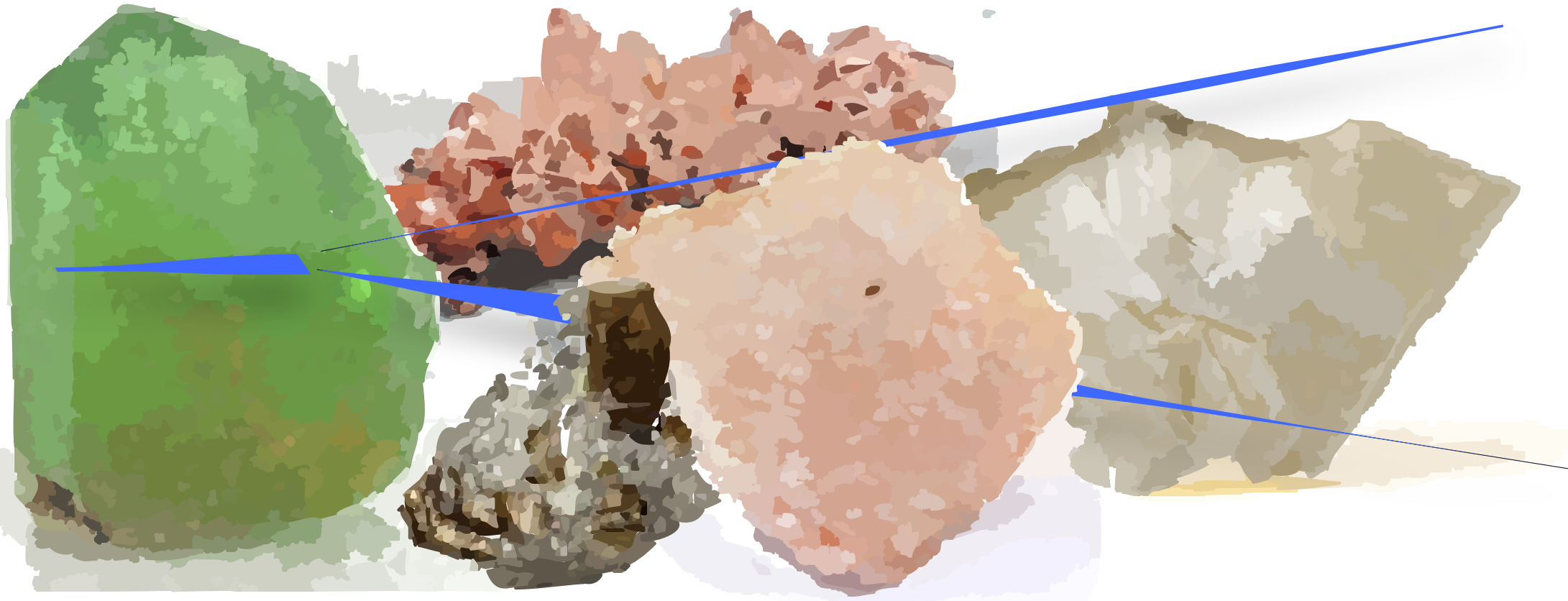


Mineral Detectors for Dark Matter

IFPU, Trieste

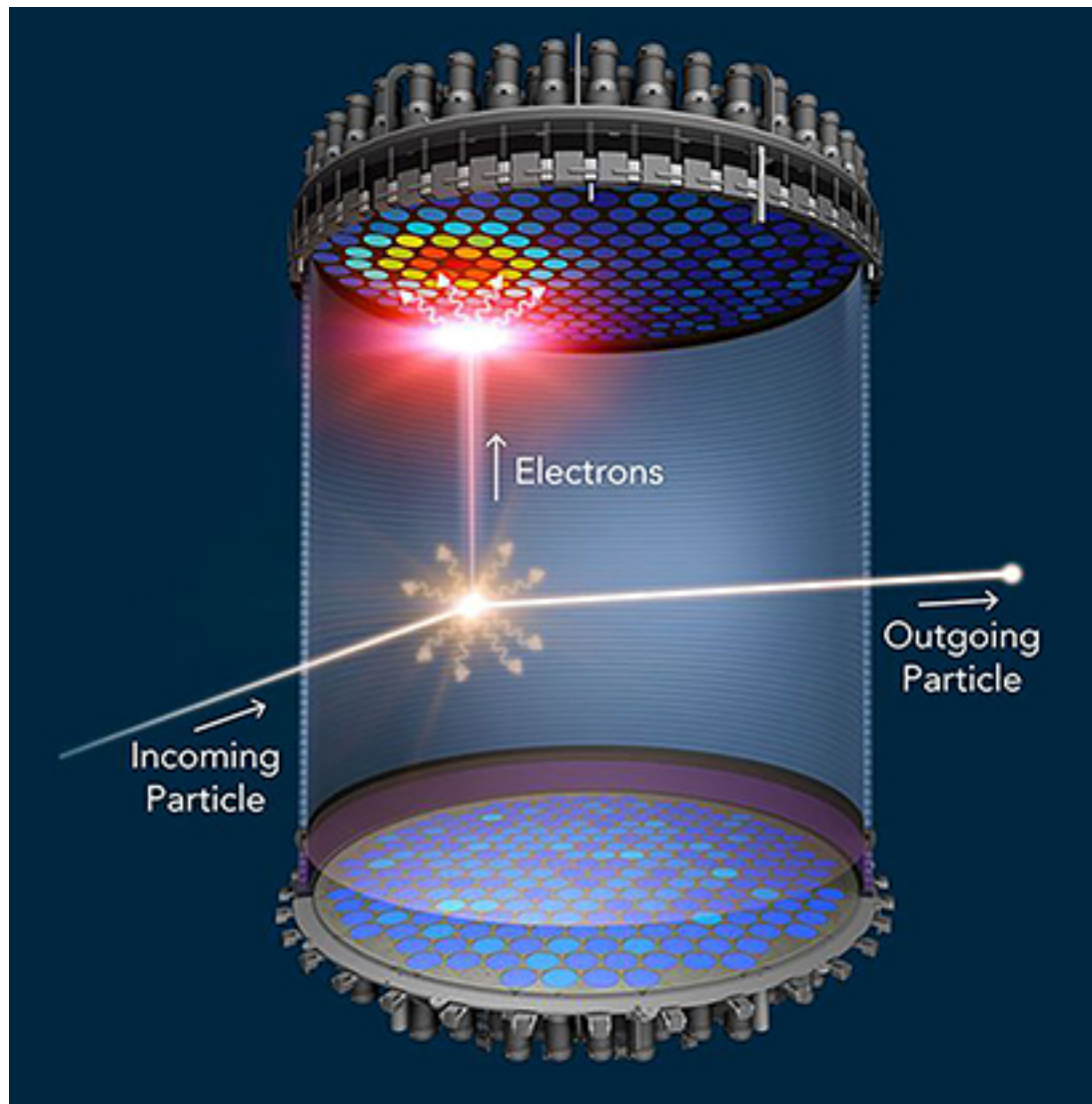


 kavanagh@ifca.unican.es

