VELOCITY-DEPENDENT OPTICAL FORCES AND MAXWELL'S DEMON

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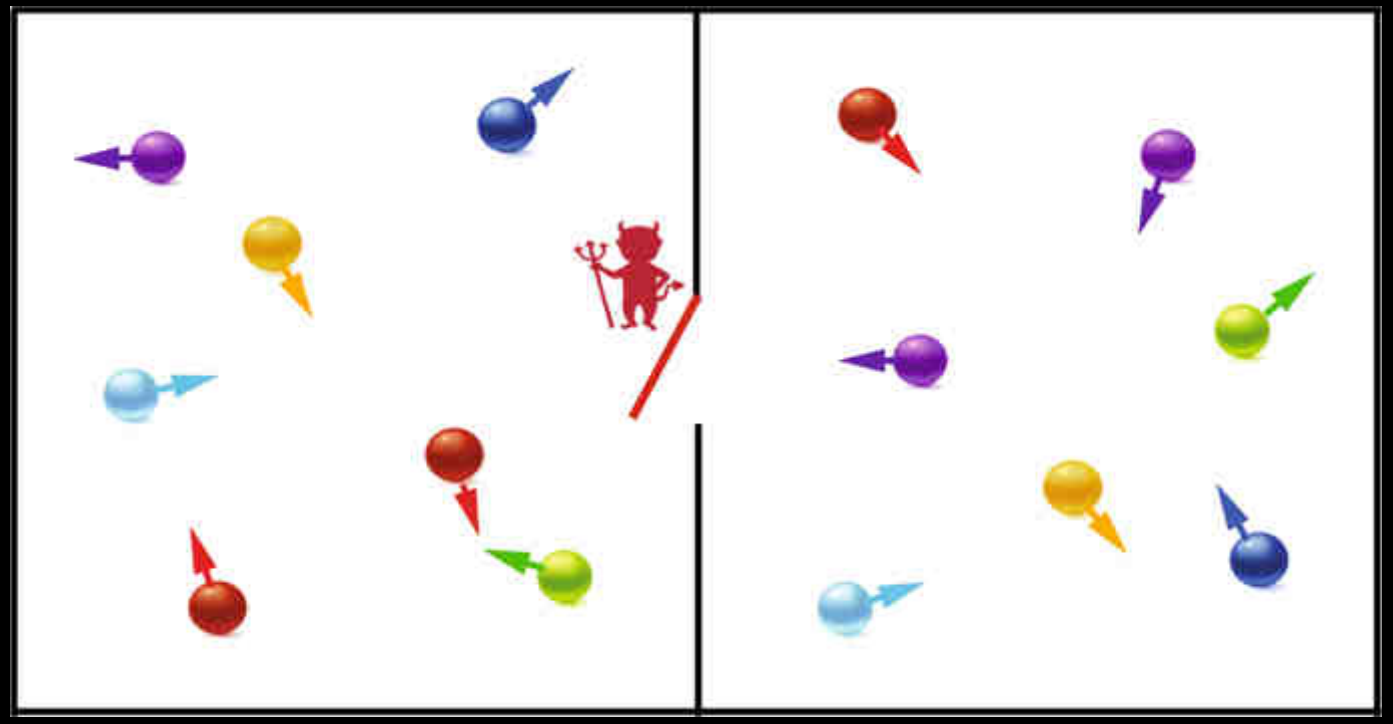
INTRODUCTION

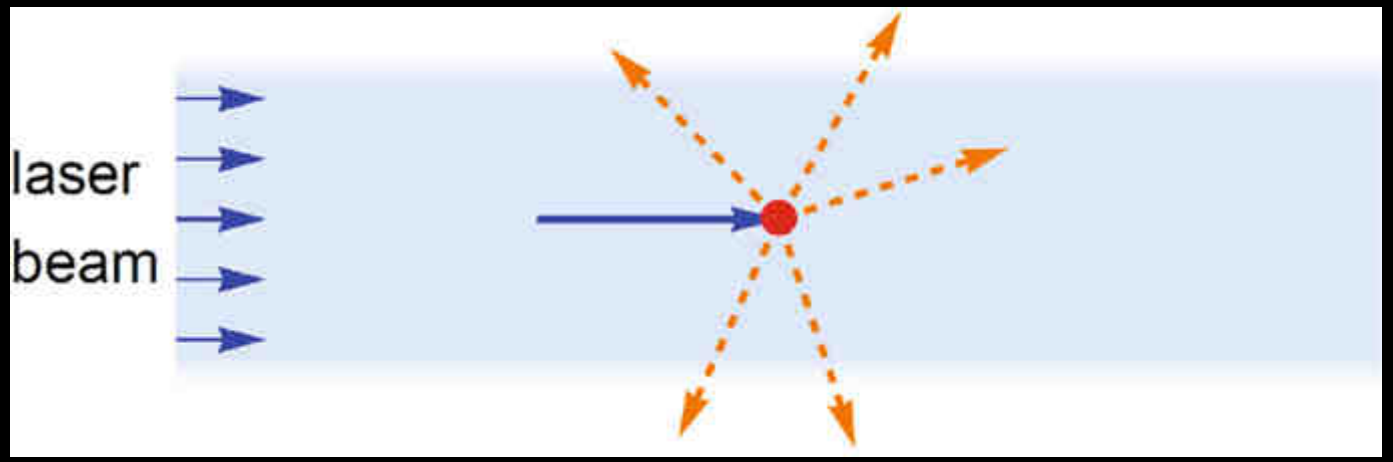
What is Maxwell's Demon?



