

## Stellar evolution and the problem of the 'first' stars

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According to evolutionists, the first chemical elements heavier than hydrogen, helium and lithium formed in nuclear reactions at the centres of the first stars. Later, when these stars exhausted their fuel of hydrogen and helium, they exploded as supernovas, throwing out the heavier elements. These elements, after being transformed in more generations of stars, eventually formed asteroids, moons and planets. But, how did those first stars of hydrogen and helium form? Star formation is perhaps the weakest link in stellar evolution theory and modern big bang cosmology. Especially problematic is the formation of the first stars—Population III stars as they are called.

Evolutionists generally agree that star formation began early after the big bang. Supposedly, the cosmic microwave background originated after some 300,000 years, while the first stars and structure in the universe developed after 1 million to 10 million years.

Forming so early, the first stars would be expected to have red shifts or  $z$  numbers  $> 10$  today. Some researchers believe the first stars formed at  $z = 20$  to 30 or greater.<sup>1</sup> However, it should be pointed out that astronomers have not yet observed objects with such large red shifts. Evolutionists hope that the Next Generation Space Telescope (NGST) may be able to find them or at least find fossils (elements formed by the  $r$  and  $s$ -process<sup>2</sup> for example) left behind by these first stars.

### The 'first' stars

The process of star formation is assumed to begin with molecular gas clouds like those that are currently observed in the galaxies. The process is envisaged to be gradual, slow, and

inefficient. However, present day molecular gas clouds have no relevance to the origin of the very first Population III stars because conditions soon after the big bang were greatly different from what exists now.

'The very first stars to form in a galaxy, called first-generation stars, are pure hydrogen and helium, for almost no elements heavier than helium were formed in the Big Bang ... . When some of these extremely massive stars explode as supernova, they produce even heavier elements, including uranium, the heaviest of all natural elements. These heavy elements are spewed out into the interstellar void and become part of the clouds of gas and dust that coalesce into the second generation and succeeding generations of stars. These stars will have more heavy elements than do the first-generation stars. The Sun is a star of the second generation or later.'<sup>3</sup>

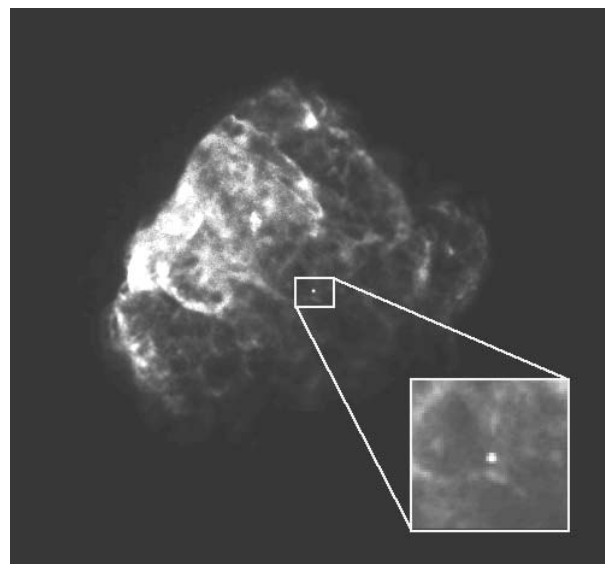
Stellar evolution theory considers three populations of stars—Population I, II, and III. Population III stars are the most significant to the development of the universe, followed by multiple generations of Population I stars. The idea of stellar populations dates back to research in WWII by Walter Baade at Mount Wilson observatory. He categorised Population II and Population I stars (in terms of their metallicity, distribution and motion) and incorporated them into an evolutionary paradigm. In this paradigm, Population II stars are considered to be the older generation of stars. Thus they lack O and B stars (which burn 'quickly') and have a higher proportion of red giants. Population I stars are considered young, and have all spectral classes includ-

ing the O and B, hot blue stars. The idea of Population III stars is a later addition to the Baade paradigm resulting from the development of big bang cosmology.