 @BradleyKavanagh

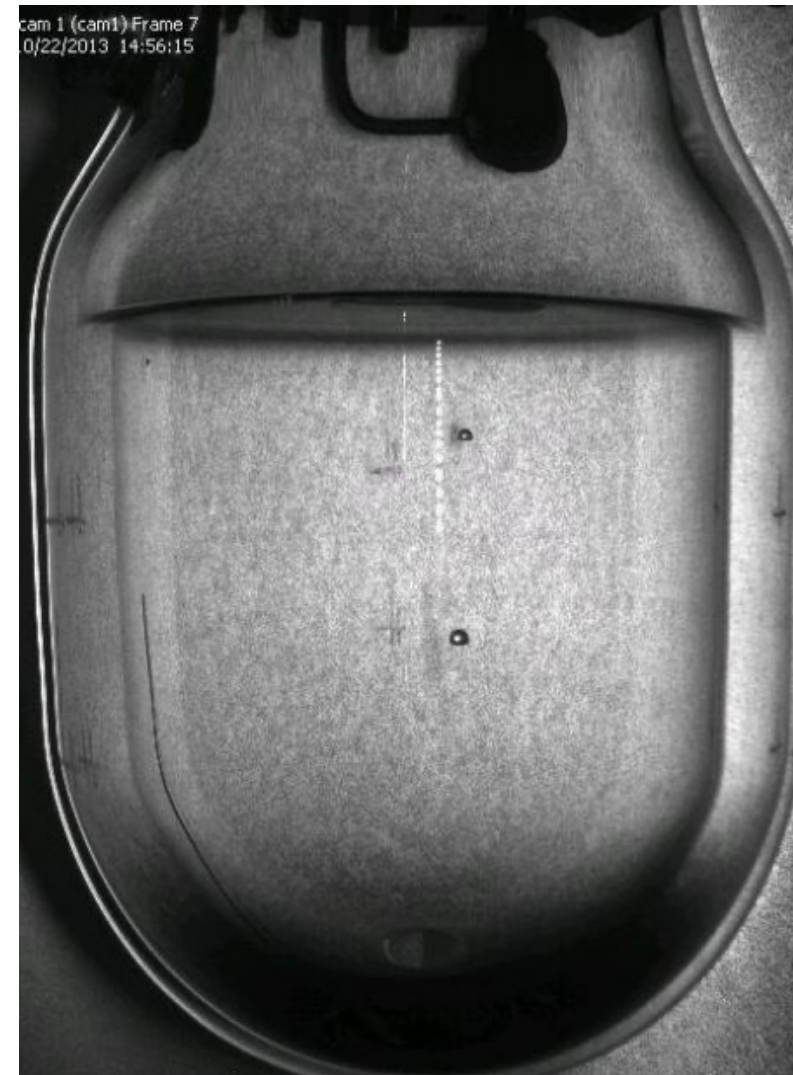
Bradley J Kavanagh
IFCA, Santander, Spain
(CSIC-Universidad de Cantabria)
17th October 2022

