First Dark Matter Search Results from the XENON1T Experiment

E. Aprile,[1] J. Aalbers,[2,*] F. Agostini,[3,4] M. Alfonsi,[5] F. D. Amaro,[6] M. Anthony,[1] F. Arneodo,[7] P. Barrow,[8]
L. Baudis,[8] B. Bauermeister,[9] M. L. Benabderrahmane,[7] T. Berger,[10] P. A. Breur,[2] A. Brown,[2] A. Brown,[8]
E. Brown,[10] S. Bruenner,[11] G. Bruno,[3] R. Budnik,[
M. Cervantes,[14] D. Cichon,[11] D. Coderre,[13] A. P. Colijn
P. de Perio,[1] P. Di Gangi,[4] A. Di Giovanni,[7] S. Diglio
W. Fulgione,[3,18] A. Gallo Rosso,[3] M. Galloway,[8]
L. W. Goetzke,[1] L. Grandi,[19] Z. Greene,[1] C. Grignon,[5]
B. Kaminsky,[13,†] S. Kazama,[8] G. Kessler,[8] A. Kis
L. Levinson,[12] Q. Lin,[1] S. Lindemann,[11,13] M. Lindner,
I. Mariş,[7] T. Marrodán Undagoitia,[11] J. Masbou,[15] F.
K. Micheneau,[15] A. Molinario,[3] K. Morå,[9] M. Murra,[1
B. Pelssers,[9] R. Persiani,[15] F. Piastra,[8] J. Piena
N. Priel,[12] L. Rauch,[11] S. Reichard,[8,14] C. Reuter,[14]
R. Saldanha,[19] J. M. F. dos Santos,[6] G. Sartorelli
M. Schumann,[13] L. Scotto Lavina,[21] M. Selvi,[4] P.
M. v. Sivers,[13,†] A. Stein,[22] S. Thapa,[19] D. Thers,[15] A.
N. Upole,[19] H. Wang,[22] Z. Wang,[3] Y. Wei,[8] C. Weinl
(XENON Coll

[1]*Physics Department, Columbia Uni*
[2]*Nikhef and the University of Amsterdam, Sci*
[3]*INFN-Laboratori Nazionali del Gran Sasso and G*
[4]*Department of Physics and Astrophysics, University*
[5]*Institut für Physik & Exzellenzcluster PRISMA, Johann*
[6]*LIBPhys, Department of Physics, Universit*
[7]*New York University Abu Dhabi,*
[8]*Physik-Institut, University of Z*
[9]*Oskar Klein Centre, Department of Physics, Stockhol*
[10]*Department of Physics, Applied Physics and Astronomy,*
[11]*Max-Planck-Institut für Kernph*
[12]*Department of Particle Physics and Astrophysics, W*
[13]*Physikalisches Institut, Universität Freiburg, 79104 Freiburg, Germany*
[14]*Department of Physics and Astronomy, Purdue University, West Lafayette, IN 47907, USA*
[15]*SUBATECH, IMT Atlantique, CNRS/IN2P3, Université de Nantes, Nantes 44307, France*
[16]*Department of Physics, University of California, San Diego, CA 92093, USA*
[17]*Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany*
[18]*INFN-Torino and Osservatorio Astrofisico di Torino, 10125 Torino, Italy*
[19]*Department of Physics & Kavli Institute for Cosmological Physics, University of Chicago, Chicago, IL 60637, USA*
[20]*Department of Physics and Astronomy, Rice University, Houston, TX 77005, USA*
[21]*LPNHE, Université Pierre et Marie Curie, Université Paris Diderot, CNRS/IN2P3, Paris 75252, France*
[22]*Physics & Astronomy Department, University of California, Los Angeles, CA 90095, USA*

