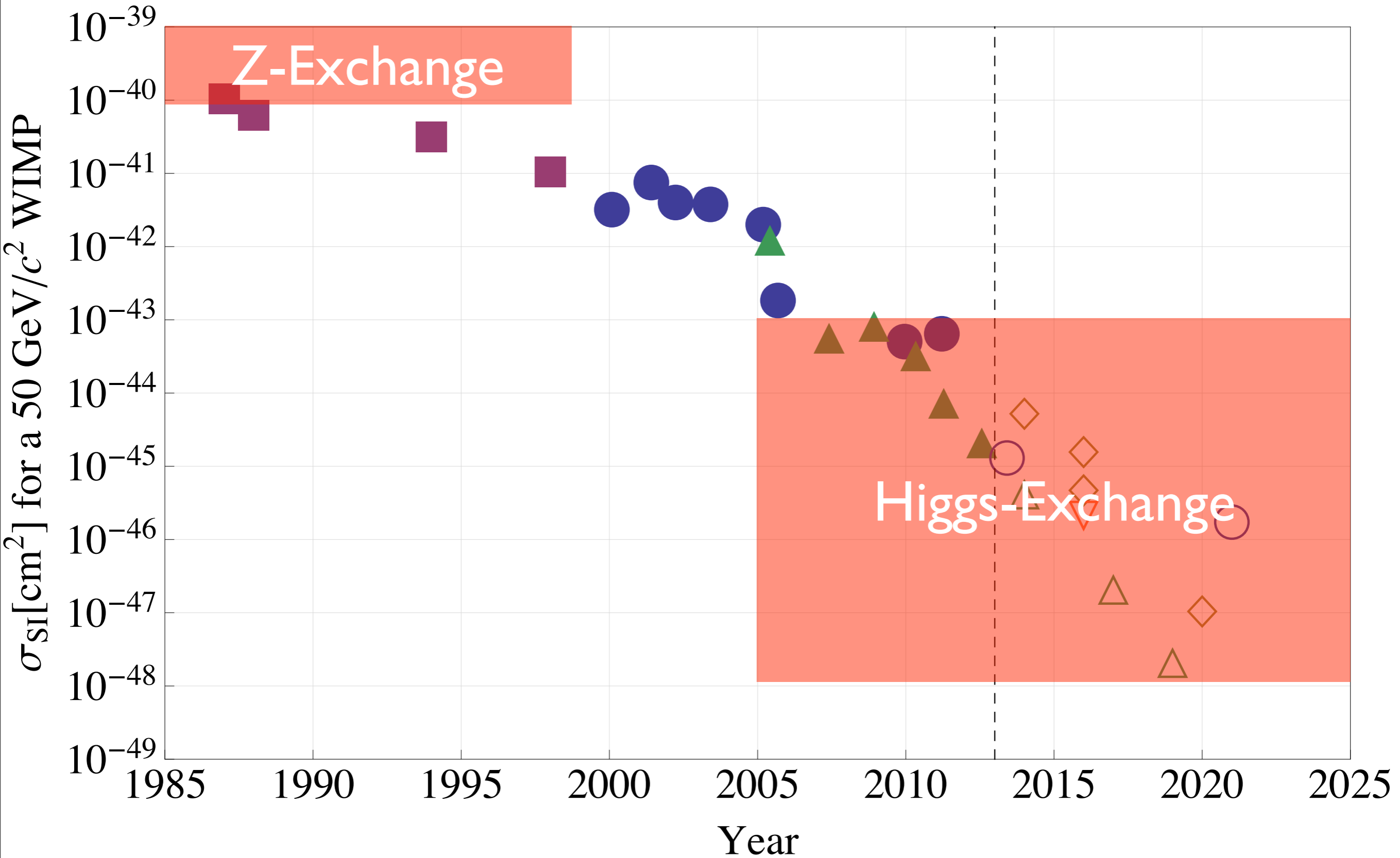
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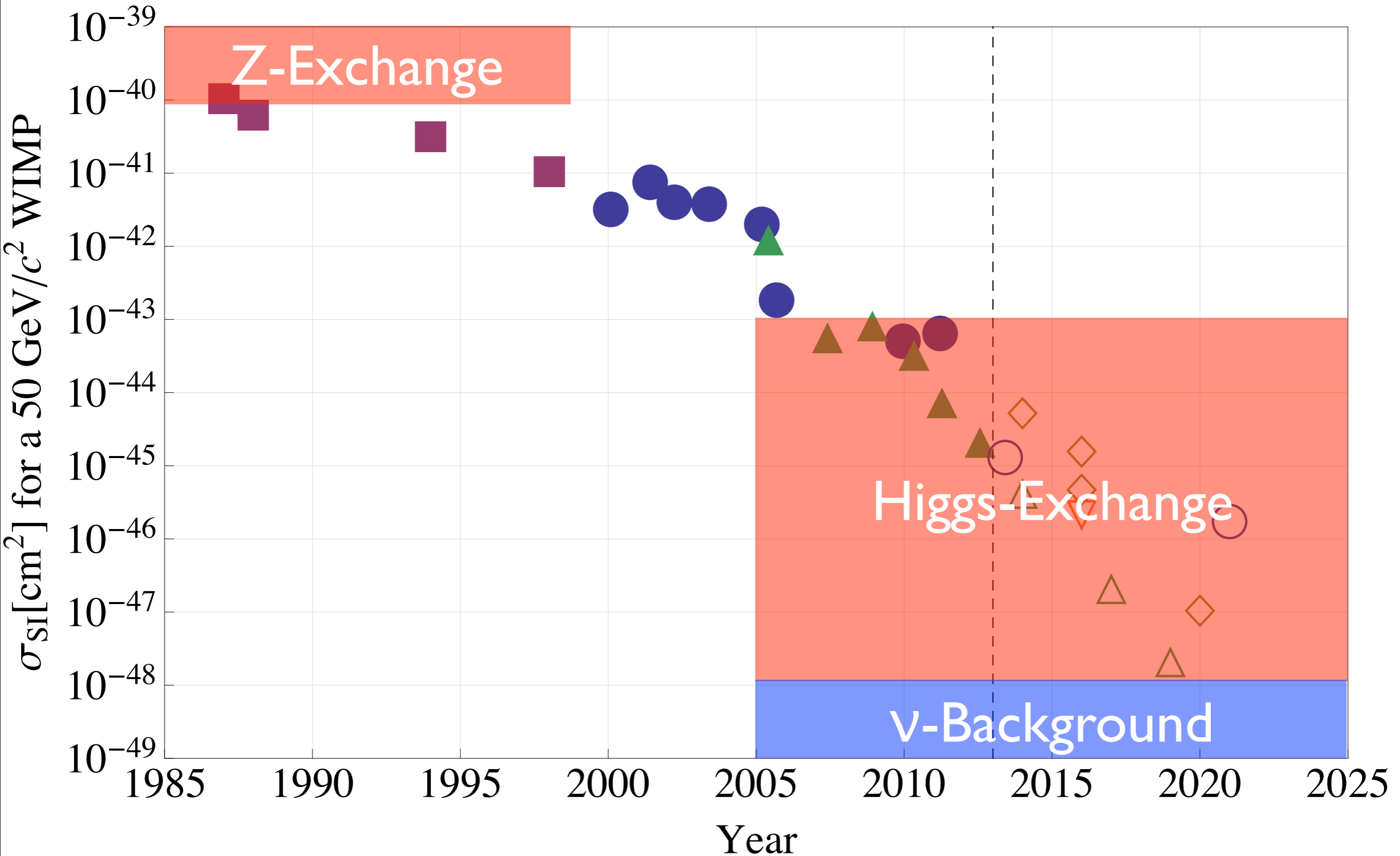
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A Theorists View of Dark Matter Experiment Complementarity

