A dark matter recoil can give the (light) $^4$He nucleus a significant kinetic energy.

<table>
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<th>kinetic excitations (phonons, rotons)</th>
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<td>KE: $\sim 0.1$ eV</td>
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The energy of a particle recoil in liquid $^4$He is partitioned among several channels:
- ionization
- electronic excitation
- quasiparticle excitations (phonons and rotons).

A recoiling nucleus efficiently produces long-lived kinetic excitations in the superfluid. Kinetic excitations can convert their energy to athermal evaporation. The overall quasiparticle detection efficiency through evaporation process, is strongly dependent on surface quasiparticle reflectivity.

Significant future advancement in threshold appears plausible, given:
1) improving the quasiparticle evaporation efficiency, perhaps by reducing surface roughness on the solid surfaces,
2) the addition of high-adhesion-gain coatings on the calorimeter surface, and
3) the continued advancement of TES-based large area calorimetry, which has yet to hit any fundamental limit.

Herald offer a unique avenue for carving out a vast swath of dark matter parameter space. Current technology will allow probing of dark matter masses as low as 60 MeV/c$^2$. With further advancements in calorimeter threshold and helium quasiparticle reactivity, the technology can probe dark matter masses as low as 600 keV/c$^2$ (via simple elastic nuclear recoils).