For there is a single general space, a single vast immensity which we may freely call Void; in it are innumerarable globes like this one on which we live and grow. This space we declare to be infinite, since neither reason, convenience, possibility, sense-perception nor nature assign to it a limit.

In it are an infinity of worlds of the same kind as our own.

Giordano Bruno
On the Infinite Universe and Worlds (1584)
Orion

Photo Credit: Matthew Spinelli
Trapezium

An open cluster of stars recently formed in the star-forming region (stellar nursery) of the Orion Nebula.

There are five or so massive energetic stars and many many sun-like stars.
Orion’s Belt
Star Forming Region NGC 6357
Orion’s Cradle (Star-Forming Region)
Formation of a Solar System

A cloud of gas gravitationally collapses due to its mutual gravitation.

The cloud has a net spin and spins itself into a disk.

A star forms from the mass of material in the center of the cloud.

Multiple stars can form if the clumps of material are large enough. Otherwise, planets are formed.

http://www.bu.edu/core/cc105/lectures/L20-SolarSystemFormation/L20-solsysformation.html
How Do We Know?

How do we know that this is what happens?
How Do We Know?

How do we know that this is what happens?

Because we can see it happening right now!

Creation didn’t happen. It continues to happen!
Protoplanetary Disks in Orion

Protoplanetary Disks Orion Nebula

HST · WFPC2

PRC95-45b · ST ScI OPO · November 20, 1995
M. J. McCaughrean (MPIA), C. R. O’Dell (Rice University), NASA
A New Star System!

This star and its system is condensing from the wisps clouds of the Orion nebula.

We view it edge on, and can see the glow from the young star.

Older stars can be seen as well. Their protoplanetary disks have presumably condensed into planets.
Stellar Nurseries

As fine dust particles clump together deep inside the protoplanetary disk, ultraviolet radiation from a nearby hot star eats away at the disk. The outer portions of the gas bubble are then heated and removed by energetic ultraviolet radiation. Material falling from the disk toward the central object fuels twin gas jets.
How Does this Theory Explain the Facts?

It Explains:

1. The orbital plane of the solar system

2. Circular orbits of the planets come from circular rotation of the disk. The planets all revolve counterclockwise when viewed from above (north).

3. The planets tend to rotate in the same direction. It would take a massive event to spin it opposite to the initial cloud.

4. Chemical differentiation of the solar system happened after the Sun formed.

5. The smallest objects in our Solar system are leftover planetesimals.

http://www.bu.edu/core/cc105/lectures/L20-SolarSystemFormation/L20-solsysformation.html
Stellar Nursery in Galaxy M33

NGC 604 in Galaxy M33
Hubble Space Telescope • Wide Field Planetary Camera 2

PRC96-27 • ST ScI OPO • August 7, 1996 • Hui Yang (U.I.L) and NASA
Young T-Tauri Stars

The star ignites from the core of the cloud. Material both blows off the star and is pulled in.
LL Orionis a T-Tauri Star