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- “Not difficult to evade constraints from lepton colliders” (JF, 7/29)

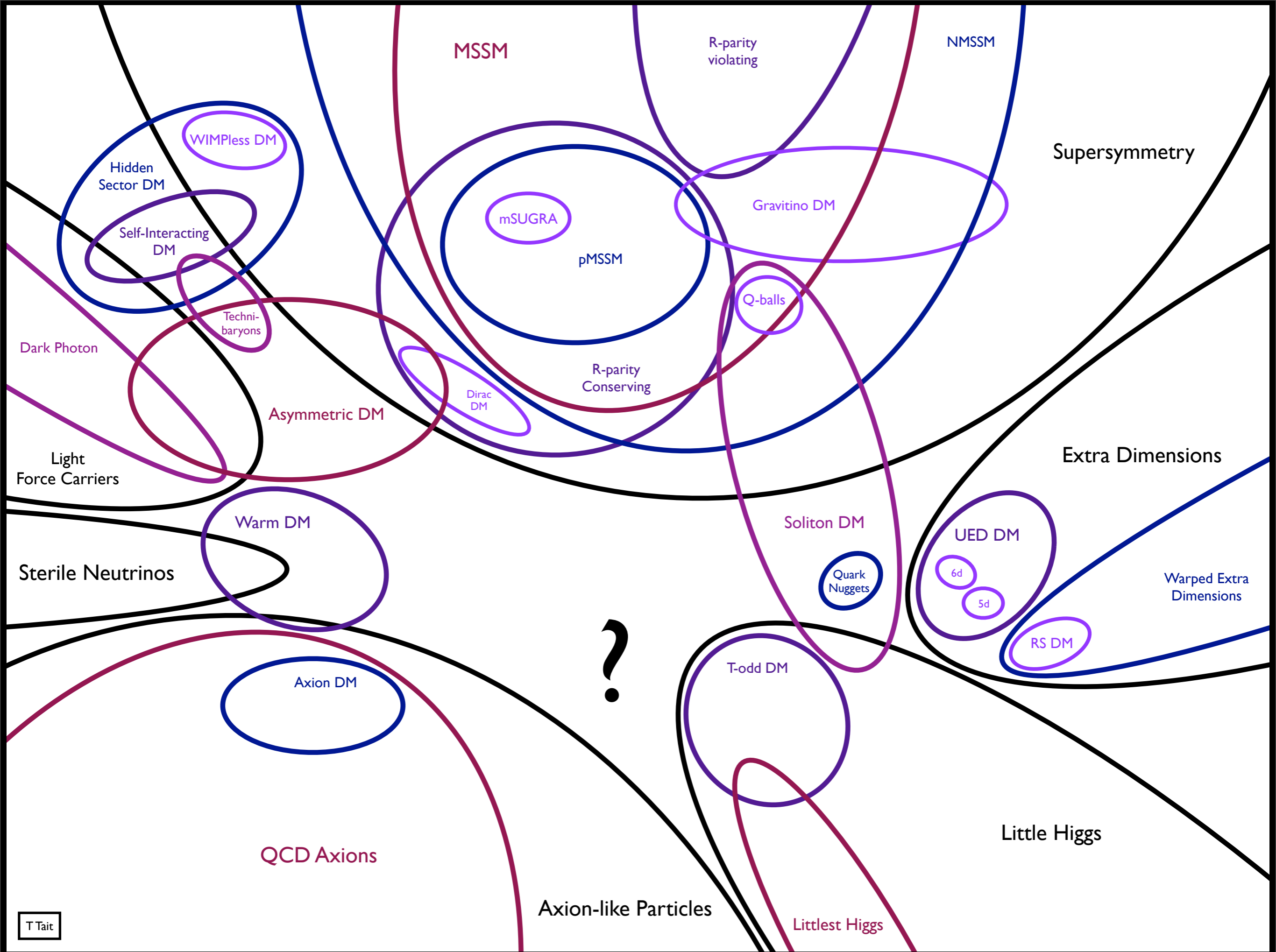
