

REVEALING NEW PROCESSES WITH SUPERFLUID LIQUID HELIUM DETECTORS: THE COHERENT ELASTIC NEUTRINO ATOM SCATTERING

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Potentialities of a low-energy detector based on ^4He evaporation to observe atomic effects in coherent neutrino scattering and physics perspectives

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COHERENT ELASTIC NEUTRINO ATOM SCATTERING

$$\nu + \bar{A} \longrightarrow \nu + \bar{A}$$

Kinematic condition:

$$|\vec{q}| \cdot R_{\text{atom}} \ll 1$$

$|\vec{q}|$: 3-momentum transfer

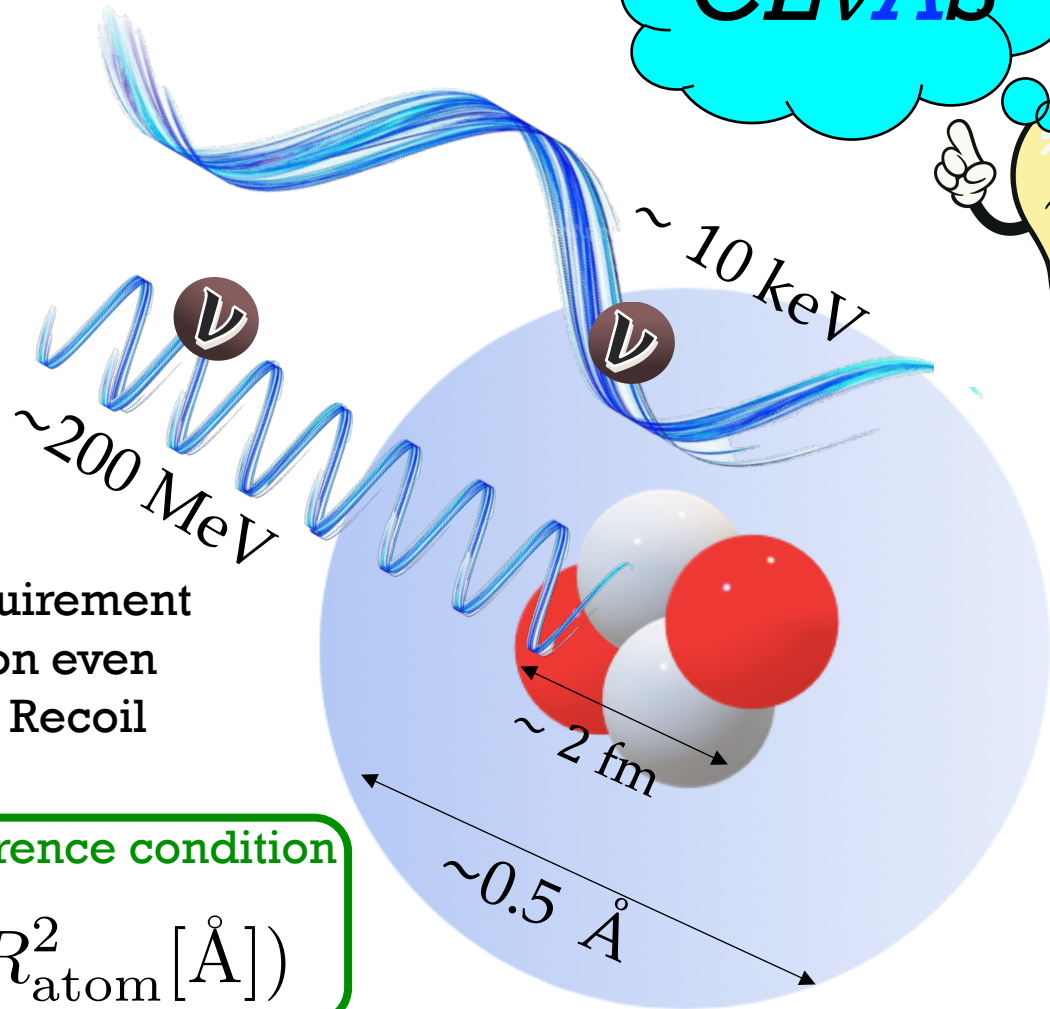
R_{atom} : atomic radius

The kinematic requirement makes the detection even more challenging! Recoil energies of **meV**!

$$|\vec{q}| \cdot R_{\text{atom}} \sim 1 \quad \text{Coherence condition}$$

$$T_R \sim 2 \text{ meV} / (A R_{\text{atom}}^2 [\text{\AA}])$$

CEvAS



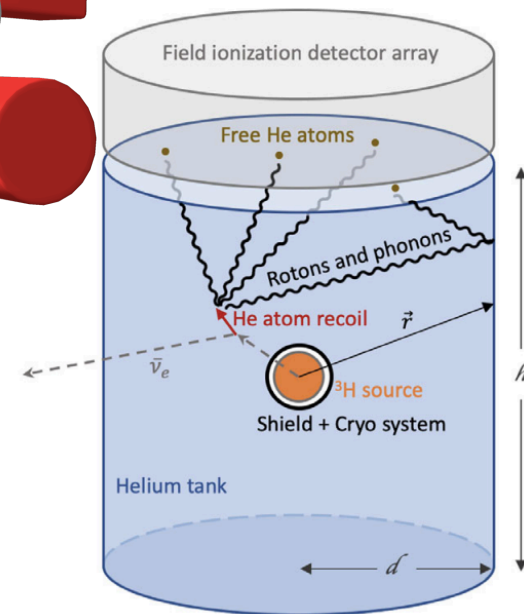
THE REAL QUESTION: IS THE PROCESS DETECTABLE NOWADAYS?

