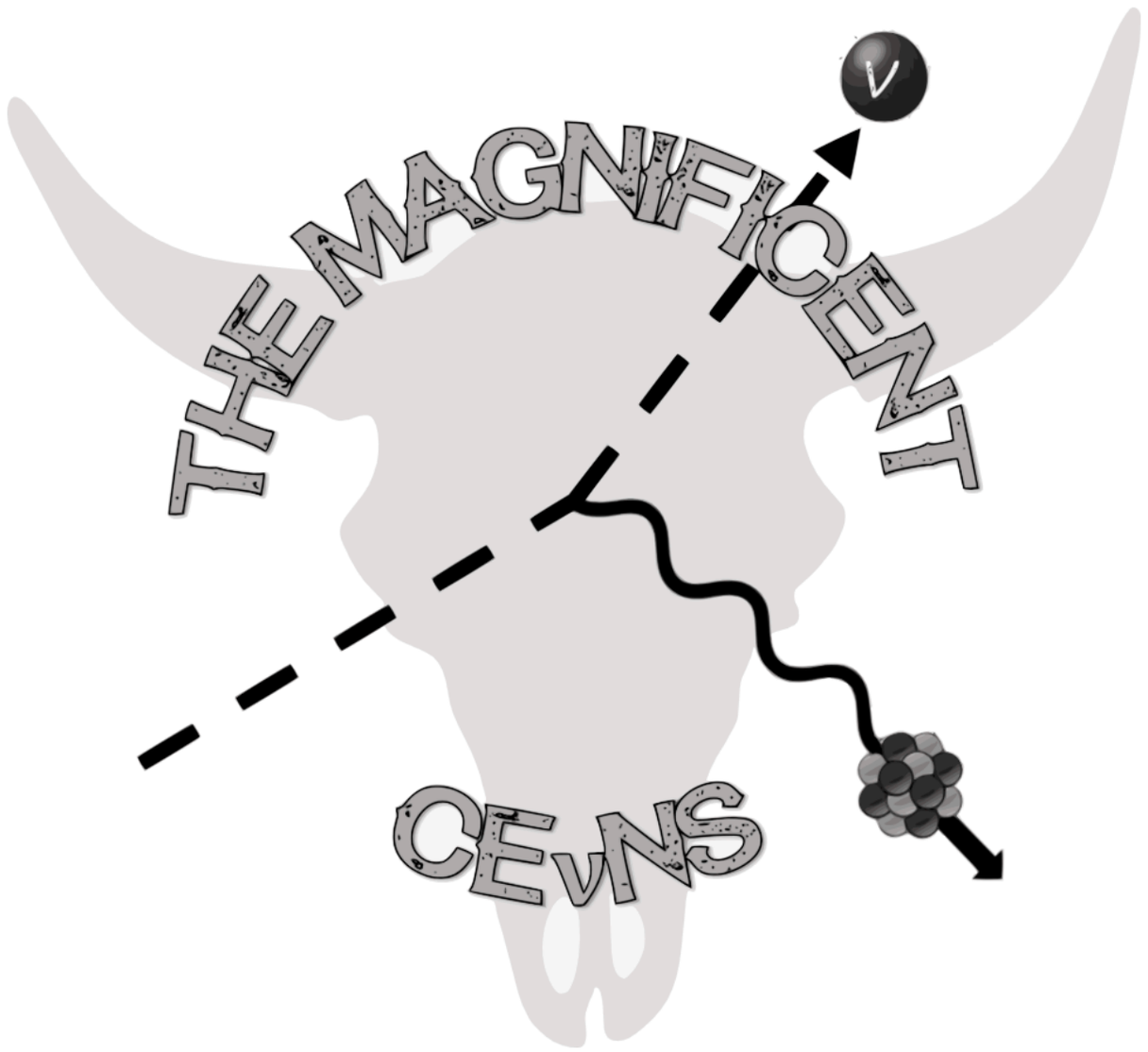
Magnificent CEνNS 2019



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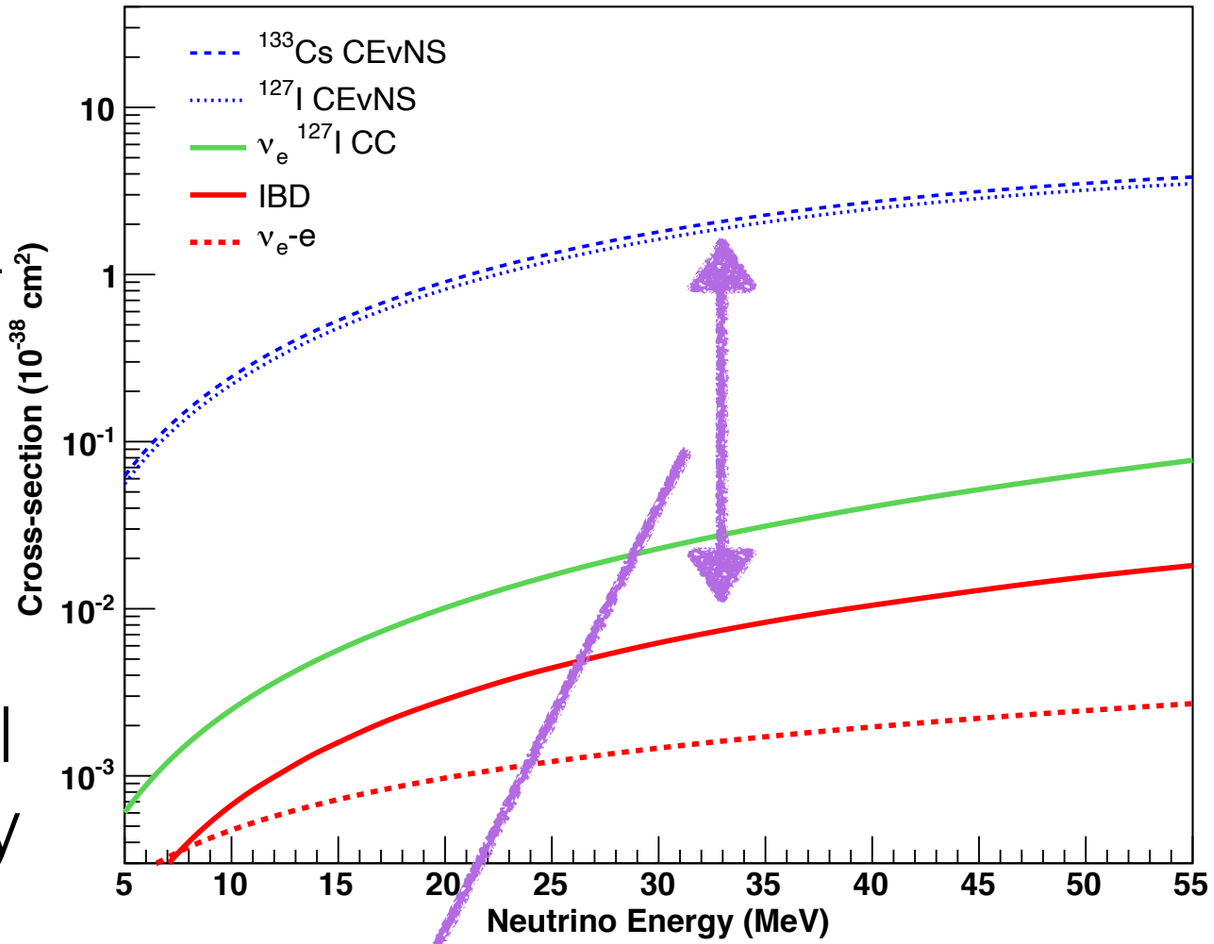
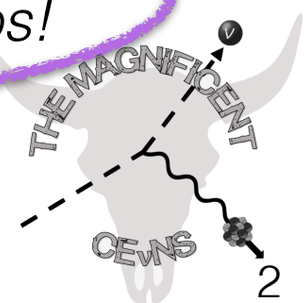
Coherent elastic neutrino-nucleus scattering (CEνNS)

- NC (flavor-independent) process postulated by D.Z. Freedman [1] / Kopeliovich & Frankfurt [2] in 1974
- In a CEνNS interaction, a neutrino scatters off of a nucleus whose nucleons recoil *in phase*, resulting in an enhanced cross section; total cross section scales approximately like N^2



