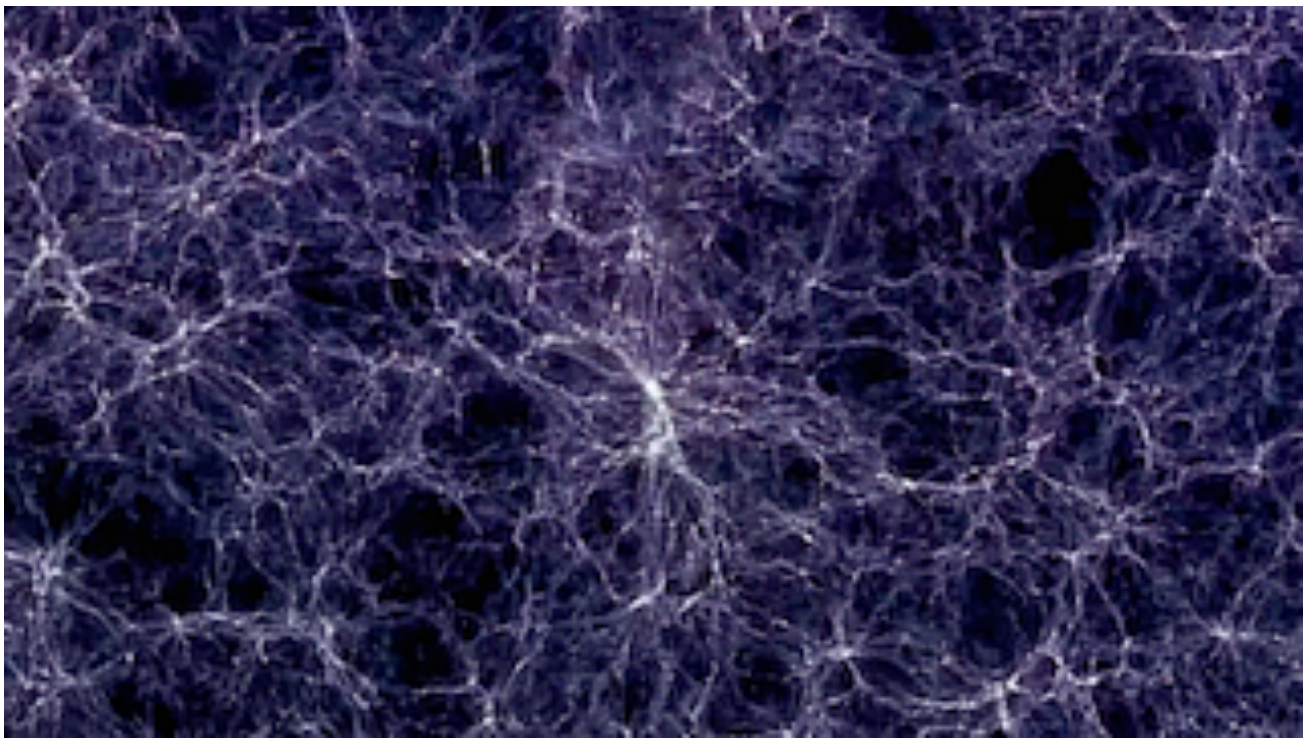

Threshold 2: Stars Light Up

Stars have been an important part of culture and religion throughout human history. But how did these balls of gas that have been a constant for humans throughout time come to be? In this video, you'll learn how our universe went from being a hot mush of particles to the diverse, complex structure we know it to be today.

Key Questions

1. What was the Universe like before the first stars formed? How long was it after the Big Bang before stars started to form?
2. Why do atoms packed together tightly heat up?
3. How long do stars continue releasing energy into space?

0:14-0:54 *Title; narrator begins speaking; negative and positive signs floating*	Right after the Big Bang, our young universe was what scientists call a plasma. This was basically an incredibly hot mush of charged particles without much structural complexity.
Screen turns black; text: 380,000; themermeter lowering in temp.; protons and neutrons appear + chemical elements	About 380,000 years later, things began to change. By then, temperatures had fallen low enough for protons, which have positive charges, to link up with electrons, which have negative charges. And together, they formed electrically neutral atoms, very simple ones like hydrogen, some helium, and a few slightly heavier atoms thrown in for good measure.

0:54-1:49 *List of ingredients;*	The universe now contained vast clouds of these atoms. Add gravity and now you have the ingredients for our second threshold, the formation of stars.
Gravity pulling in matter; text: Goldilocks conditions	Here's what happened next. Wherever there was slightly more matter, gravity is more powerful. So, tiny variations in the density of matter became the first Goldilocks condition for this second threshold.
Graphic depicting gravity making regions denser; text: 2nd Goldilocks condition	Gravity packed slightly denser regions ever closer together, squashing them so tightly that they began to heat up. This growing pressure and heat created our second Goldilocks condition.
Clouds merging together as protons and electrons split; text: 10 million degrees celsius; plus signs (protons) fusing together	Eventually, the clouds got so hot, that protons and electrons split apart once more, recreated a plasma. And when temperatures in these hot spots got to about 10 millions degrees Celsius, protons began to fuse together and part of them turned into energy as they did so.
1:49-2:49 *Screen turns black before stars light up*	This huge release of heat from the center of each cloud of matter stopped the cloud from collapsing any further. And this is how the first stars lit up.
Zooming out in space	Soon, the universe had billions of hot spots pouring energy into the cold of deep space. Each star would continue releasing energy into space for millions or even billions of years until it had no more protons to fuse.
Zooms out showing galaxies, chains, and clusters; text: Goldilocks equation	And as these stars formed, so did galaxies, each containing billions of stars. Galaxies in turn grouped together into huge clusters and chains of galaxies, the largest structures in the universe. Suddenly, the universe seemed to have a lot more variety and a lot more structure.
Screen goes black; text: What new things could happen?; outro music; text: Big History	Now, what new things could happen in a universe filled with stars?