Direct detection experiments



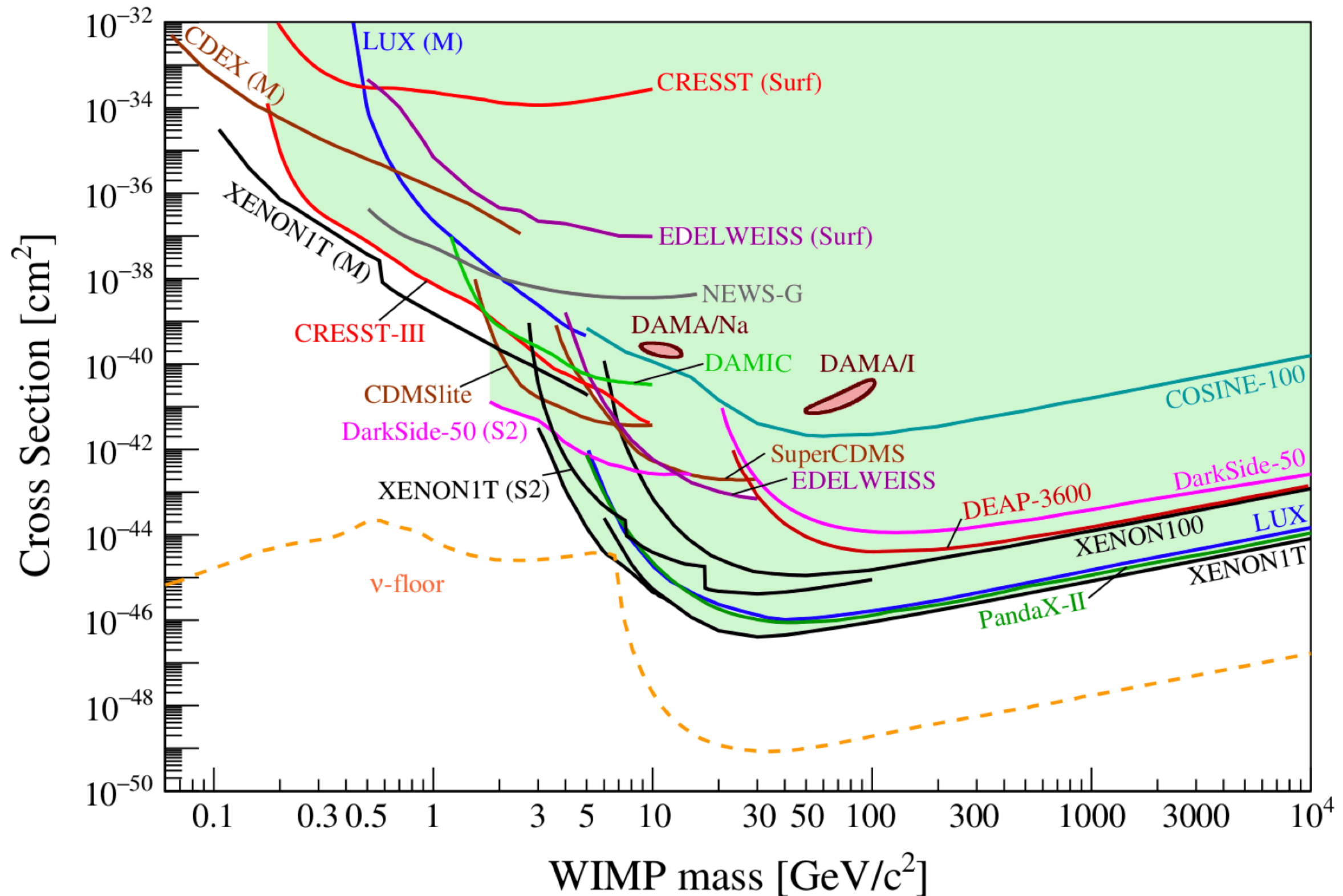
Xenon Experiment

[\[Image Credit\]](#)