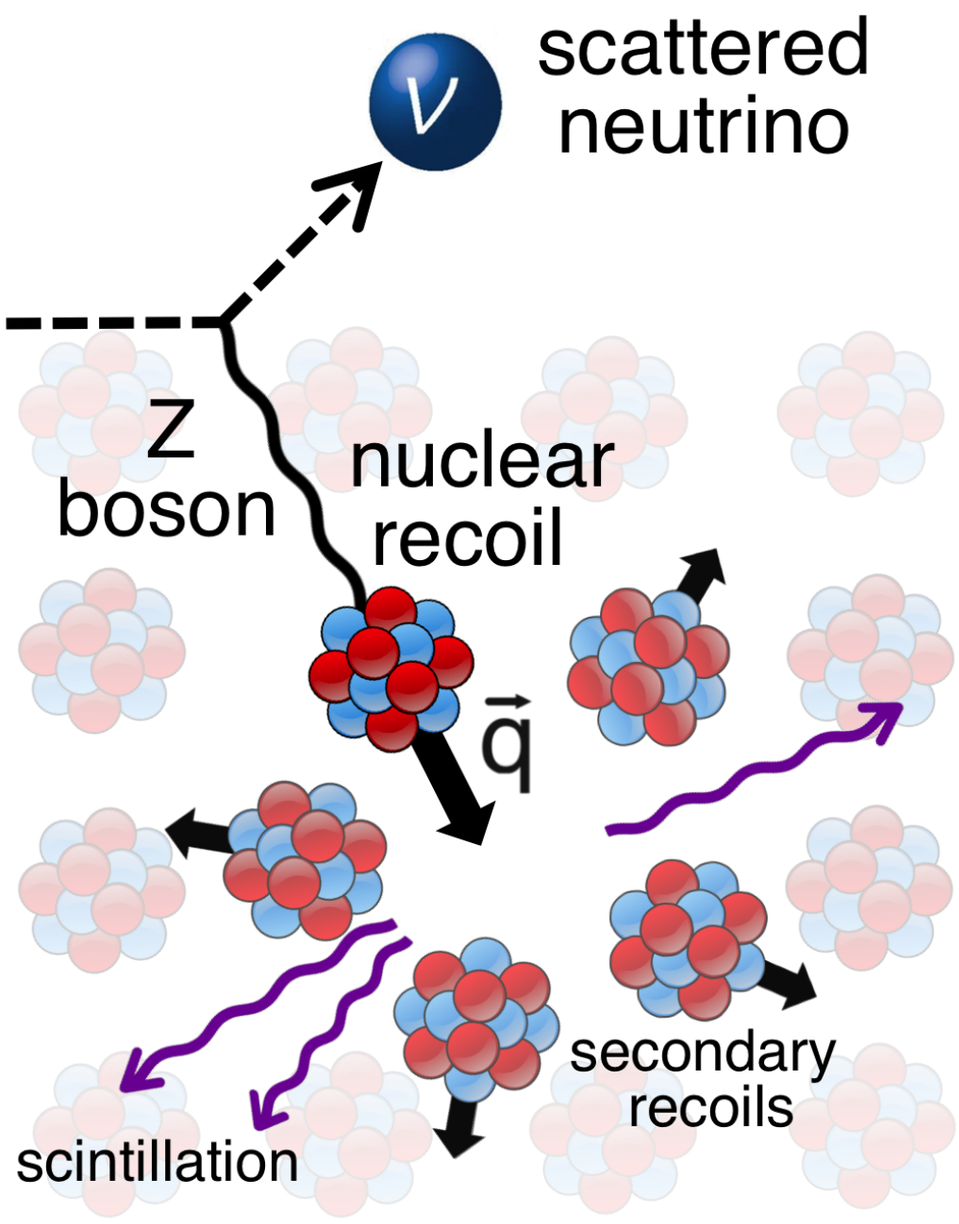
$$\sigma \approx \frac{G_F^2 N^2}{4\pi} E_\nu^2$$

Cross section can be orders of magnitude larger than IBD process used to first observe neutrinos!



[1] D.Z. Freedman, Phys. Rev. D 9 (1974)
[2] V.B. Kopeliovich and L.L. Frankfurt, ZhETF Pis. Red. 19 (1974)

“An act of hubris”



Freedman [1] noted that several factors combine to make CEνNS an exceptionally challenging process to observe

- Need an appropriate source of neutrinos
- Only evidence of the interaction is a low-energy recoiling nucleus
  - Heavier nuclei: higher cross section but lower recoil energies
  - Nuclear recoil signal yields are quenched, i.e. reduced compared to signal from electrons of same energy by a factor called the quenching factor (QF)
  - Detector performance hard to calibrate
- Very-low-threshold detectors are very sensitive to backgrounds
  - Neutron backgrounds are particularly dangerous: produce low-energy nuclear recoils just like CEνNS

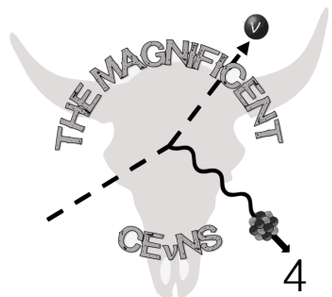
[1] D.Z. Freedman, Phys. Rev. D 9 (1974)

Why we're here

Coherent elastic neutrino-nucleus scattering

- First described 1974, **first observed 2017**
    - Field and interest still very much growing!
- Touches particle physics, nuclear physics, astrophysics, applications
    - We can extend the physics reach and overall impact by *working effectively together*

Promoting effective, collegial engagement between groups and fields is the goal of this workshop



