Atomic modeling of argon

Project 5, FYS-3150

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Abstract

The aim of this project is to numerically find the critical temperature for the two dimentional Ising model by using the metropolis algorithm. We will first test the implementation of the algorithm carefully, first by comparing with theoretical values calculated for a small system. Then we will see if the algorithm behaves as expected according to our physical intuition for a larger system.

When we have found a estimate for the critical temperature we will compare it to Lars Onsagers analytical result.

All source codes can be found at: `https://github.com/inakbk/Project_5`.

Contents

1 Introduction

The goal in this project is to develop a code that can perform simulations of an open cluster using Newtonian gravity. First, however we will compare the stability of two different methods. This is because when we are looking at a system with a large number of particles, we are more interested in the statistical properties of the system than in the individual motion of each of the particles. This means that the stability of the solution method is more important than its short term accuracy. This project is inspired by an article by Joyce *et al.*, see Ref. [1] below.

In the first part of this project we will explore the stability of two well-tested numerical methods for solving differential equations. The algorithms to test and implement are the fourth-order Runge-Kutta method and the Velocity-Verlet method.

2 Theory

The Newtonian two-body problem in three dimensions

dimentionless variables

3 Numerical methods

Runge-Kutta method and the Velocity-Verlet method discussed in the lecture notes.