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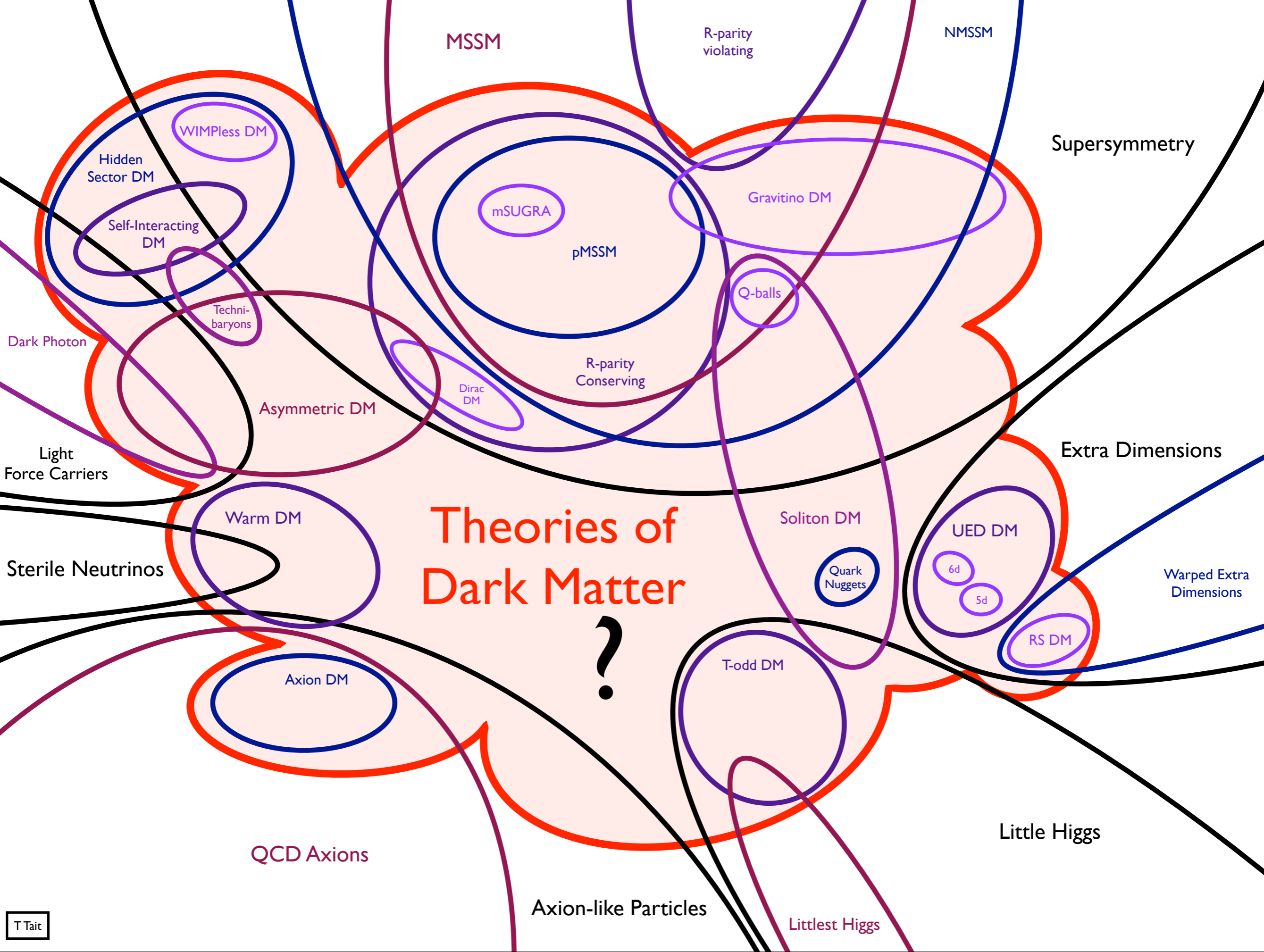
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