In big bang cosmology, Population III stars are the first generation of stars. As such, Population III stars would contain no metals (elements heavier than helium) with the possible exception of some primordial Li. This distinctive composition means that their spectra would stand out as sharply different from Population II and I stars—that is, if they could be observed today. Unlike the spectra of Population II or I stars, the C/H and Fe/H ratios in Population III stars would not be detectable. In addition, the stellar spectra of Population III stars would reflect the supposed primordial H/He abundance with possible exception of some primordial Li.

### How did they form?

Because they were first, Population III stars would not have formed by the same mechanisms that evolutionists use to explain the origin of Population I stars, which *are* observed today. There are a number of significant differences. First, evolutionists cannot invoke a supernova to trigger the gas cloud collapse. Supernovae did not occur until



An X-ray image of the Puppis A supernova remnant, created using data from the ROSAT High Resolution Imager. The inset shows an expanded view of the neutron star and its surroundings.

Photo courtesy NASA

after Population III stars had formed and burned all their nuclear fuel. Second, there were no dust grains or heavy molecules in the primordial gas to assist with cloud condensation and cooling, and form the first stars. (Evolutionists now believe that molecular hydrogen may have played a role, in spite of the fact that molecular H almost certainly requires a surface—i.e. dust grains—to form.) Thus, the story of star formation in stellar evolution theory begins with a process that astronomers cannot observe operating in nature today.

Also, evolutionists have modified the equations of state used in the computer models that describe the formation of stars from molecular gas clouds (M42 in Orion is a classic example).

Another significant change for Population III stars is the introduction of dark matter to alter the calculations for the minimum Jeans mass.<sup>1</sup> The minimum Jeans mass, defined by density, temperature, pressure, and gravitational potential, is critical in stellar evolution theory. It is an attempt to define the minimum stellar mass that could form via gas cloud fragmentation.<sup>5</sup> Dark matter assumptions highly influence the calculation for the Jeans mass. Certainly, gas clouds like M42 are missing this in the equations used in computer models. Early reports from the 1970s and 1980s showed that evolutionists commonly believed that Population III stars could form with masses ranging from 0.1 to 100  $M_{\text{solar}}$ .<sup>6</sup>

Since low masses ( $< 1 M_{\text{solar}}$ ) were considered possible for Population III stars, and since low-mass stars deplete their nuclear fuel more slowly, astronomers concluded that some Population III stars should still exist. Careful searches, however, failed to find any Population III stars.

In more recent times the computer models used to predict the masses of Population III stars have been modified and now favour much larger masses (remember that the equations of state have been altered since the early reports.) Some reports now suggest the lower mass range could be 3 to 16

$M_{\text{solar}}$ .<sup>7</sup> Thus, evolutionists now do not expect to find any Population III stars today because they were all too massive and burnt their nuclear fuel a long time ago. Some of the massive stars are believed to have evolved into white dwarfs, but most are assumed to have exploded as supernovae, seeding the universe with the heavy elements created from the r and s-process.

### Do they exist?

In the big bang model for star-formation we see a big difference between the story for the first unobservable stars and the stars that are observed today. Keep in mind that about 90% of the stars observed today plot on the main sequence of the H-R star diagram. Of these, the majority (about 70% or more) are less than 0.8  $M_{\text{solar}}$ . However, evolutionists could not tolerate this situation for the Population III stars, otherwise the universe would be filled with numerous examples to observe. Yet, none have been found.

It seems that evolutionists commonly gloss over this part of the story when they attempt to convince the public that they understand the origin of stars (and by implication the origin of people, i.e. carbon, oxygen, and iron in our bodies forged in the stars.) *Astronomy* recently published some information on the origin of Population III stars:

‘The problem: If water is crucial in the formation of stars in these clouds, how would the first stars have formed since no water was available?’<sup>8</sup>

The editors answer:

‘Astronomers don’t know for sure how the universe made its first stars, but they do have a reasonably good guess. (As you can imagine, there’s no way to observe the formation of the first generation of stars, so all the work is based upon theoretical considerations.) The best scenario has molecular hydrogen playing the role of the cooling agent. If the clouds from which stars formed were some four to five times denser in the early universe

than they are today, then enough collisions between hydrogen atoms would have taken place to create a lot of molecular hydrogen. The big question is: Were the first galaxies that much denser? Obviously the overall density of the universe was much higher back in the early days, but no one knows whether the star-forming clouds were this much denser.

