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A Superfluid Film Burner for the nEDM Experiment JAMES MAXWELL, MIT, NEDM COLLABORATION — A planned measurement of the neutron electric dipole moment (nEDM) to 10^{-28} e·cm using the Golub–Lamoreaux method presents complex cryogenic challenges. One such hurdle is the injection of ^{3}He from a polarized atomic beam source into a liquid ^{4}He bath while maintaining the temperature gradient from the cold bath to the warm beam source and minimizing the vapor above the bath. The feasible temperature range for the experiment falls around 400 mK and is constrained from below by the achievable magnetic field gradients, and above by the spin relaxation time of ^{3}He and rate of ultracold neutron up-scattering. The superfluid behavior of ^{4}He below 2.1 K means superfluid film will tend to climb, or "creep," up the sides of the beam tube to reach the warmer space above, creating vapor, resulting in convection and scattering of incident ^{3}He. To stop the superfluid film creep and contain the vapor, a "film burner" is under development by the nEDM collaboration. We will describe the effort toward developing a suitable film burner for nEDM, and show preliminary results of a prototype film burner in operation.

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