Global CEνNS efforts

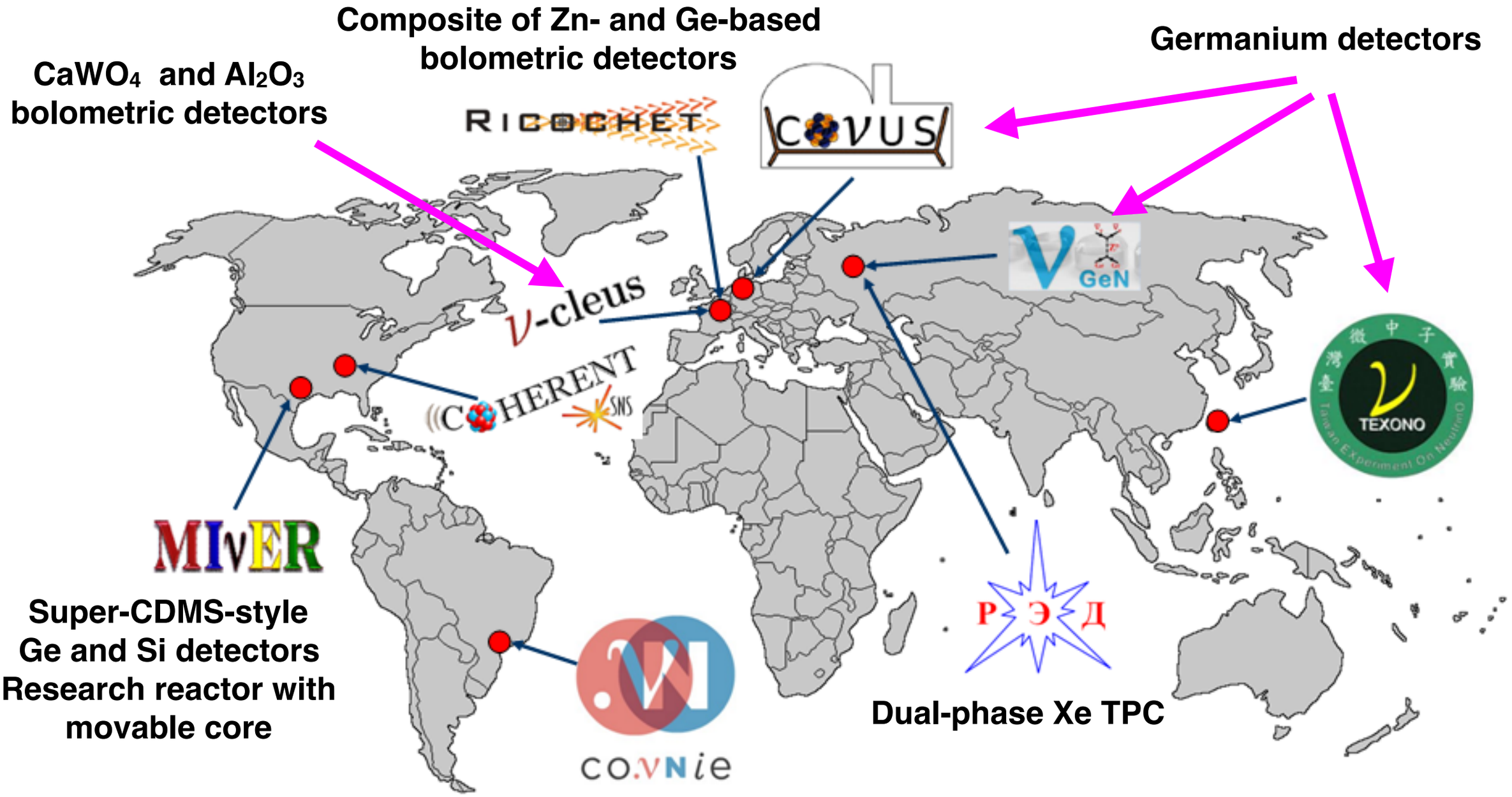


Figure from Alexey Konovalov

The Magnificent CEvNS

A workshop exploring coherent elastic neutrino-nucleus scattering

November 2-3, 2018

Physics Research Center
University of Chicago
Chicago, IL USA

- First iteration of M7s workshop occurred last year in Chicago, ~70 attendees
- Slides posted as proceedings on Zenodo, along with a collection of short summaries
  - Zenodo posts have DOIs, can be cited easily and accurately
  - Credit to Neutrino 2018 for promoting this approach

Magnificent CEνNS 2019

- > 50 talks from theory, phenomenology, experiment, and application
- ~90 attendees, ~10 remote
  - Attempt to bring together everyone with interests in the field, even if peripheral, to promote connections

Not-exactly-physics agenda items

- Establish advisory panel for M7s
  - How do we carry this meeting forward?
- Begin discussions for CEvNS-community contributions to Snowmass process
- Enjoy each other's company and *talk*

Planning and organization

- We will distribute sign-up sheets for van transport / carpooling for banquet during lunch

- Snowmass “panel” discussions tomorrow

- More organizational discussions via Slack / posted later today