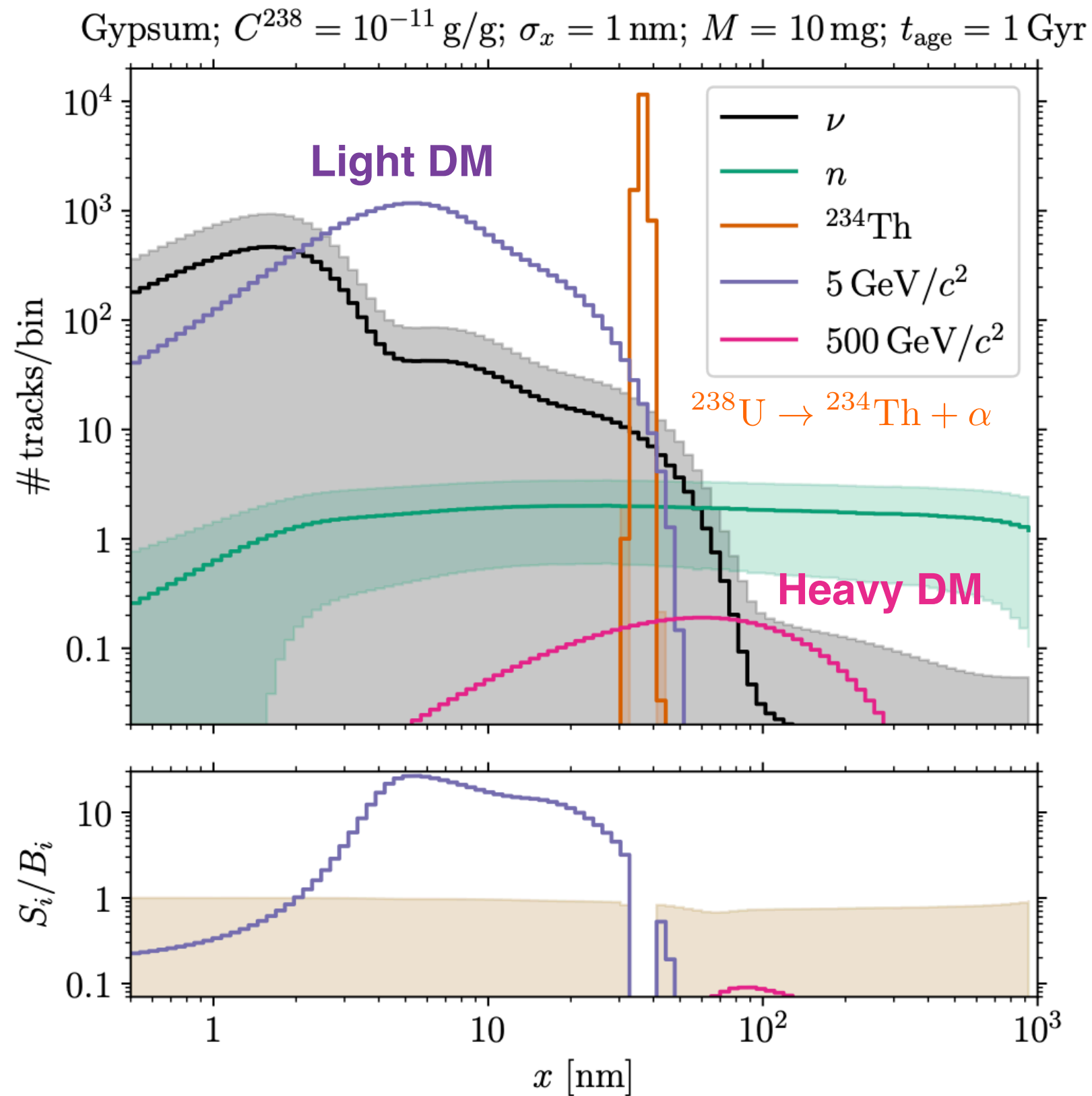
PICO-2L

[\[Image Credit\]](#)



