

Extrasolar Planets and Astrophysical Discs

Problem Set 5

March 2010

The last stages of terrestrial planet formation are thought to occur in a gas-free environment after the gaseous protostellar disc has been dispersed. The usual scenario is that coagulation of solids has led to the build-up of a few fairly massive protoplanets that are widely spaced. Substantial orbit crossing between these protoplanets must arise before they can undergo collisions that lead to the final accumulation of earth-like planets. By assuming that the time scale for this final accumulation stage to occur is just the time scale required for collisions between the protoplanets to occur, estimate how long this final stage of terrestrial planet formation will take.

Given that gaseous protostellar discs are observed to have life times between $10^6 - 10^7$ yr, argue that the process involved in producing the cores of gas giant planets must differ from that outlined for the formation of terrestrial planets.