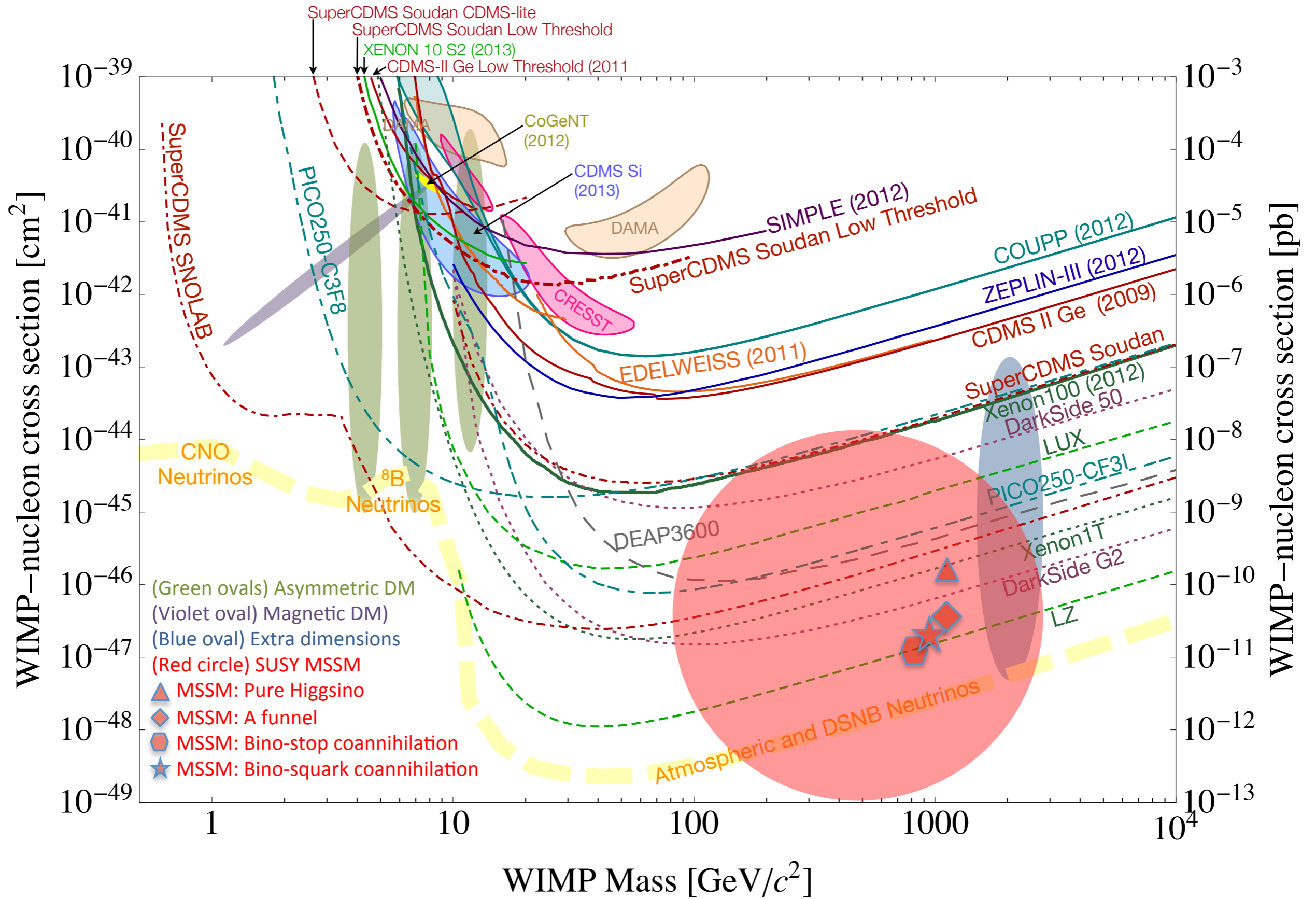
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- Difficult to escape direct detection constraints

