

## 11.16: The Birth of Stars and the Discovery of Planets outside the Solar System (Exercises)

---

### For Further Exploration

#### Articles

##### Star Formation

Blaes, O. "A Universe of Disks." *Scientific American* (October 2004): 48. On accretion disks and jets around young stars and black holes.

Croswell, K. "The Dust Belt Next Door [Tau Ceti]." *Scientific American* (January 2015): 24. Short intro to recent observations of planets and a wide dust belt.

Frank, A. "Starmaker: The New Story of Stellar Birth." *Astronomy* (July 1996): 52.

Jayawardhana, R. "Spying on Stellar Nurseries." *Astronomy* (November 1998): 62. On protoplanetary disks.

O'Dell, C. R. "Exploring the Orion Nebula." *Sky & Telescope* (December 1994): 20. Good review with Hubble results.

Ray, T. "Fountains of Youth: Early Days in the Life of a Star." *Scientific American* (August 2000): 42. On outflows from young stars.

Young, E. "Cloudy with a Chance of Stars." *Scientific American* (February 2010): 34. On how clouds of interstellar matter turn into star systems.

Young, Monica "Making Massive Stars." *Sky & Telescope* (October 2015): 24. Models and observations on how the most massive stars form.

#### Websites

Formation of Stars: [https://www.spacetelescope.org/science/formation\\_of\\_stars/](https://www.spacetelescope.org/science/formation_of_stars/). Star Formation page from the Hubble Space Telescope, with links to images and information.

#### Videos

A Star Is Born: [www.discovery.com/tv-shows/otc/star-is-born/](http://www.discovery.com/tv-shows/otc/star-is-born/). Discovery Channel video with astronomer Michelle Thaller (2:25).

### Review Questions

1. Give several reasons the Orion molecular cloud is such a useful "laboratory" for studying the stages of star formation.
2. Why is star formation more likely to occur in cold molecular clouds than in regions where the temperature of the interstellar medium is several hundred thousand degrees?
3. Why have we learned a lot about star formation since the invention of detectors sensitive to infrared radiation?
4. Describe what happens when a star forms. Begin with a dense core of material in a molecular cloud and trace the evolution up to the time the newly formed star reaches the main sequence.
5. Describe how the T Tauri star stage in the life of a low-mass star can lead to the formation of a Herbig-Haro (H-H) object.
6. Look at the four stages shown in Figure 21.1.7 in Section 21.1. In which stage(s) can we see the star in visible light? In infrared radiation?
7. The evolutionary track for a star of 1 solar mass remains nearly vertical in the H-R diagram for a while (see Figure 21.2.1 in Section 21.2). How is its luminosity changing during this time? Its temperature? Its radius?
8. Two protostars, one 10 times the mass of the Sun and one half the mass of the Sun are born at the same time in a molecular cloud. Which one will be first to reach the main sequence stage, where it is stable and getting energy from fusion?
9. Compare the scale (size) of a typical dusty disk around a forming star with the scale of our solar system.

## Thought Questions

1. A friend of yours who did not do well in her astronomy class tells you that she believes all stars are old and none could possibly be born today. What arguments would you use to persuade her that stars are being born somewhere in the Galaxy during your lifetime?
2. Observations suggest that it takes more than 3 million years for the dust to begin clearing out of the inner regions of the disks surrounding protostars. Suppose this is the minimum time required to form a planet. Would you expect to find a planet around a  $10-M_{\text{Sun}}$  star? (Refer to Figure 21.2.1 in Section 21.2.)

---

This page titled [11.16: The Birth of Stars and the Discovery of Planets outside the Solar System \(Exercises\)](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [OpenStax](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

- **21.E: The Birth of Stars and the Discovery of Planets outside the Solar System (Exercises)** by [OpenStax](#) is licensed [CC BY 4.0](#). Original source: <https://openstax.org/details/books/astronomy>.