



Introduction

Dark Matter:

Particle nature is unknown despite strong astrophysical evidence and extensive searches.

Ultra-Heavy Candidates:

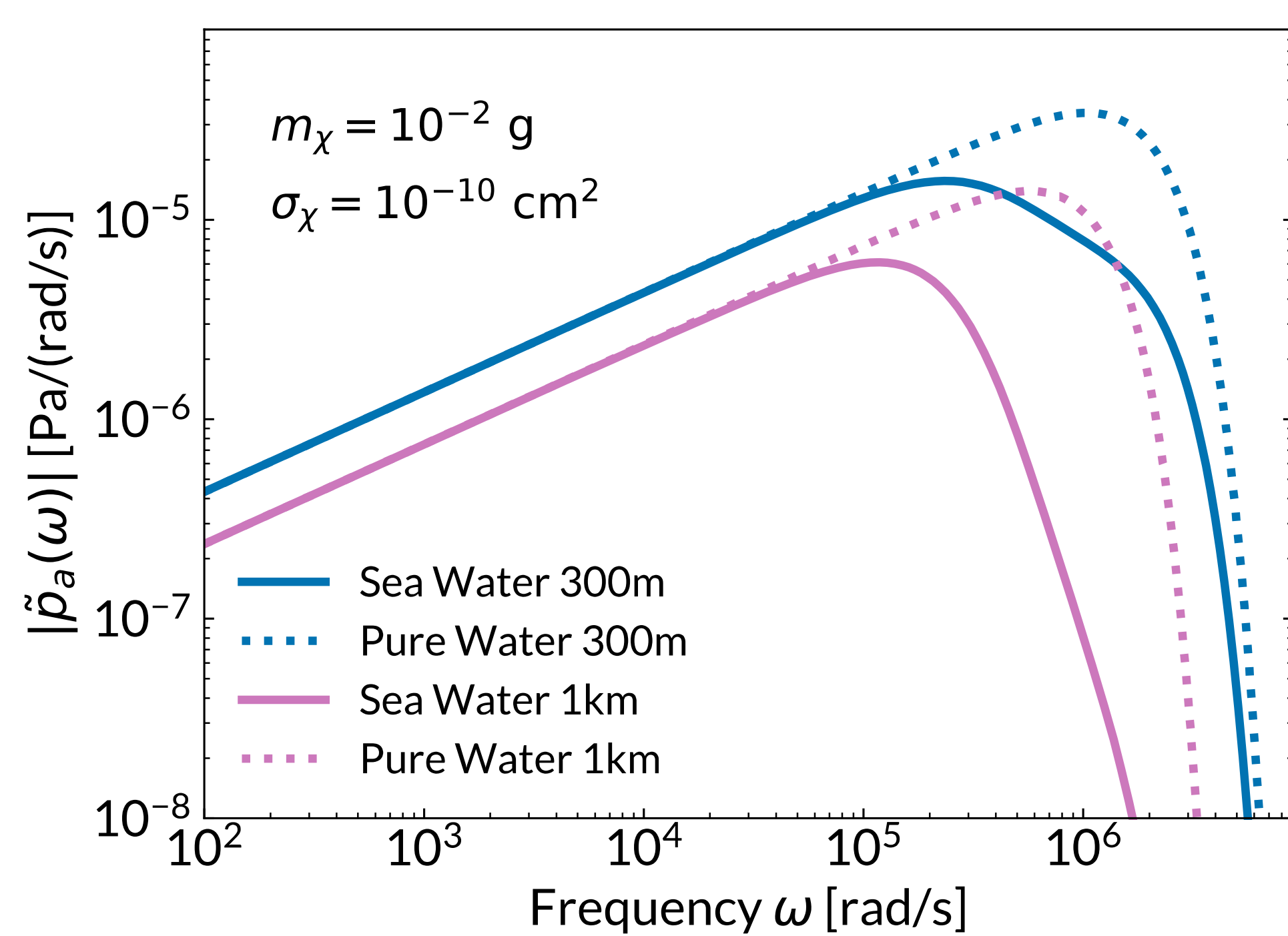
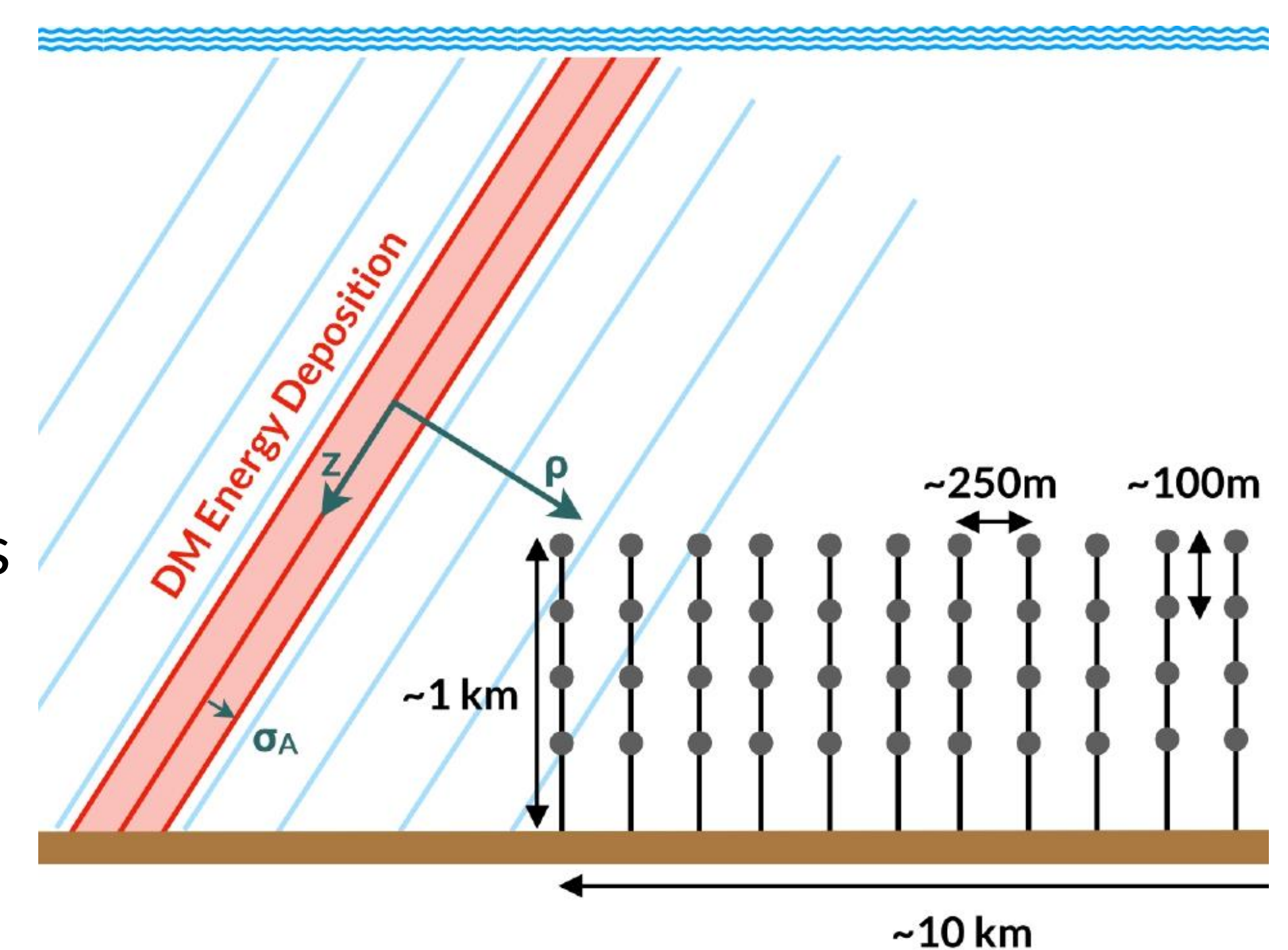
Evade conventional direct detection due to low flux, even with strong interactions.

