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Obtaining the thermodynamics of harmonically trapped gases from their column density[1] MARK KU, ARIEL SOMMER, LAWRENCE CHEUK, WENJIE JI, WASEEM BAKR, TARIK YEFSAH, MARTIN ZWIER-LEIN, Department of Physics, MIT-Harvard Center for Ultracold Atoms, and Research Laboratory of Electronics, MIT, Cambridge, Massachusetts 02139, USA — We present a procedure to obtain the equation of state (EoS) of a harmonically trapped atomic gas directly from its column density. We show that the column density of a harmonically trapped gas is a thermodynamic quantity, and its variation with respect to the external trapping potential encodes the EoS. This procedure also prescribes a powerful tool to perform thermometry for trapped atomic gases. We demonstrate the procedure on the unitary Fermi gas, where the column density is directly related to the trap-averaged heat capacity. This trap-averaged quantity shows evidently only a benign rise above its normal value around the superfluid transition, in contrast to the sharp rise in the homogeneous case. We also report on the progress to measure the temperature dependence of the spin susceptibility in spin-imbalanced Fermi gases at unitarity.

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