Título/Title:

Solving Kepler's equation

Area:

Exoplanets

Orientador/Supervisor:

João Faria (joao.faria@astro.up.pt)

Local do Estágio/Host Place:

IA-Porto (Faculdade de Ciências da Universidade do Porto).

Descrição/Description:

Because exoplanets follow elliptical orbits around their stars, Kepler's laws of motion can be used to calculate the velocity of the host star along the line of sight. This quantity is known as the *radial velocity* (RV) and can be measured by observing the stellar spectrum. However, the theoretical calculation of the RV for a given planet involves one particularly interesting step: finding a solution for Kepler's equation $E = M - e \sin(E)$. Although it may look simple, this equation cannot be solved (for E) analytically, which has led to the development of a number of different numerical algorithms.

In this project, the student will study the numerical solution of Kepler's equation by implementing and comparing different algorithms. The solutions will be thoroughly tested and the performance of each method will be measured using real RV observations. We will also explore the use of Graphics Processing Units (GPUs) to develop more efficient methods for repeatedly solving Kepler's equation. These new methods will allow us to efficiently analyse RV datasets with thousands of observations and to predict the best future times to obtain new measurements.

Requisitos/Requirements:

The project does not require prior knowledge of astronomy and/or exoplanets. The candidate is expected to be comfortable with a scientific programming language such as Python or C.