This shows Maxwell's demon opens a trap door allowing the gas atoms on the right transferring to the left side.

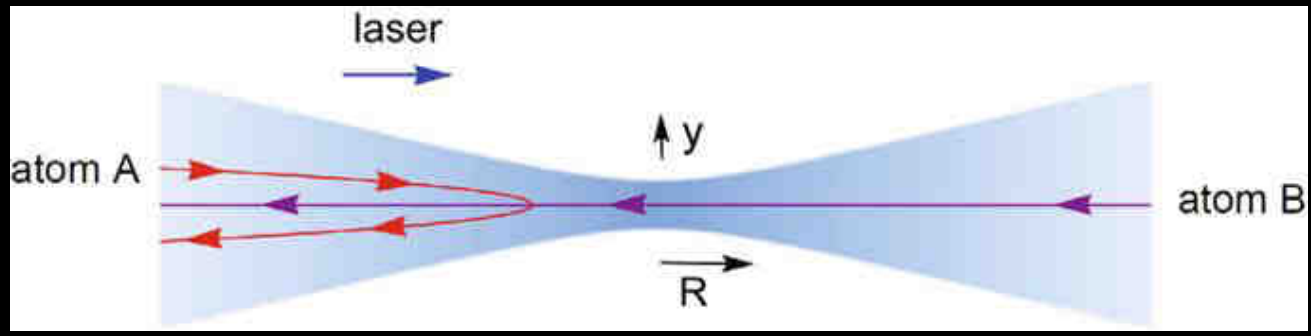
DIPOLE FORCES

- What does the dipole force do unto the atom?
- How the dipole force travels in a laser beam?



The scattering force exerted on an atom in a uniform (unfocused) laser beam. This effect is commonly used to cool atoms, but energy is dissipated in the process.

MAXWELL'S DEMON THEORY



How those Maxwell's Demon affects the outcome in the experiment?