Idea

Detection Method: UHDM deposits energy through elastic scattering, producing thermo-acoustic waves.

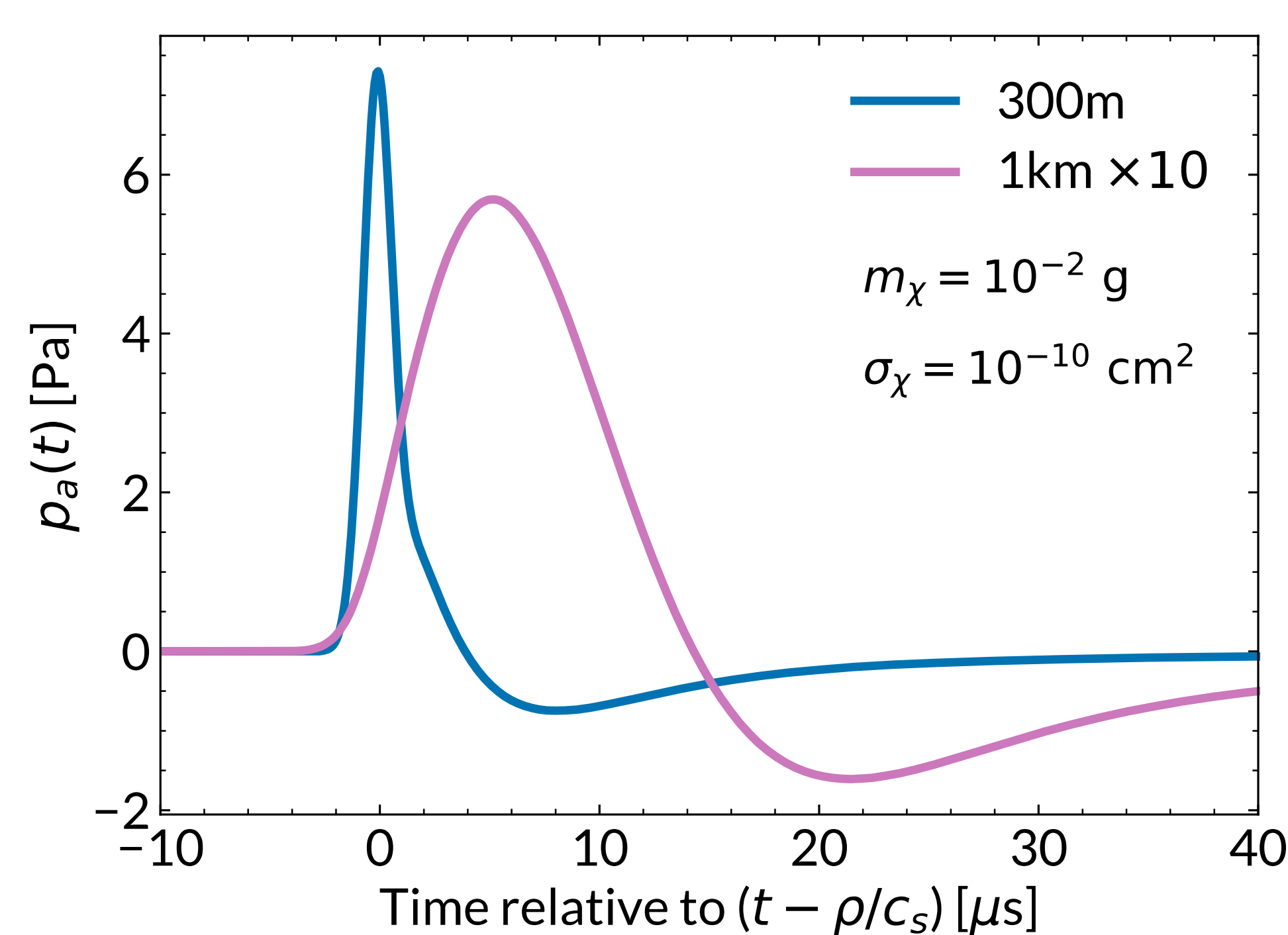
Hydrophone Array: A sparse array of hydrophones spanning $\sim 100 \text{ km}^3$ detect these waves.

Already proposed for ultra-high energy neutrino detection!



Cut-off in frequency domain determined by attenuation in **sea water**.

Dotted line shows **pure water** attenuation model.



Signal Characteristics

Signal has a **bipolar shape** with $O(10 \mu\text{s})$ extent.

