

Physics of Planetary Systems — Exercises — Set 11

Problem 11.1

(2 points)

Give at least two basic hypotheses/scenarios that can explain the correlation of host star metallicity and planet occurrence.

Problem 11.2

(1 point)

A nearby open cluster has a metallicity $[Fe/H] = 0.5$. You will start a radial velocity survey of 100 solar-like stars in this cluster. Based on results from radial velocity surveys of field stars, how many planet-hosting stars do you expect to find?

Problem 11.3

(2 points)

In the scenario of THOMMES, DUNCAN, and LEVISON (2002), Uranus and Neptune originally formed between Jupiter and Saturn, i. e. at a distance of around 7 au from the Sun. Jupiter and Saturn subsequently scattered them outward to their current orbits. Assume that Jupiter was the main reason for that scattering event. By how much did Jupiter's orbital semi-major axis change during this process?

Hints: assume circular orbits; consider conservation laws.

Bonus problem 11.4

(0.5 extra points for each item)

List open questions, difficulties, unsolved problems in the state-of-the-art planet formation theories.

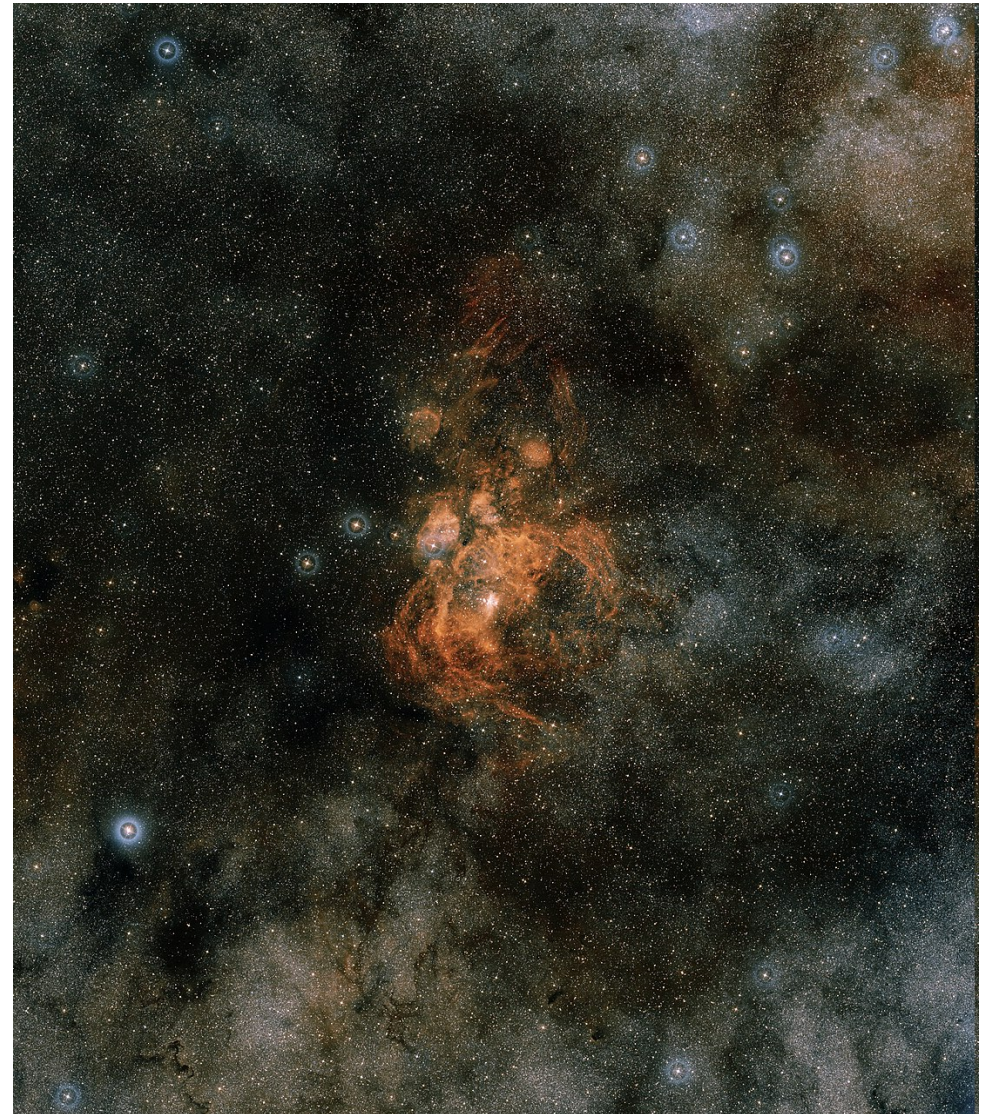


Figure 1: NGC 6357, a star-forming region in Scorpius, with open cluster Pismis 24 in its center. (Credit: Davide de Martin (ESA/Hubble), the ESA/ESO/NASA Photoshop FITS Liberator & Digitized Sky Survey 2.)