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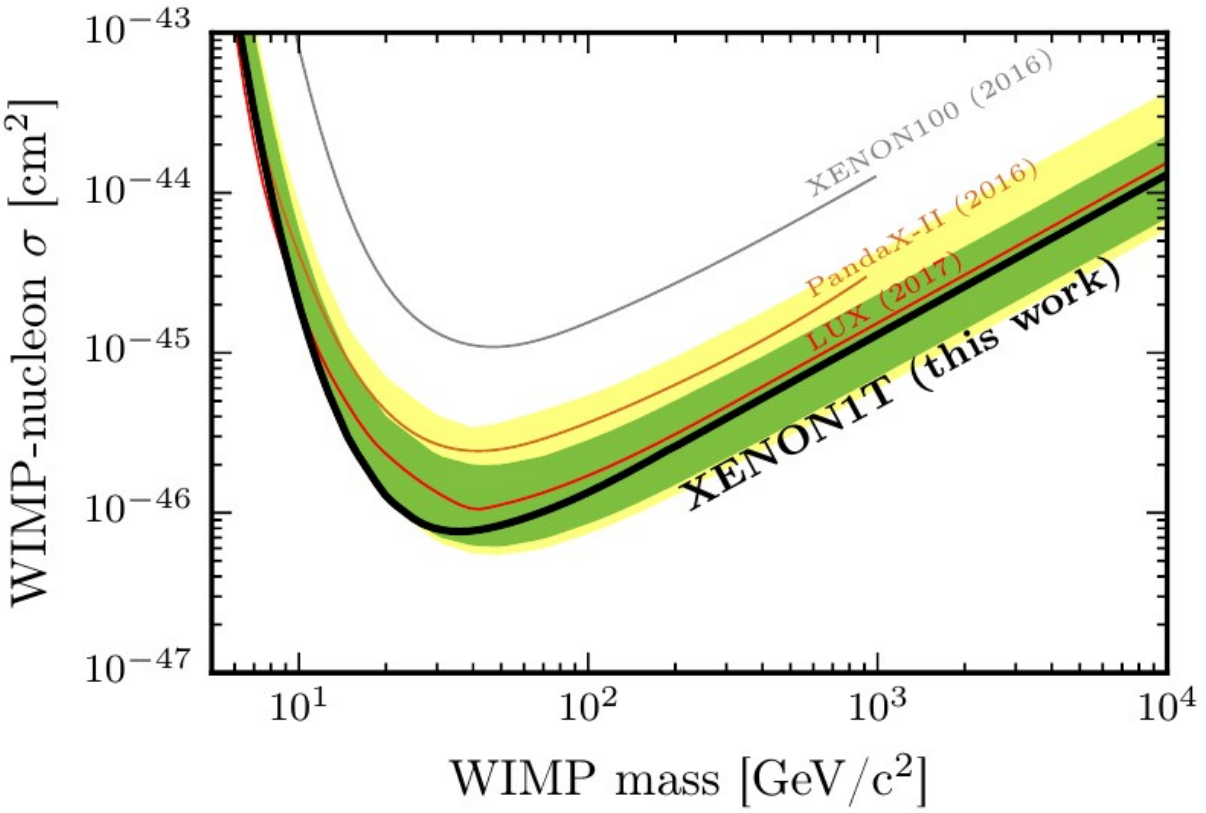
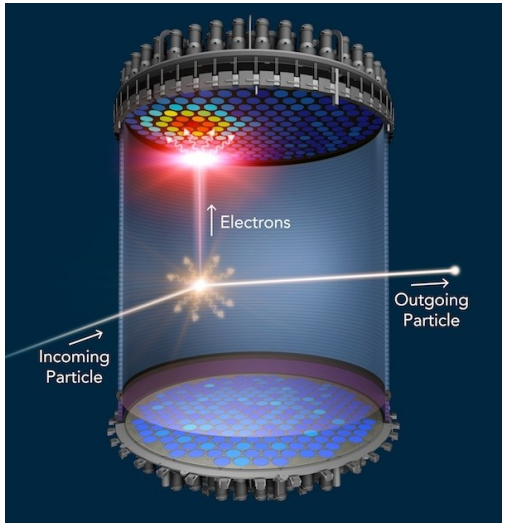
We report the first dark matter search results from XENON1T, a ∼2000-kg-target-mass dual-phase (liquid-gas) xenon time projection chamber in operation at the Laboratori Nazionali del Gran Sasso in Italy and the first ton-scale detector of this kind. The blinded search used 34.2 live days



Sub zepto barn era !