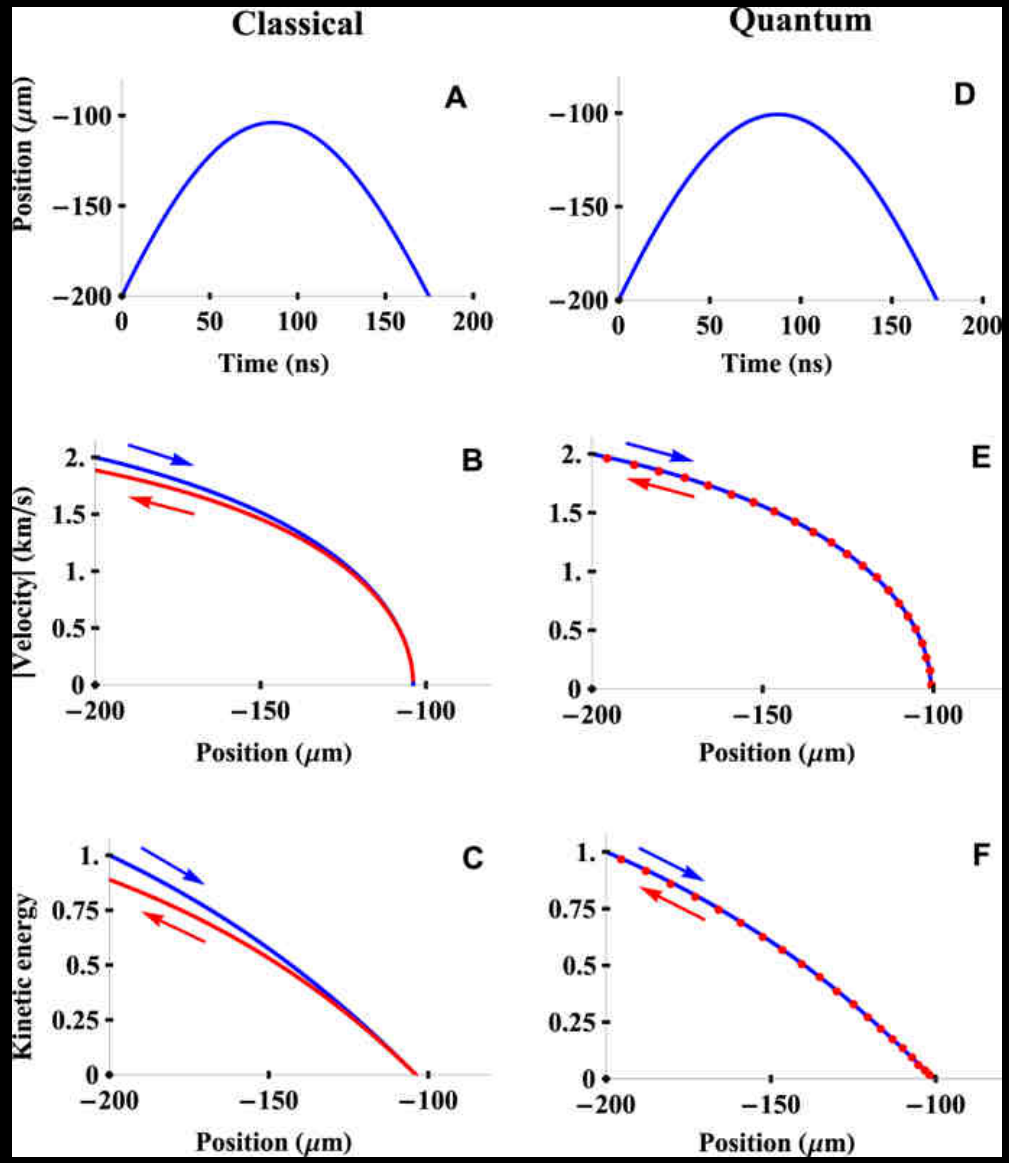
Maxwell's demon implemented the velocity-dependency when using a focused laser beam and the dipole force.

OBJECTIVE

- Possibility of Maxwell's demon implemented dissipate a minimum amount of energy within the atom using dipole force exerting in a classical models.
- Determined the dipole force of a atom by focusing it with a high osculated laser beam.
- Analyzing the velocity-dependence of the atom dipole force in an classical and quantum-mechanical motion.

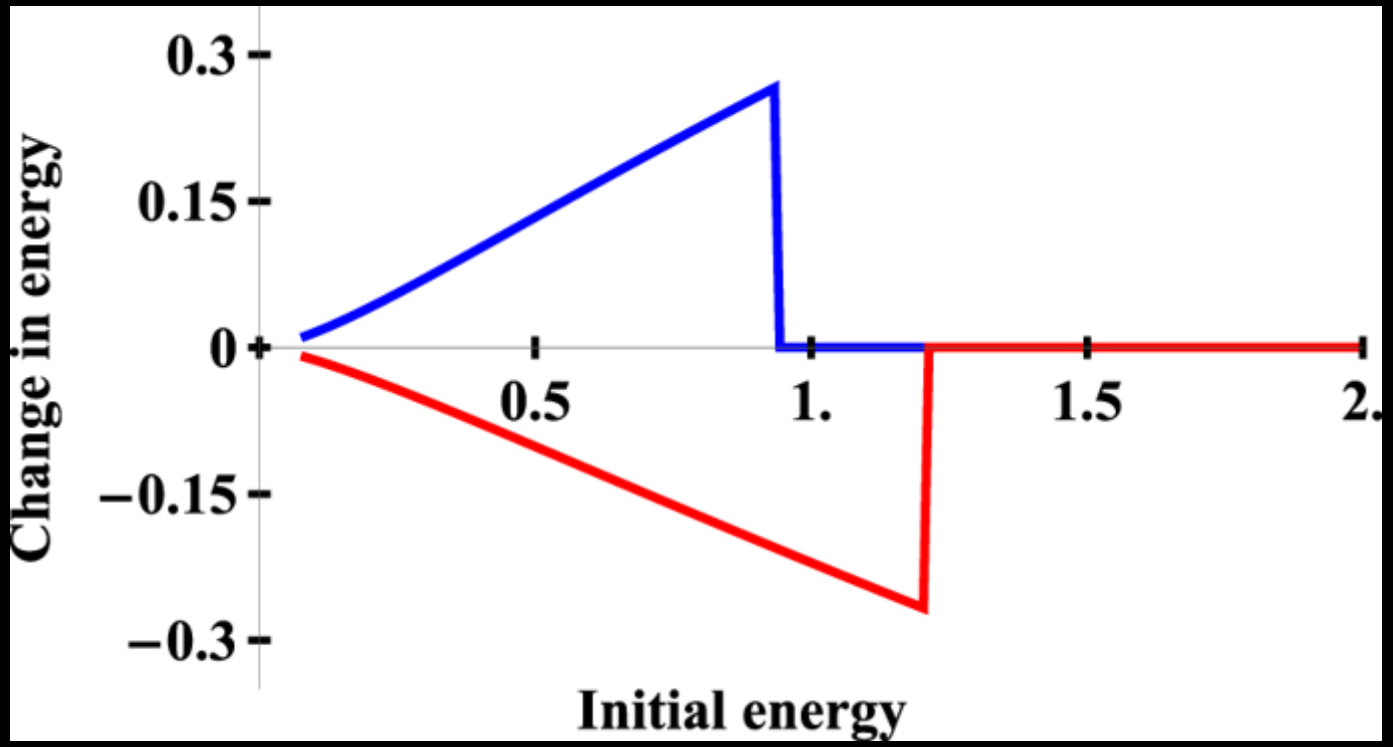
CLASSICAL CALCULATION OF THE DIPOLE FORCE