Asymmetry of pulse depends on distance travelled.

Sensitivity Projections

Array Geometry

10km x 10km x 1km

45 x 45 x 10 hydrophones

Typical of neutrino experiment proposals

Detection Efficiency

Use Monte Carlo of tracks in the array

$p > p_{thr}$ required in 10 hydrophones

Quantify DE by fraction of tracks detectable

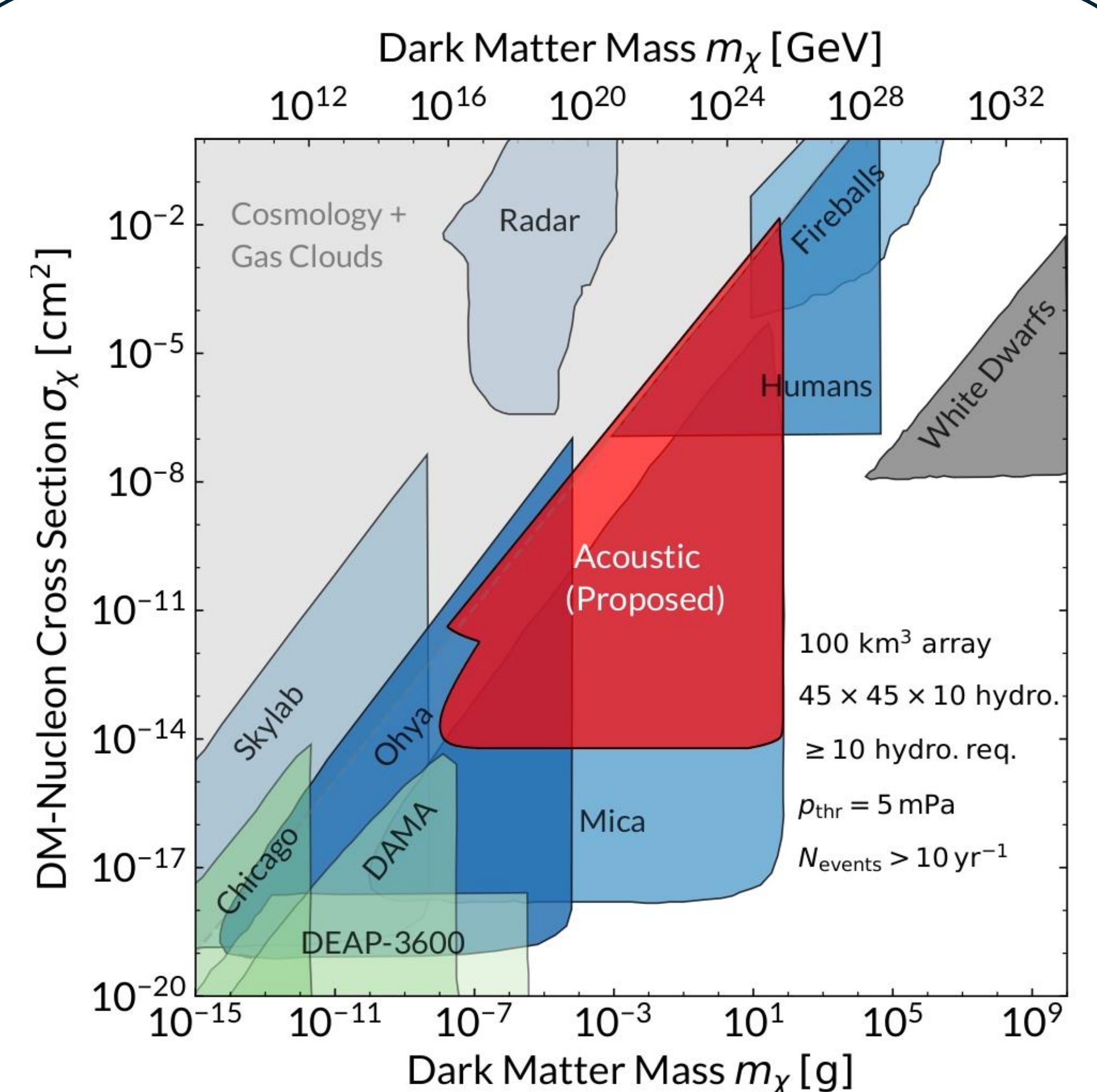
DM Flux

Large DM cross section = daily modulation

Smoking gun of DM over UHE neutrinos

Flux typically $\sim 4 \left(\frac{1g}{m_\chi}\right) \text{ yr}^{-1}$

Require $N_{events} > 10 \text{ yr}^{-1}$