Dark matter direct detection

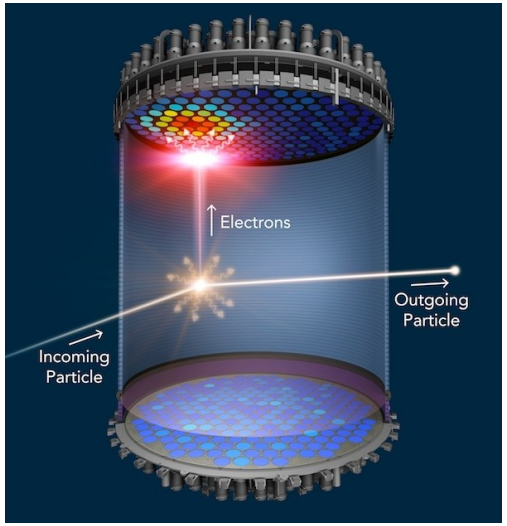


$$\frac{d\mathcal{R}}{dE_R} = \frac{\rho_\odot}{M_{DM}} \frac{d\sigma}{dE_R} \int_{v_{min}}^{v_{esc}} d^3\vec{v}\, \frac{\mathrm{f}(\vec{v}(t))}{v}$$

Astrophysics:

Local dark matter features ?
Density
Phase space distribution
Escape velocity
Dark disk ?

Dark matter direct detection



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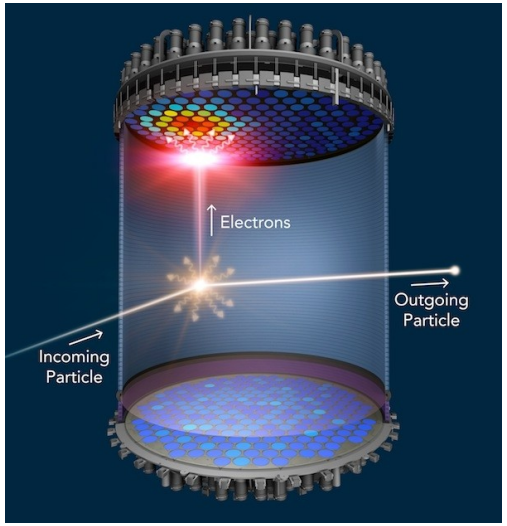
Astrophysics:

Usual assumptions : Standard Halo Model (SHM)
Maxwellian velocity distribution
(self-grav isothermal sphere)

$$\rho_\odot = 0.3\ \mathrm{GeV/cm^3} \qquad f_{\vec{v}}(\vec{v}) = \frac{1}{v_0^3 \pi^{3/2}} \exp\left(-\frac{|\vec{v}|^2}{v_0^2}\right)$$

$$v_c = 220\ \mathrm{km/s}, \quad v_0 = v_c \qquad v_{esc} = 544\ \mathrm{km/s}$$

Dark matter direct detection



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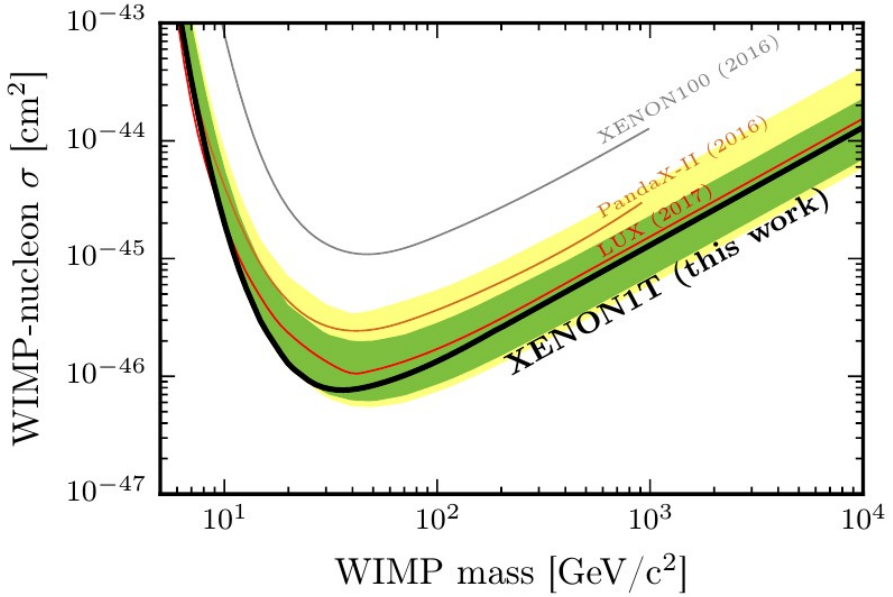

