

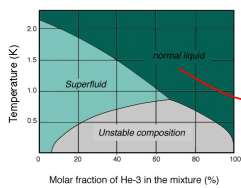
the dilution refrigerator

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The dilution refrigerator

The tool to reach the mK region.

phase diagram of a ^3He - ^4He mixture :

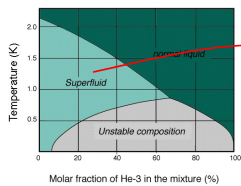


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If the temperature is low enough, most compositions are unstable and will unmix into a layer with a large ^3He concentration floating onto a mixed layer with 6% ^3He .

high % ^3He

6% ^3He

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The dilution refrigerator

Pumping on a gas cools it down (evaporative cooling – explain) :

In the phase-shifted ^3He - ^4He mixture, consider only the ^3He atoms:

If you manage to pump away the ^3He atoms only, then evaporative cooling at the phase boundary occurs.

Dilution refrigerator: feed the pumped ^3He back into the top layer, to have a continuous cycle with a fixed amount of gas.

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Condensor:
The ^3He -rich gas is condensed again, and fed back into the high-concentration phase.

Still: ^3He has a larger vapour pressure than ^4He : mostly ^3He is pumped away.

Mixing chamber with the two floating phases

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