(1) Could a snowflake cooled to 10 microkelvins be lifted with an ordinary permanent magnet acting on the induced nuclear polarization?

The proton's magnetic moment is 1.4×10^{-23} erg/gauss (obtainable from the spin precession in kHz/G given in our "Round Number Handbook" last January). In 1000 gauss the energy μB is ten times kT at 10 microkelvins. The protons will be polarized almost completely. The moment induced per gram of ice is then (almost exactly) 1.0 erg G^{-1} g^{-1}. A field gradient of 10^3 G/cm will provide enough lift, 1000 dyn/g. A field of 1000 G with a gradient of 1000 G/cm over the dimensions of a snowflake is easy to achieve with an ordinary permanent magnet. Before deciding that the answer is yes we should note that the magnetic interaction between neighboring protons is small compared to μB, the field of a proton moment 10^{-8} cm away being of order 10 G. That disposes of the possibility that the snowflake in 1000 G could be antiferromagnetic, with zero moment.