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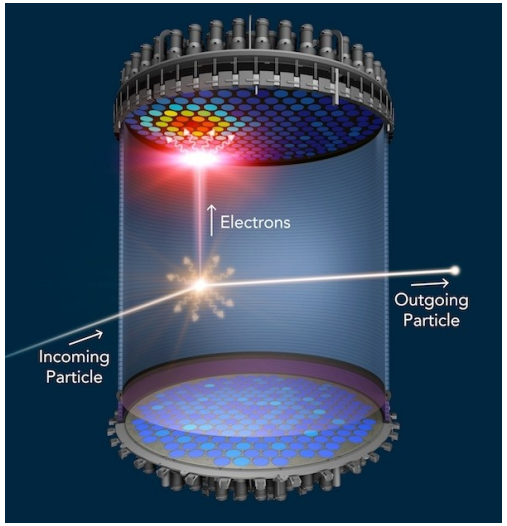

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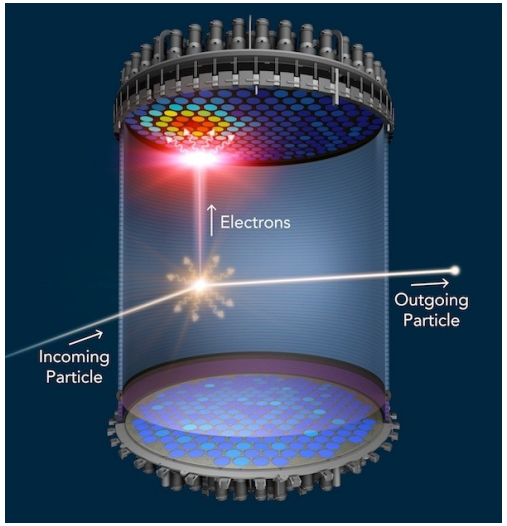
- *Other functions (Generalized Maxwellian, Tsallis ...)*

- *Simulations of “MW-like” galaxies - > f(v)*

- *MW mass model + Eddington inversion - > f(v)*

Dark matter direct detection



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Implications of hydrodynamical simulations for the interpretation of direct dark matter searches

Nassim Bozorgnia and Gianfranco Bertone

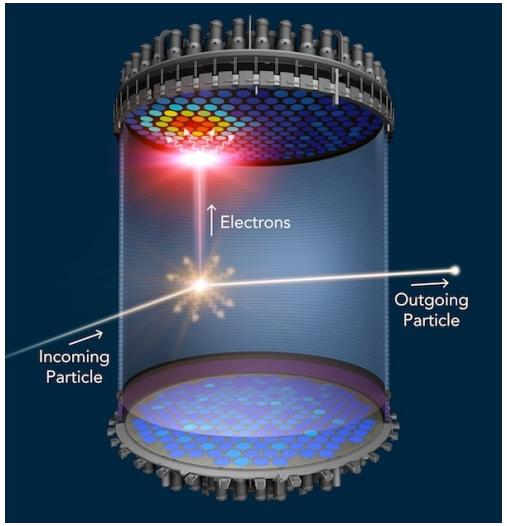
GRAPPA, Institute for Theoretical Physics Amsterdam,
and Delta Institute for Theoretical Physics, University of Amsterdam,
Science Park 904, 1098 XH Amsterdam, The Netherlands

E-mail: n.bozorgnia@uva.nl, g.bertone@uva.nl

Abstract. In recent years, realistic hydrodynamical simulations of galaxies like the Milky Way have become available, enabling a reliable estimate of the dark matter density and velocity distribution in the Solar neighborhood. We review here the status of hydrodynamical simulations and their implications for the interpretation of direct dark matter searches. We focus in particular on: the criteria to identify Milky Way-like galaxies; the impact of baryonic physics on the dark matter velocity distribution; the possible presence of substructures like clumps, streams, or dark disks; and on the implications for the direct detection of dark matter with standard and non-standard interactions.