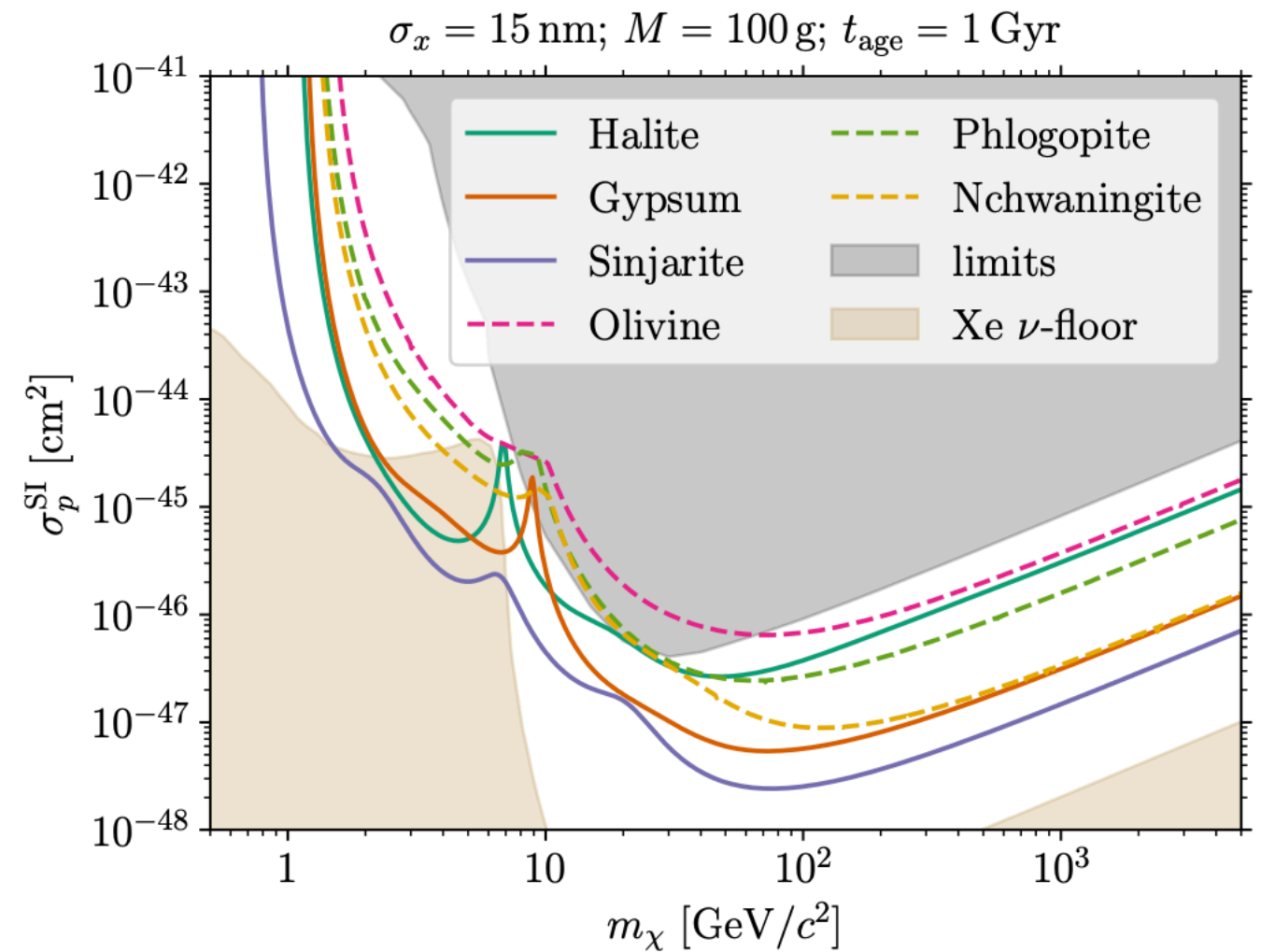
Damage track spectrum

[Baum et al., [2106.06559](#)]