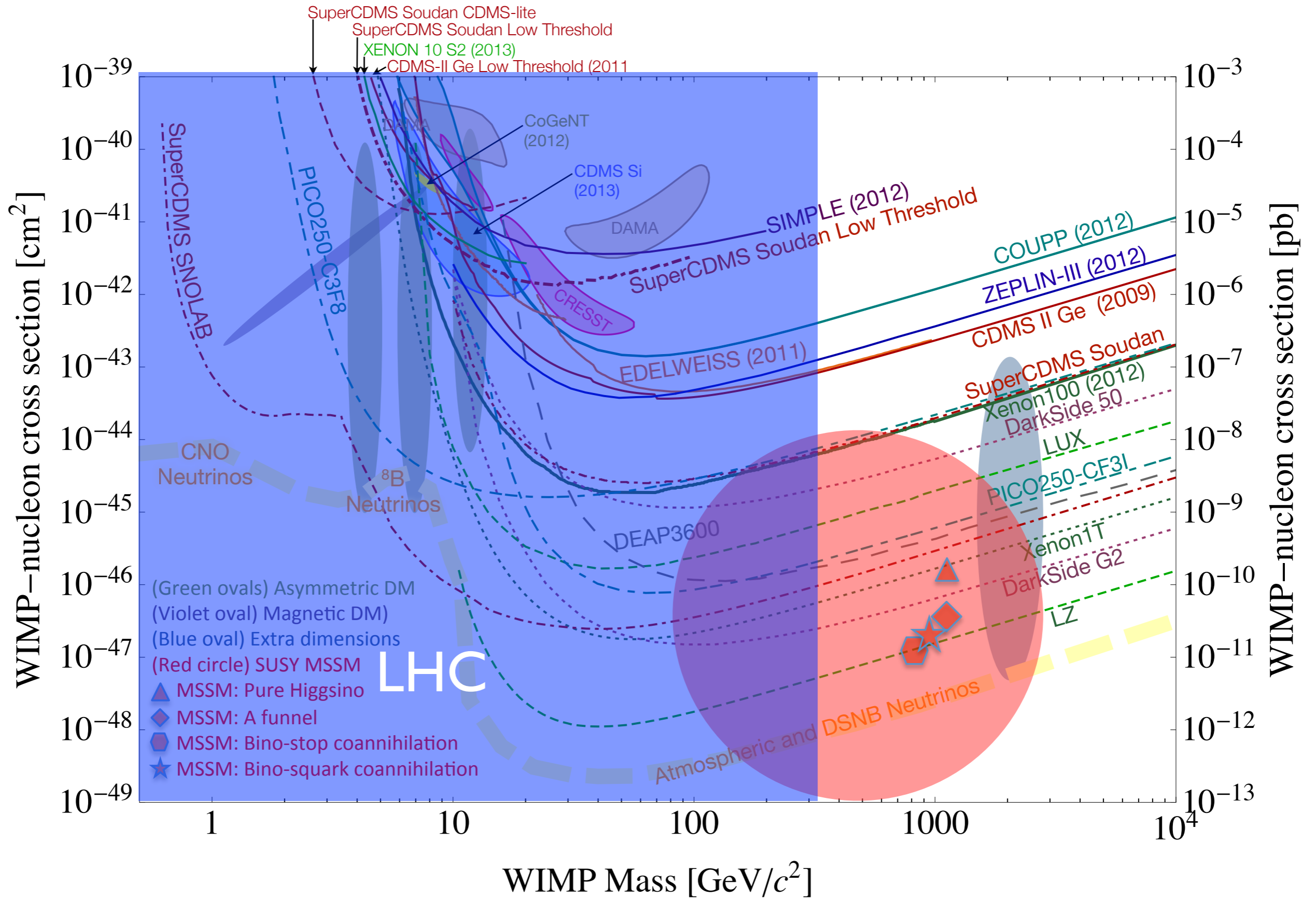


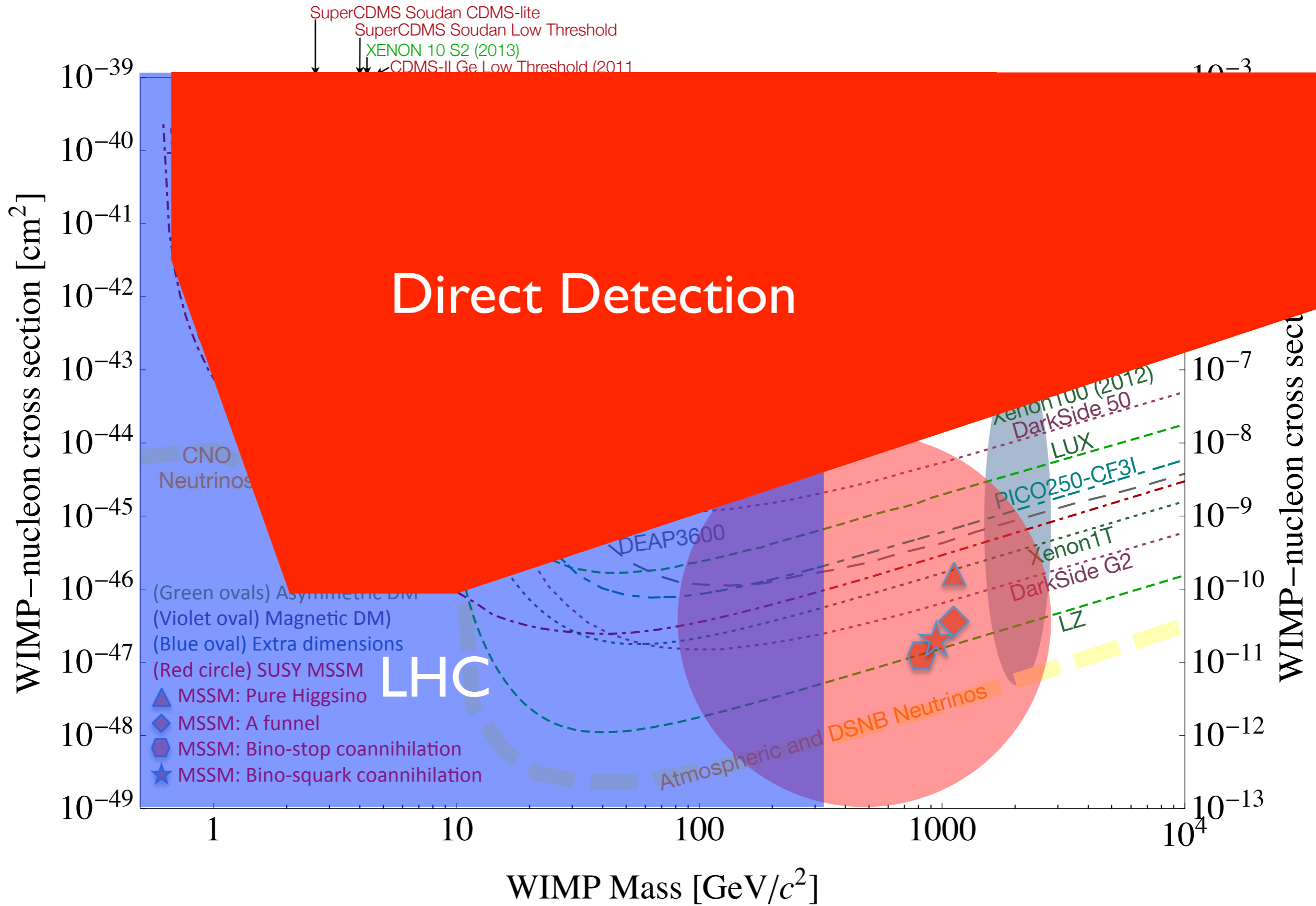
Theories of Dark Matter



T Tait

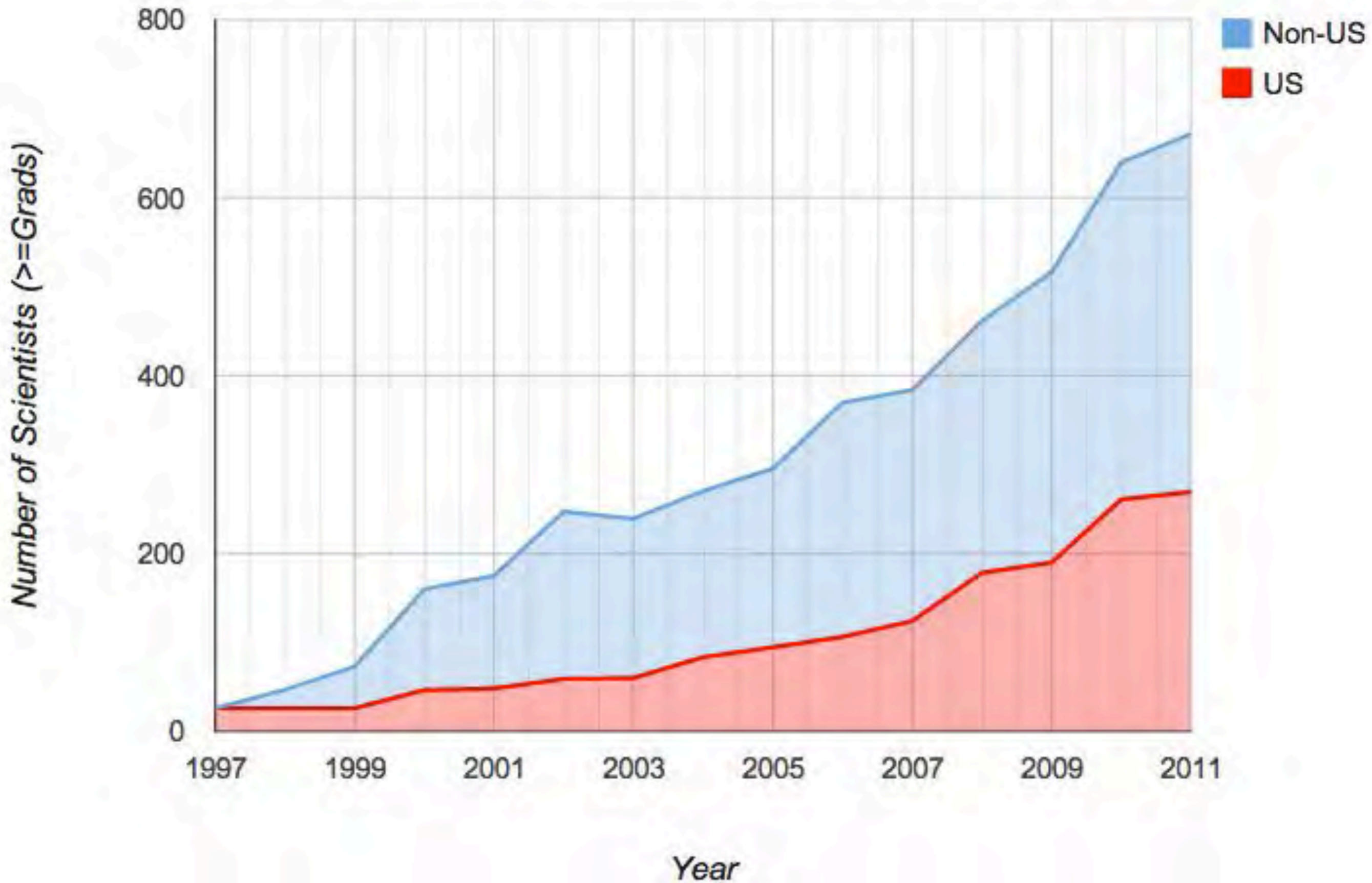






A Discovery Could
Come at Any Time!
Stay Tuned.

Scientists Working in Dark Matter Direct Detection by year



Ongoing Field Consolidation

- NSF and DOE working on joint selection of G2 program
 - DOE trimmed program to 5 contestants (including one axion)
 - NSF competition open to entire field
 - Key deadlines end of October 2013
- Field needs to keep alive strong R&D for technology development
 - Experiments operating at edge of threshold, with techniques required to improve limits by orders of magnitude
 - Need array of techniques at all times to probe any kind of evidence at any mass!
 - In case of discovery, directional detection will play special role in extracting science. Needs special line of R&D support

A Post-G2 Roadmap for Direct Detection

Discovery

Search for WIMPS over a wide mass range (1 GeV to 100 TeV), with at least an order of magnitude improvement in sensitivity in each generation, until we encounter the coherent neutrino scattering signal that will arise from solar, atmospheric and supernova neutrinos

Confirmation

Check any evidence for WIMP signals using experiments with complementary technologies, and also with an experiment using the original target material, but having better sensitivity

Study

If a signal is confirmed, study it with multiple technologies in order to extract maximal information about WIMP properties

R&D

Maintain a robust detector R&D program on technologies that can enable discovery, confirmation and study of WIMPs

The End