# Assignment II (Parallelize Particle Simulation)
GPU Programming (Fall 2021)
Shiraz University
Due Time: 21 Mehr 1400

The purpose of this assignment is introduction to programming in shared memory models. Your goal is to parallelize a toy particle simulator (similar particle simulators are used in mechanics, biology, astronomy, etc.) that reproduces the behavior shown in the following Figure:
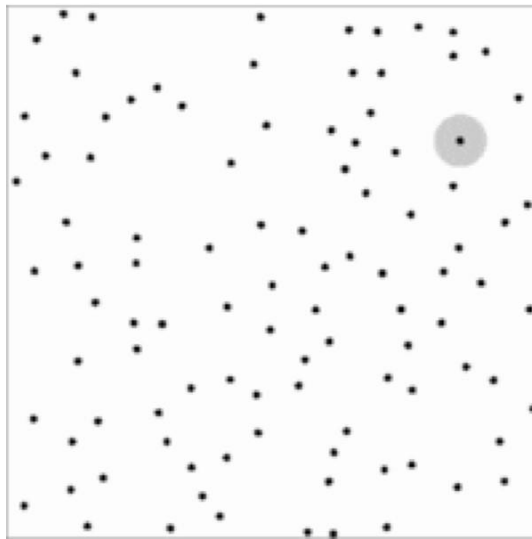
The range of interaction forces is limited as shown in grey for a selected particle. Density is set sufficiently low so that given n particles, only $O(n)$ interactions are expected. Suppose we have a code that runs in time $T = O(n)$ on a single processor. Then we'd hope to run in time T/p when using p processors. We'd like you to write parallel codes using pthreads that approach these expectations. The serial code will be provided through a zip file.

Deliverable

Here is the list of items you might show in your report:

- A description of the synchronization you used in the shared memory implementation.
- A description of the design choices that you tried and how did they affect the performance.
- Speedup plots that show how closely your parallel codes approach the idealized $p$times speedup and a discussion on whether it is possible to do better.
- Where does the time go? Consider breaking down the runtime into computation time, synchronization time and/or communication time. How do they scale with p?
- A discussion on using pthreads.