Keywords: dark matter theory; dark matter simulations; dark matter direct detection

Dark matter direct detection



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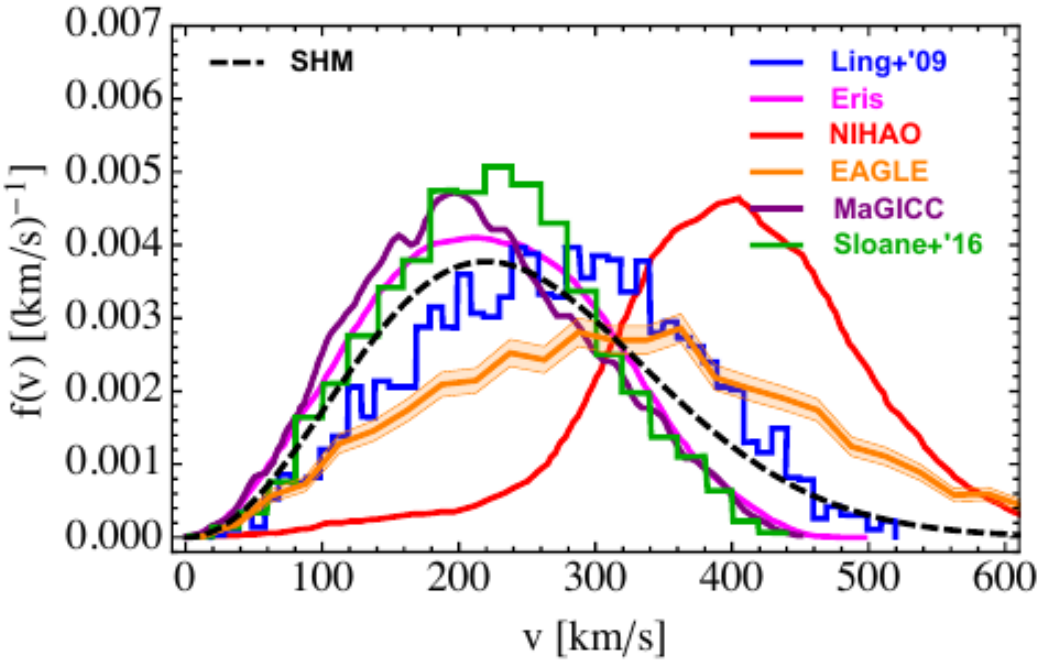
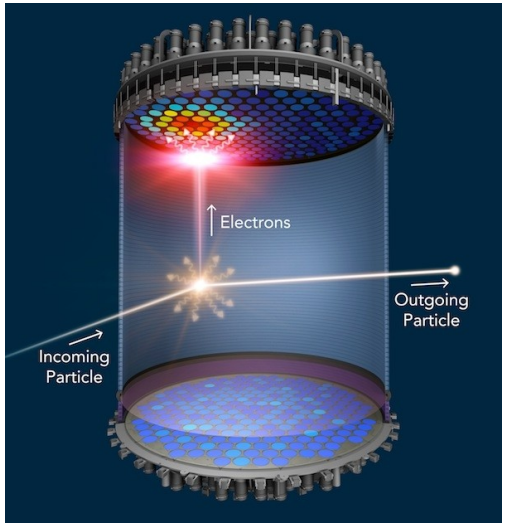


