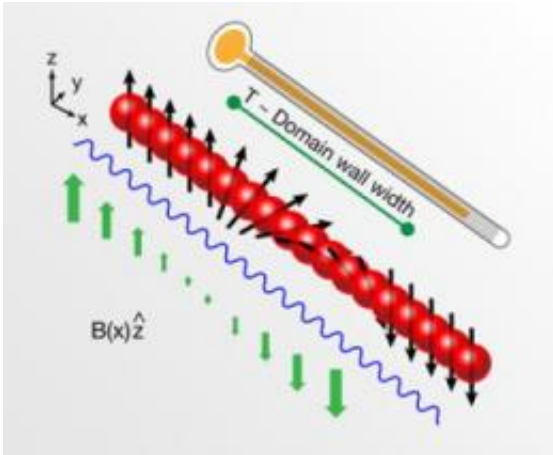


Super cool atom thermometer

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Physicists have developed a new thermometry method suitable for measuring temperatures of ultracold atoms. Illustration: Alan Stonebraker

As physicists strive to cool atoms down to ever more frigid temperatures, they face the daunting task of developing new, reliable ways of measuring these extreme lows. Now a team of physicists has devised a thermometer that can potentially measure temperatures as low as tens of trillionths of a degree above absolute zero. Their experiment is reported in the current issue of *Physical Review Letters* and highlighted with a Viewpoint in the December 7 issue of *Physics*.

Physicists can currently cool [atoms](#) to a few billionths of a degree, but even this is too hot for certain applications. For example, Richard Feynman dreamed of using [ultracold atoms](#) to simulate the complex quantum mechanical behavior of electrons in certain materials. This

would require the atoms to be lowered to temperatures at least a hundred times colder than what has ever been achieved. Unfortunately, thermometers that can measure temperatures of a few billionths of a degree rely on physics that doesn't apply at these extremely low temperatures.

Now a team at the MIT-Harvard Center for Ultra-Cold Atoms has developed a thermometer that can work in this unprecedentedly cold regime. The trick is to place the system in a [magnetic](#) field, and then measure the atoms' average magnetization. By determining a handful of easily-measured properties, the physicists extracted the [temperature](#) of the system from the magnetization. While they demonstrated the method on atoms cooled to one billionth of a degree, they also showed that it should work for atoms hundreds of times cooler, meaning the thermometer will be an invaluable tool for physicists pushing the cold frontier.

More information: Spin Gradient Thermometry for Ultracold Atoms in Optical Lattices, David M. Weld, Patrick Medley, Hirokazu Miyake, David Hucul, David E. Pritchard, and Wolfgang Ketterle, Phys. Rev. Lett. 103, 245301 (2009) - Published December 07, 2009, [Download PDF](#) (free)

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