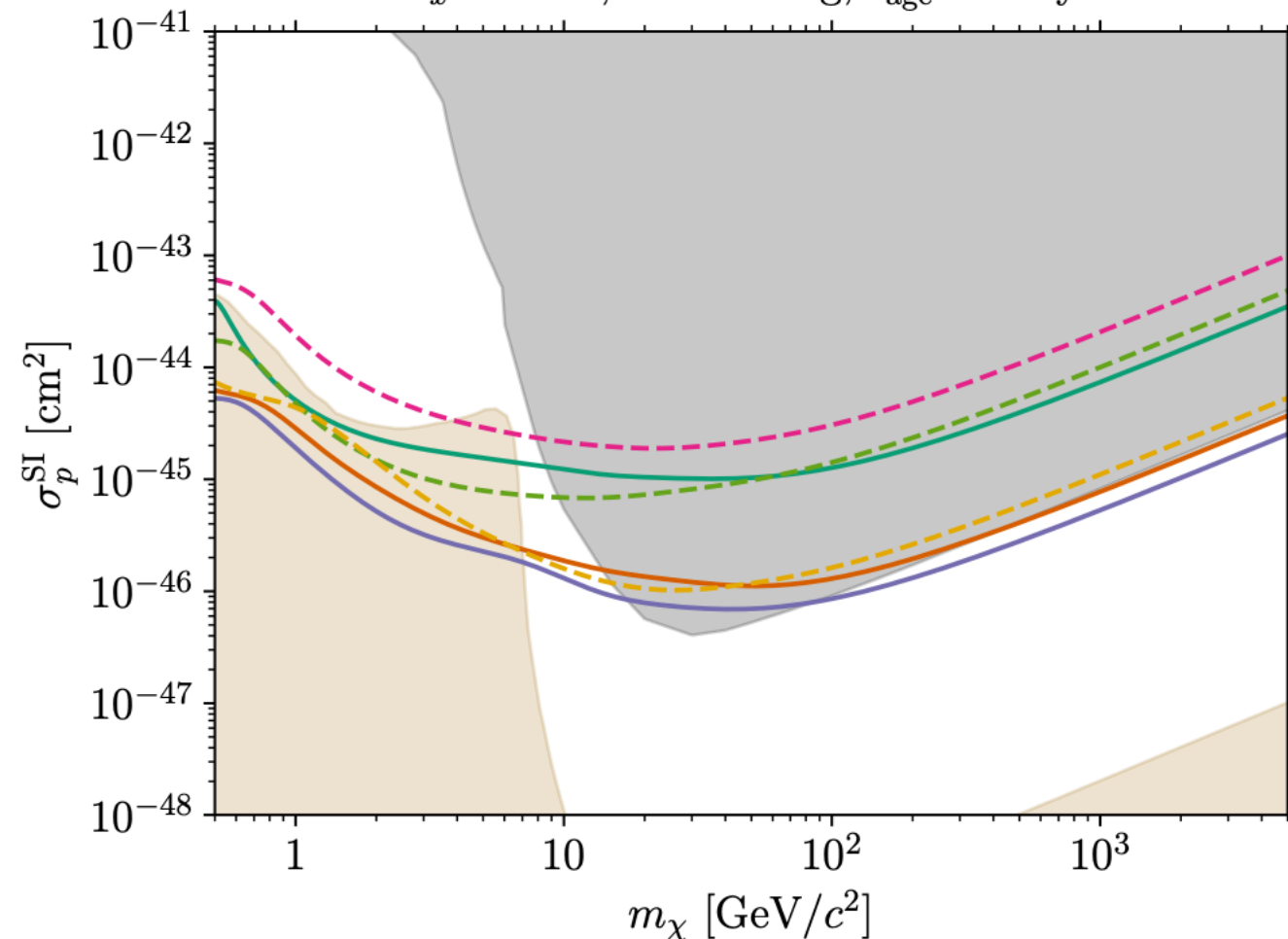


Projected Limits

Low resolution,
High exposure



$\sigma_x = 1 \text{ nm}; M = 10 \text{ mg}; t_{\text{age}} = 1 \text{ Gyr}$



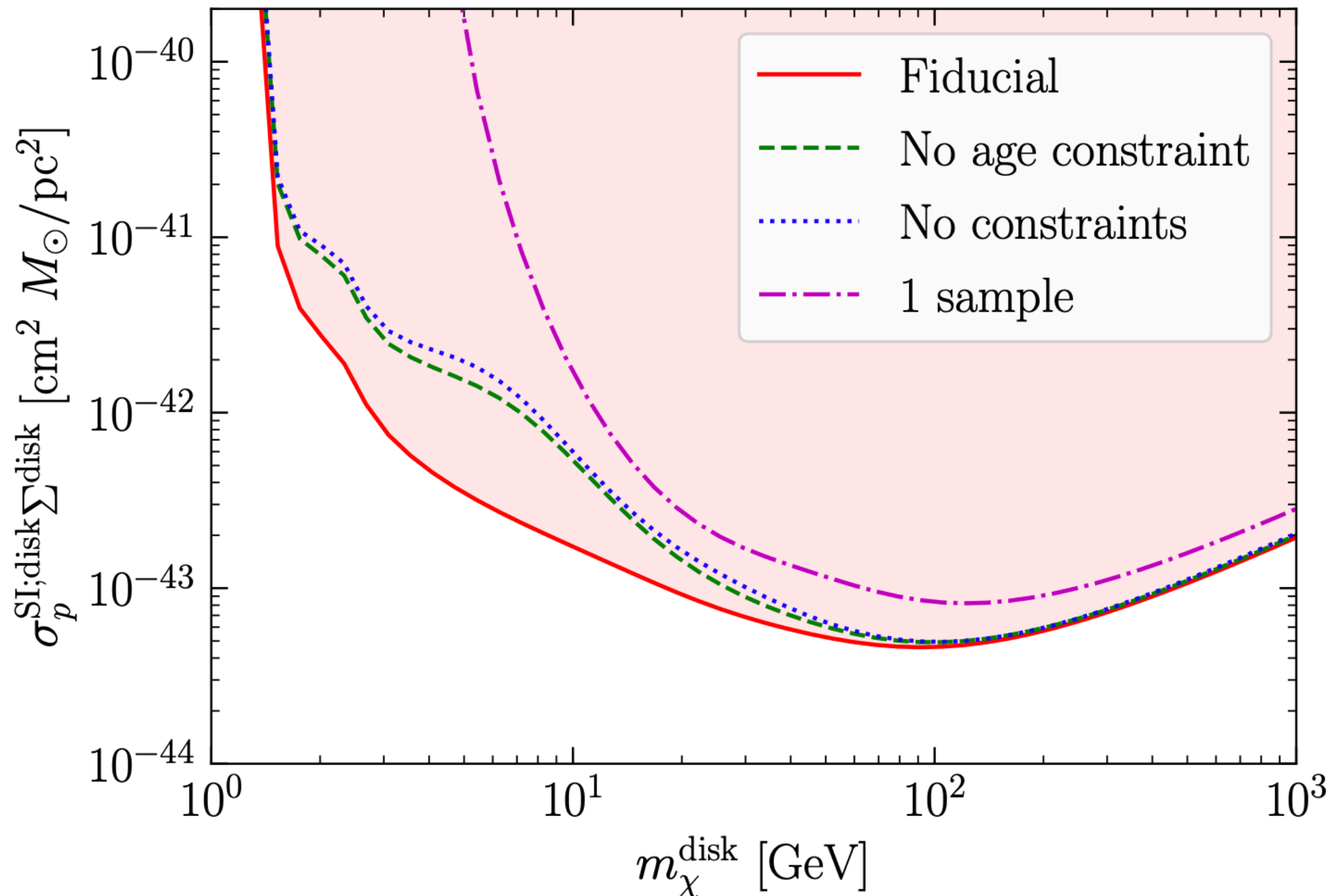