- A and D graph shows the trajectory of the atom in a focus point.
- B and E graph shows the velocity of the atom moving toward and away of the focus point.
- C and F graph shows the kinetic energy of the atom moving toward and way of the focus point.



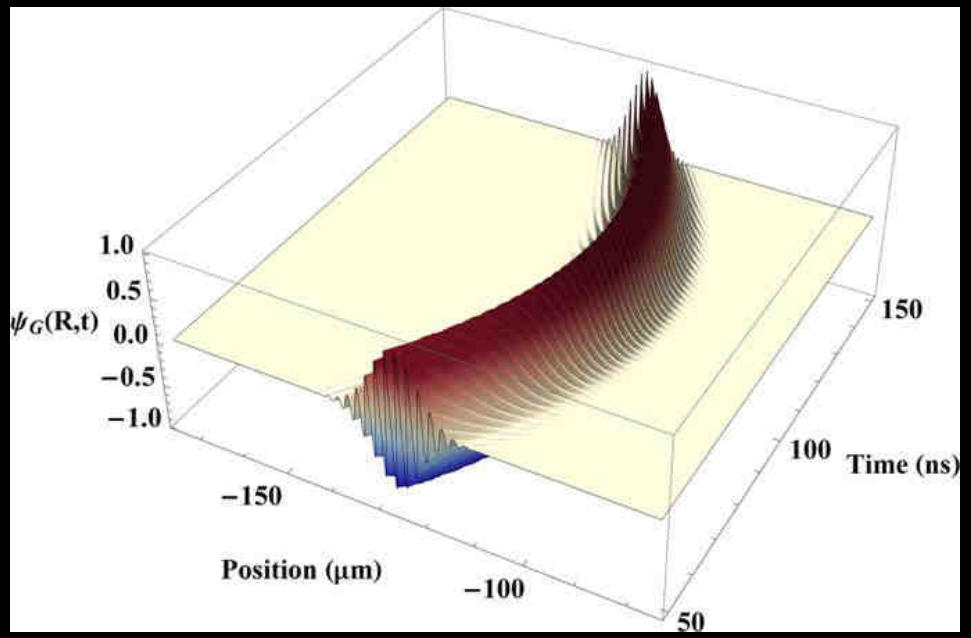
ATOM FORCE

- The change in the kinetic energy of an atom.
- The red (lower) curve corresponds to an atom incident from the left while the blue (upper) curve corresponds to an atom incident from the right in Figure 2.



SCHRODINGER'S EQUATION

- Schrodinger's equation is use for calculating the atom position.
- From the graph in Figure 4, there no difference between the initial and final in both the velocity and kinetic energy of the atom.



This graph shows the wave function of the atom moving in a focus laser.

CONCLUSION

- Maxwell's Demon cannot implement using a focused laser beam and the Doppler shift because the velocity dependency of the dipole force was cancelled out by another force in the field of the focus laser beam.
- If the existence of a velocity-dependent optical force with a negligible dissipation and a high amounts of energy, the implementation of Maxwell's demon capable of reducing the overall entropy.