...or maybe in the future?

What do we need?

Shopping List

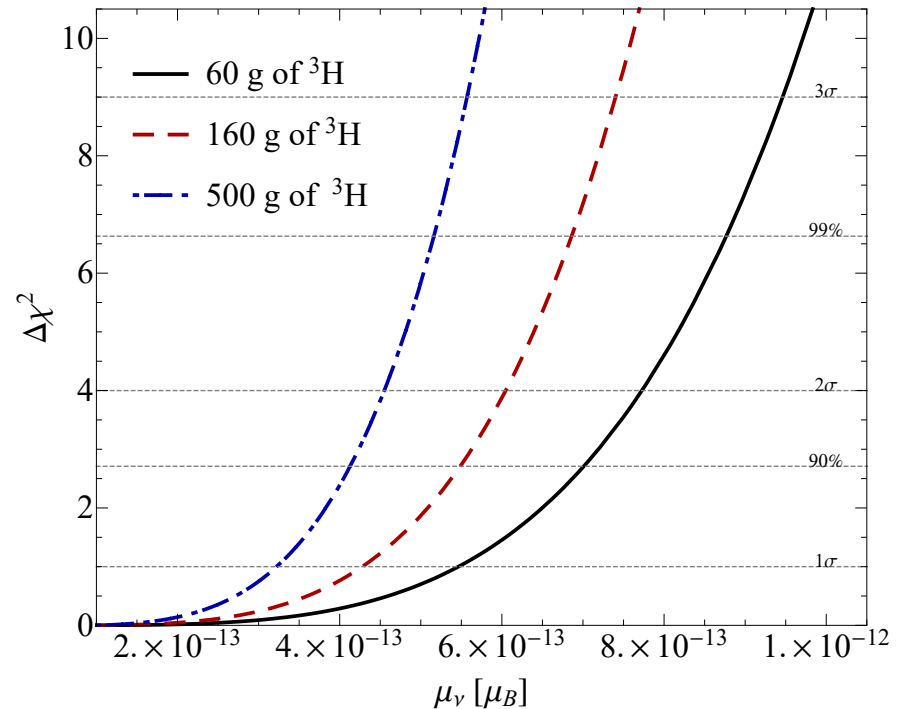
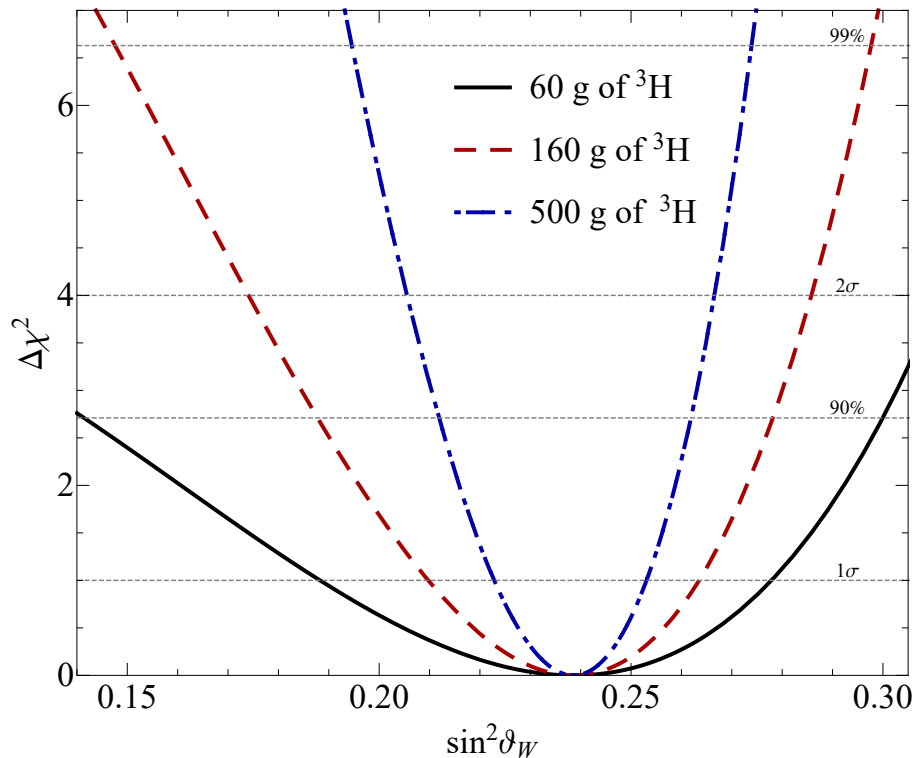
- A **source** of low energy neutrinos to achieve the coherence with the whole atom: **Tritium source**
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- A **target** with mass number and atomic radius as small as possible: **Superfluid liquid helium**
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- A **detector**, based on the same target, with threshold to detect such a small energy releases: **Helium evaporation**
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POSSIBLE MEASUREMENT EXPLOITING CEvAS

Weak Mixing Angle

...at energy scales never reached before



Neutrino Magnetic Moment

...2 order of magnitude lower than
current experiments