High resolution,
Low Exposure



[Baum et al., [2106.06559](#)]

Where minerals shine

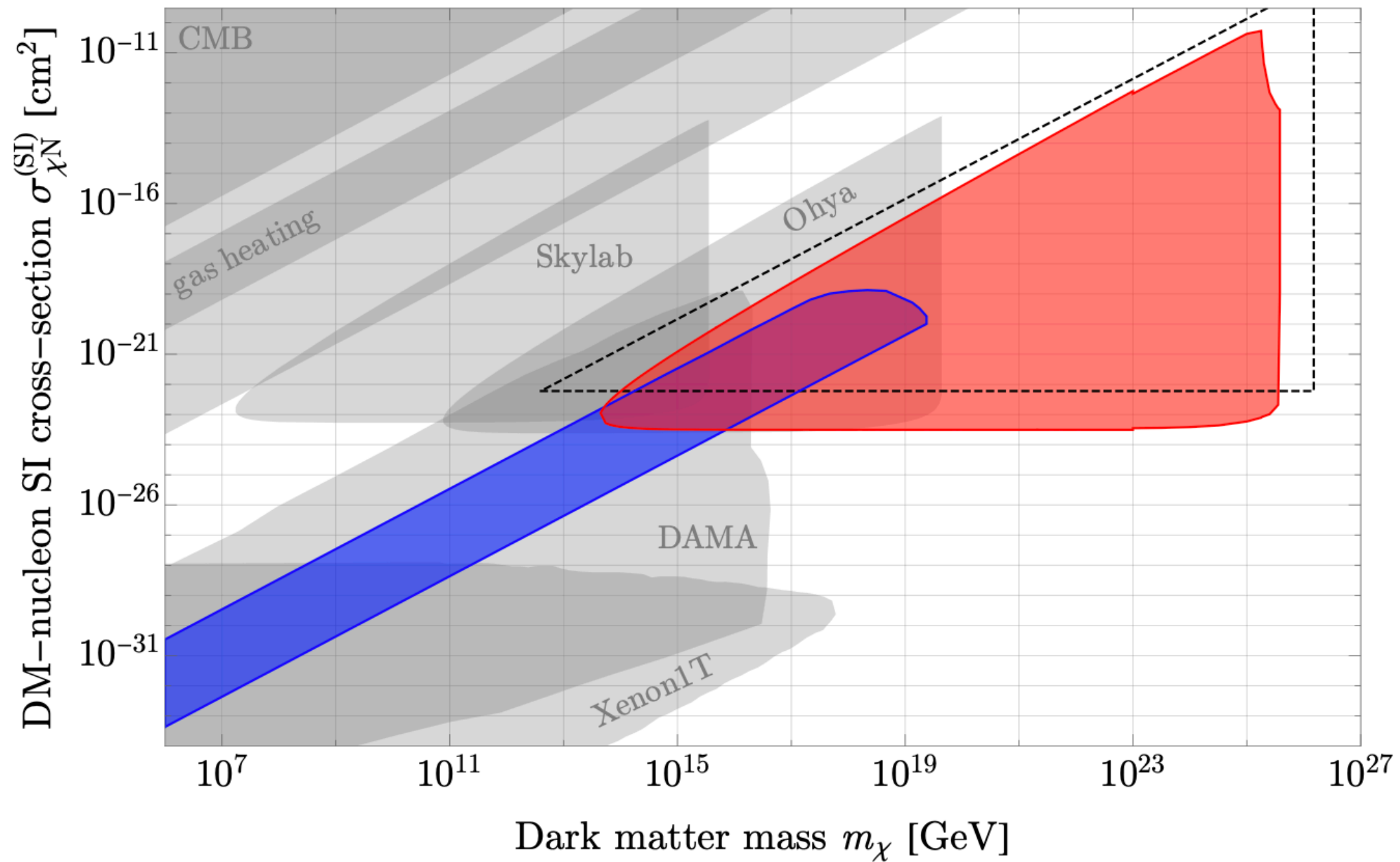
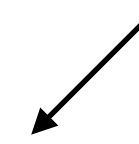
Time-varying
DM signals