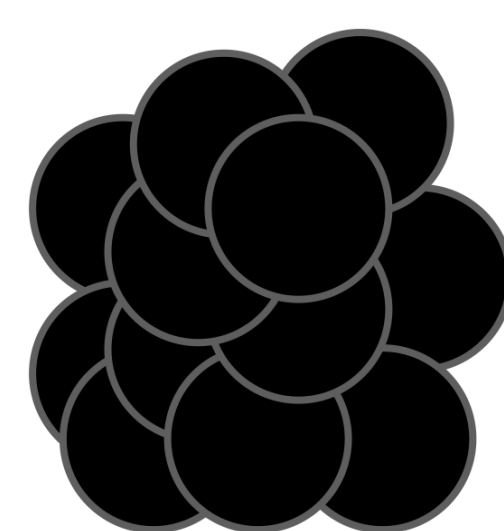
Key References

J. G. Learned, Physical Review D 19, 3293 (1979).

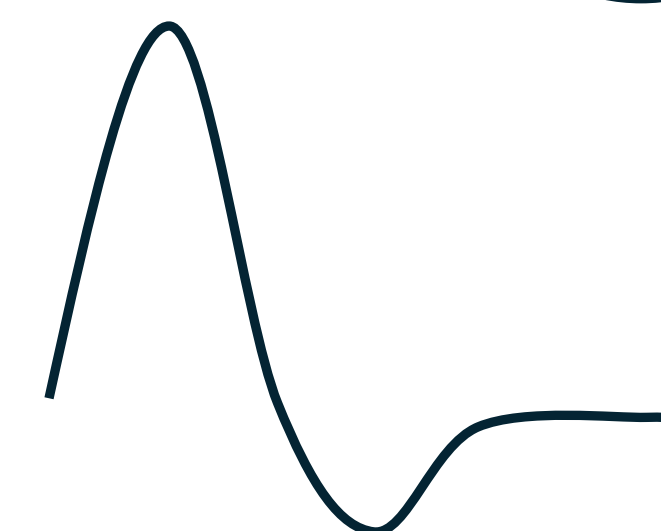
V. Niess and V. Bertin, Astroparticle Physics 26, 243 (2006), astro-ph/0511617.

R. Lahmann, Habilitation Thesis, Friedrich-Alexander-Universität Erlangen-Nürnberg (2011).

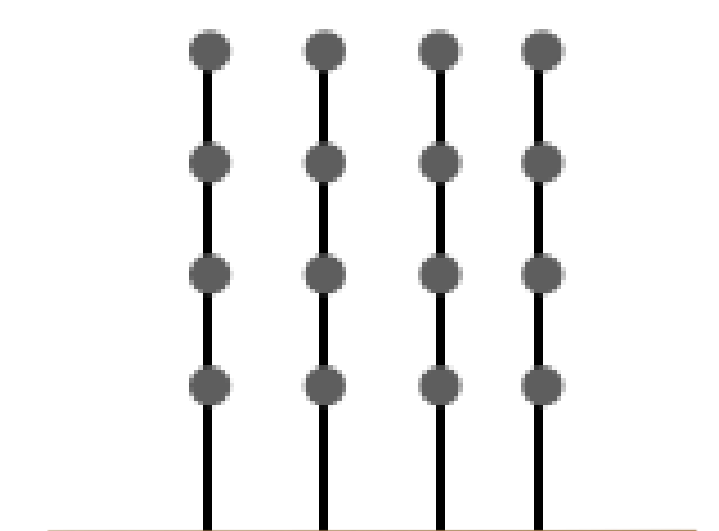
Conclusion



UHDM hard to directly detect



UHDM elastic scattering produces thermo-acoustic radiation



Proposed hydrophone arrays for UHE neutrino detection are sensitive to UHDM