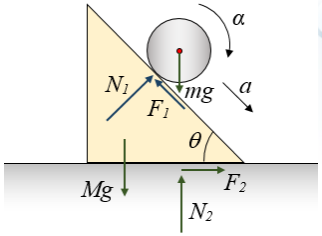
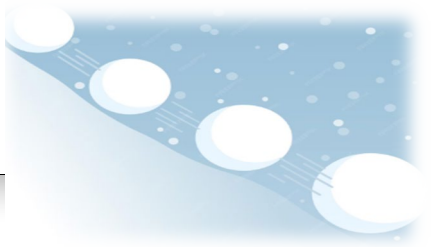
Angry Santa
GPU Snowball Simulation

- Focus: physically simulate a snowball rolling downhill, growing in mass by collecting snow particles from terrain (stochastic process)





- Key Components:
  - Pseudo-realistic downhill motion (gravity, friction…)
  - Large-scale snowfield with thousands of particles
  - Parallel snow accumulation and terrain interaction
  - Real-time rendering (OpenGL)

- Core simulation is dominated by highly parallel particle processing

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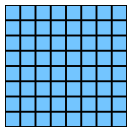
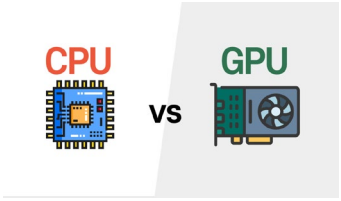
GPU Leverage

1. Particle accumulation is massively parallel:
   - Each particle **independently** checks if it is absorbed by the ball



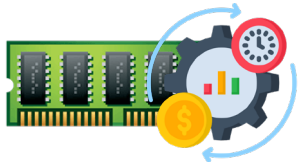
2. Real-time physics updates:
   - Requires parallel reductions and **atomic** operations

3. Strong CPU vs GPU **performance difference**:
   - CPU: sequential → O(n) per timestep
   - GPU: thousands of threads → huge speedup

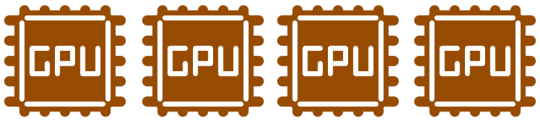


4. CUDA Streams & Events:
   - Enables optimized **multi-kernel pipeline**

5. Memory **Optimization**:
   - Shared and Coalescing Memory, Occupancy, Reductions



6. Multi-GPU scalability:
   - Allows **near-linear scaling** for very large particle counts



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