- Last Lecture
  - Potential Energy diagrams, Potential Energy of springs
- Today
  - Conclusion of energy discussion
  - The next important conservation law: Momentum
- Important Concepts
  - Momentum is a vector.
  - Think carefully about internal versus external forces.

Important Reminders

- Exam #2 is tomorrow at 10 am.
  - Covers material through last Thursday's lecture, last Friday's problem-solving and Pset, and Monday's MasteringPhysics assignment
- Q&A review session tonight 7-8:30pm
- MasteringPhysics due next Monday.
- No class next Friday.
- Pset #7 due next Thursday.

Work/Energy Summary

- $W = \Delta E = E_F - E_I \quad E = PE + KE \quad KE = \frac{1}{2}mv^2$
- $PE_{gravity} = mgy \quad PE_{spring} = +\frac{1}{2}k\left(L - l_0\right)^2$
- $W = \int \vec{F} \bullet d\vec{s} \quad |W| = |F||ds|\cos(\theta)$
- Every force goes in the work term or in the PE
- Minima and maxima of the PE correspond to F=0, which are equilibrium points. PE minima are stable equilibrium points, maxima are unstable.

Momentum

- Very simple formula: $\vec{p}_{Tot} = \Sigma\left(m_i \vec{v}_i\right)$
  - Note the vector addition!
- This quantity is conserved, another fundamental property of our universe derivable from F=ma.
  - I could also claim F=ma is derivable from momentum.
- Sometimes it is impractical to include the whole universe in the system under study.
- In this case, we say momentum is conserved only if:
  - No net external forces acting on the system.
  - Or, study the system only over a very short time span.