[E.g. Baum et al., [2107.02812](#)]

Where minerals shine

Ultra-heavy DM



[E.g. Acevedo et al., [2105.06473](#)]

References



Classics (the “Mica” era)

Search for Supermassive Magnetic Monopoles Using Mica Crystals - <https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.56.1226>

Limits on Dark Matter Using Ancient Mica - <https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.74.4133>

Probing the structure of the cold dark matter halo with ancient mica - <https://arxiv.org/abs/astro-ph/9711039>

Macro Dark Matter - <https://arxiv.org/abs/1410.2236>

Dark Matter paleo-detectors revisited

Searching for Dark Matter with Paleo-Detectors - <https://arxiv.org/abs/1806.05991>

Paleo-detectors: Searching for Dark Matter with Ancient Minerals - <https://arxiv.org/abs/1811.06844>

Digging for Dark Matter: Spectral Analysis and Discovery Potential of Paleo-Detectors - <https://arxiv.org/abs/1811.10549>

A counter-top search for macroscopic dark matter - <https://arxiv.org/abs/1905.10025>

Ultra-Heavy Dark Matter Search with Electron Microscopy of Geological Quartz - <https://arxiv.org/abs/2105.03998>

Old Rocks, New Limits: Excavated Ancient Mica Searches For Dark Matter - <https://arxiv.org/abs/2105.06473>

New Projections for Dark Matter Searches with Paleo-Detectors - <https://arxiv.org/abs/2106.06559>

Galactic Geology: Probing Time-Varying Dark Matter Signals with Paleo-Detectors - <https://arxiv.org/abs/2107.02812>

Scattering searches for dark matter in subhalos: neutron stars, cosmic rays, and old rocks - <https://arxiv.org/abs/2109.04582>

What about setting up a ‘master’ reference list?

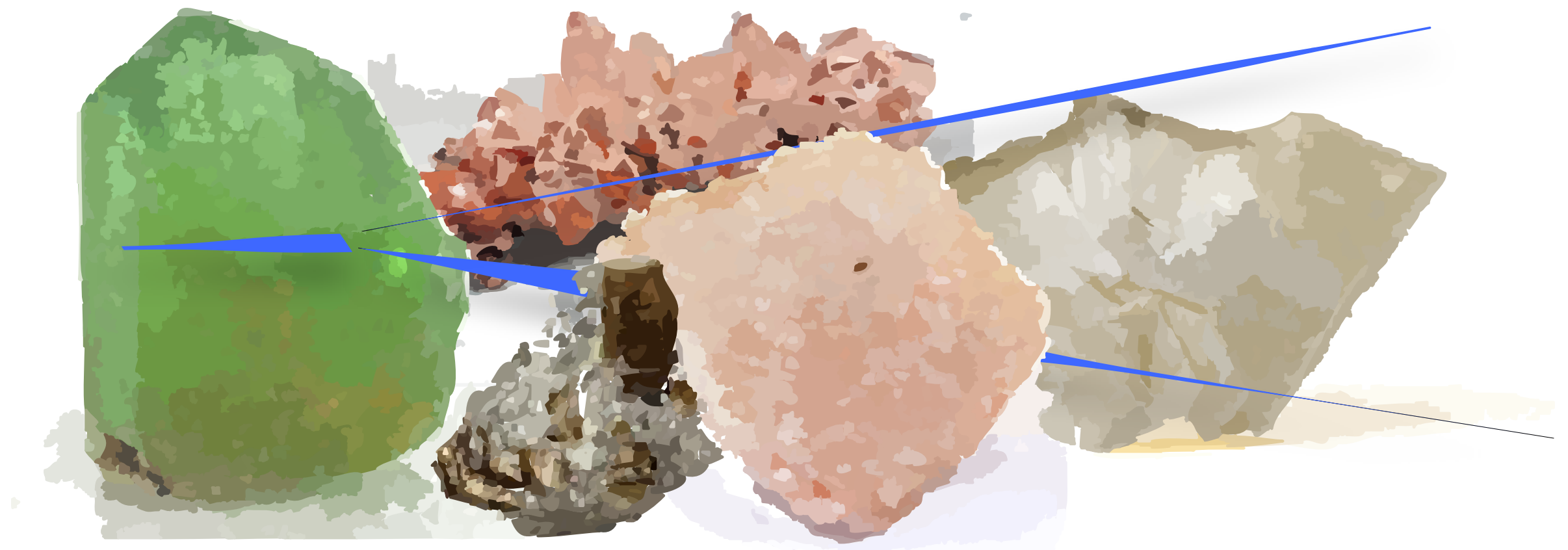
Codes



Paleopy - <https://github.com/tedwards2412/paleopy>

PaleoSpec - <https://github.com/sbaum90/paleoSpec>

PaleoSens - <https://github.com/sbaum90/paleoSens>



Thank you!