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Abstract for an Invited Paper  
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### **Laser cooling of a diatomic molecule<sup>1</sup>**

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We report the experimental demonstration of laser cooling applied to a diatomic molecule. Using an optical cycling scheme requiring only three lasers, we observe both Sisyphus and Doppler cooling forces acting on the transverse velocity distribution of a beam of the polar molecule strontium monofluoride (SrF). This results in substantial reduction of the transverse temperature of the beam to as low as  $\sim 300\mu\text{K}$ , limited by finite interaction time with the laser. The properties of a new type of cryogenic molecular beam source, which made observation of laser cooling possible, will be discussed. Possible scientific applications and recent progress towards longitudinal cooling and slowing of the SrF beam will be discussed.

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