Dark matter direct detection



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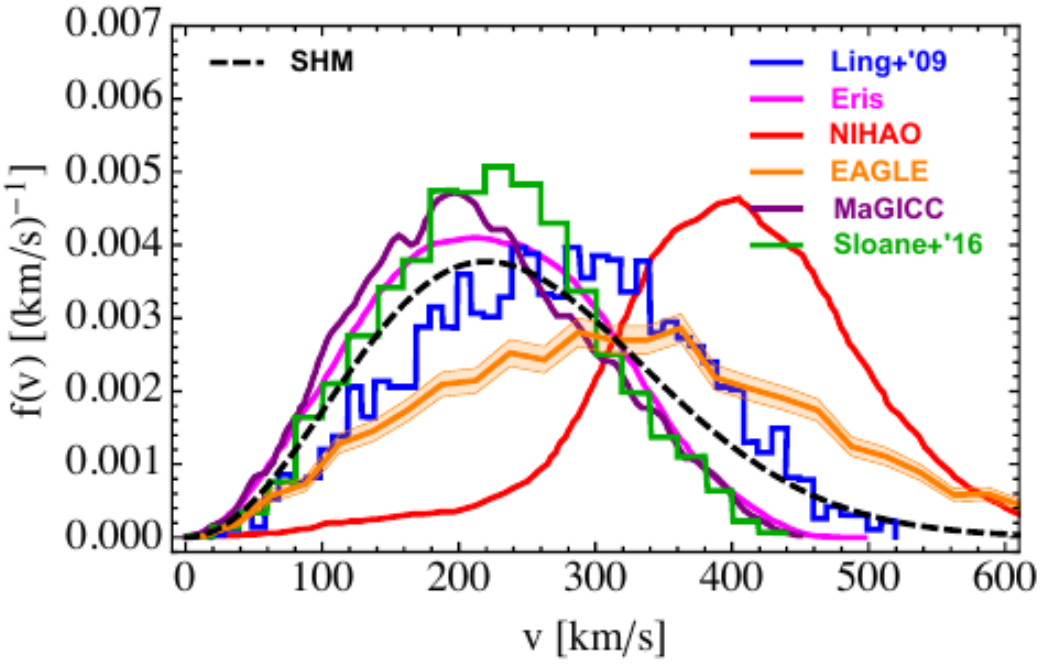
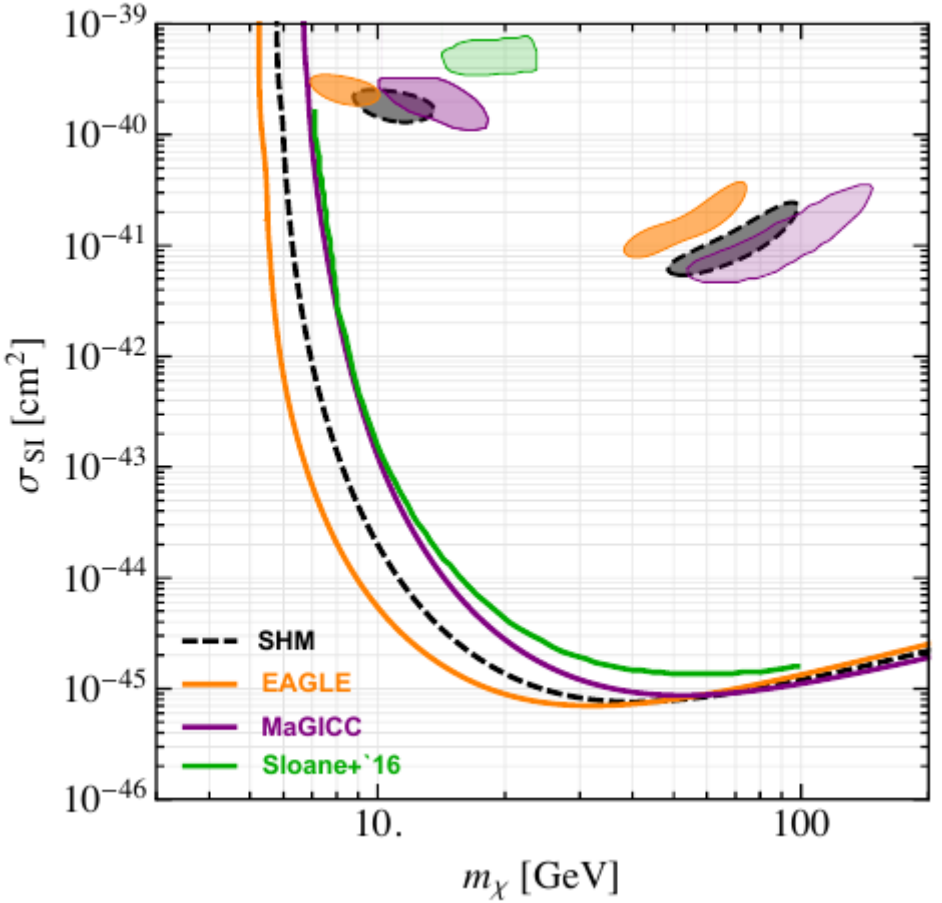
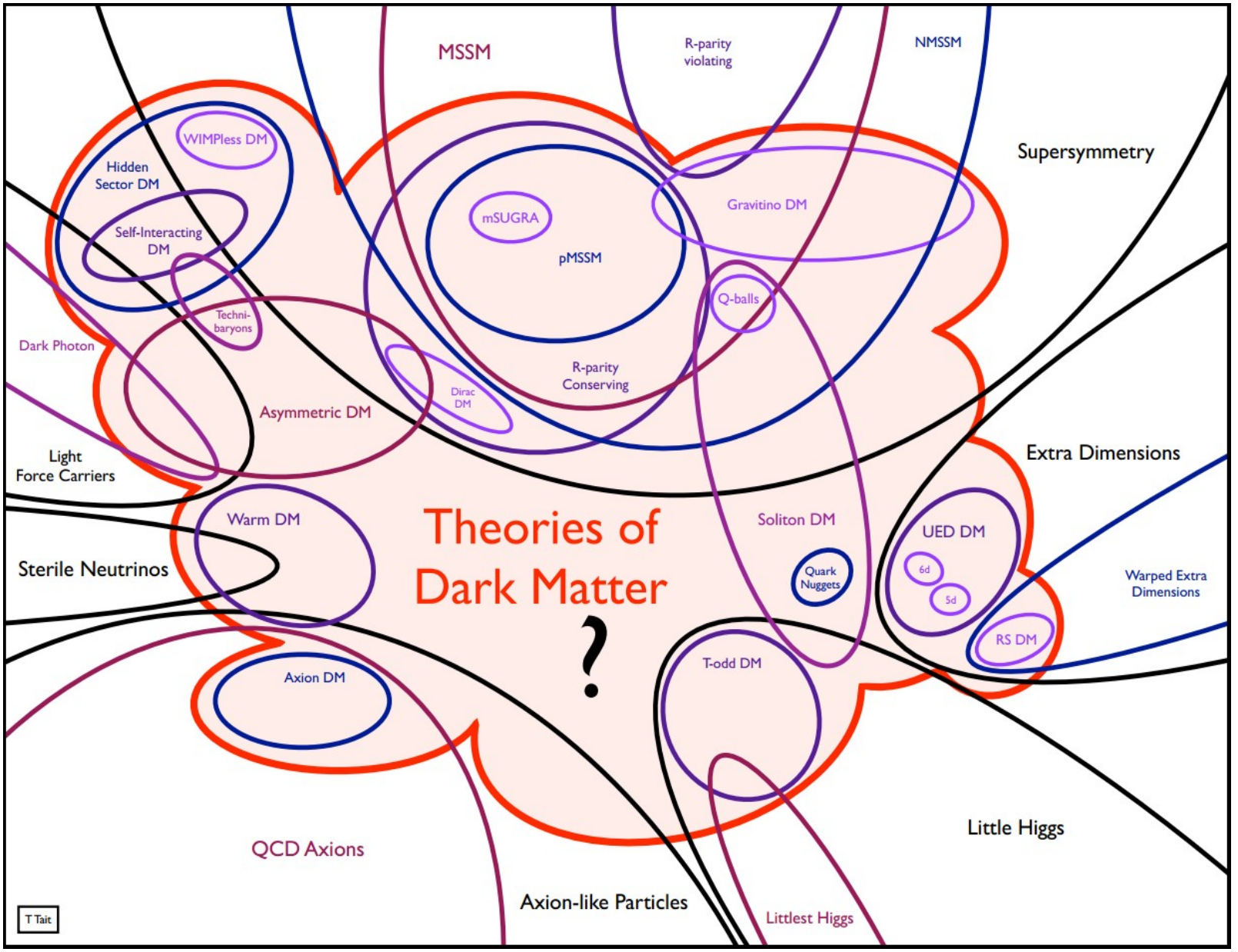
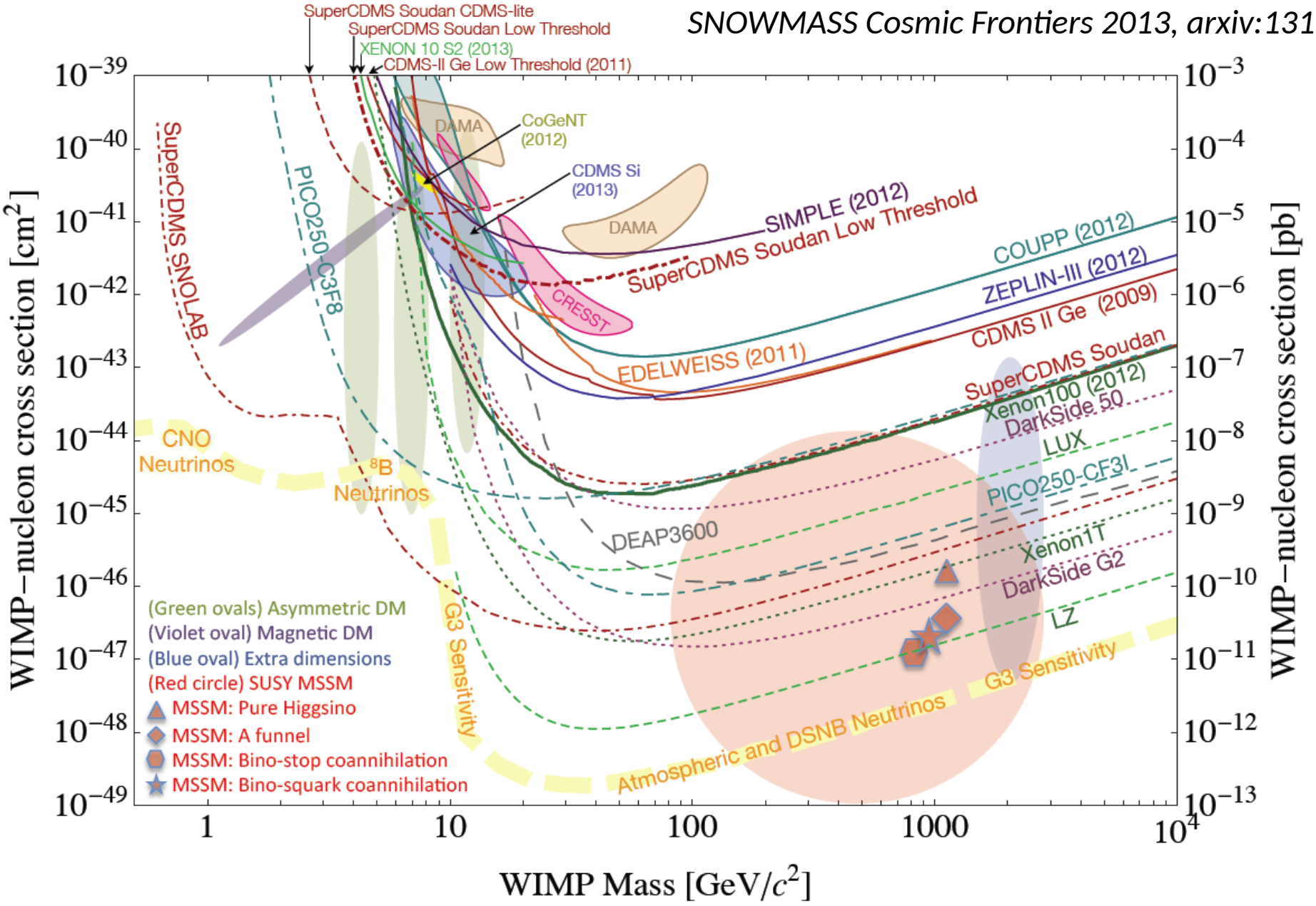





Theories of Dark Matter
?
MSSM
R-parity violating
NMSSM
Supersymmetry
WIMPless DM
Hidden Sector DM
Self-Interacting DM
mSUGRA
pMSSM
Gravitino DM
Q-balls
Techni-baryons
Dark Photon
R-parity Conserving
Dirac DM
Asymmetric DM
Light Force Carriers
Extra Dimensions
Warm DM
Soliton DM
UED DM
6d
5d
Quark Nuggets
Warped Extra Dimensions
Sterile Neutrinos
RS DM
Axion DM
T-odd DM
Little Higgs
QCD Axions
Axion-like Particles
Littlest Higgs
T Tait

SNOWMASS Cosmic Frontiers 2013, arxiv:1310.8327



- *Strong probe of WIMP models*

- *Neutrino floor is around*