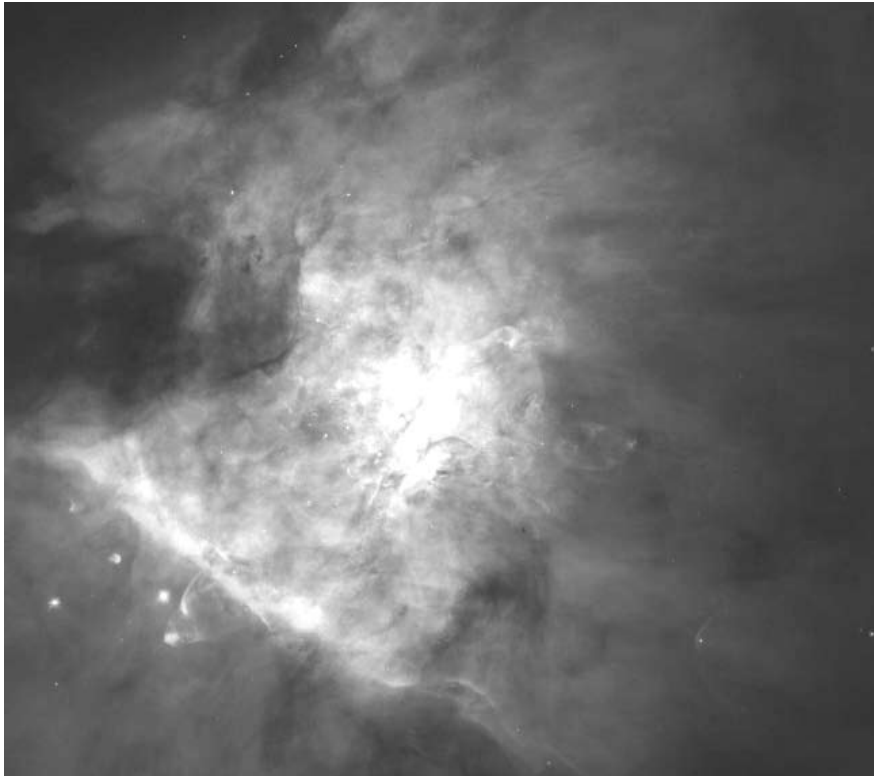
‘Most astronomers would say that the fact that stars do exist tells us that the density was higher back then, because otherwise there would be no stars ... Nowadays, of course, nature has found a simpler, easier way to cool the clouds (with water), so that’s what she uses.’<sup>8</sup>

It seems there is a major problem with the answer given:

‘The first generation of stars likely formed when the universe was only a few million years old (though these ‘Population III’ stars have not yet been identified).’<sup>9</sup>

The term, ‘have not yet been identified’ leads to the ‘big question’: Where are examples of these first generation stars or Population III stars? There is no evidence that the universe ever had or does contain Population III stars. There is no evidence that the universe ever contained the primordial star forming clouds that contained no metals. The editors failed to point this out in the ‘theoretical’ answer provided. Their answer assumes that Population III stars are real. Indeed, their answer is tantamount to conjecture and circular reasoning based upon the big bang. The editors also failed to identify the critical role of dark matter in the equations of state used to model the formation of Population III stars, as say compared to molecular gas clouds like M42.

Recent reports about possible gas giant planets located in M42 have been drawing attention.<sup>10</sup> If confirmed, this shows that evolutionists cannot predict the minimum Jeans mass for gas clouds like M42 or what type of stellar mass distribution may form with any reliability. This makes me wonder about how reliable predictions for the



The Great Orion Nebula (M42, NGC 1976) is located in the 'Sword' part of the constellation of Orion, just below the eastern-most of the three stars that comprise Orion's belt. Approximately 1,500 light years distant, M42 is a very active and turbulent cloud of gas and dust.

minimum Jeans mass may be that are modelled using *unobserved* primordial star forming clouds and dark matter.

### Conclusions

No one has observed or can observe the primordial star forming gas clouds that evolutionists believe existed in the early universe, shortly after the big bang. Their existence remains a matter of conjecture, not fact.

The formation of Population III stars in big bang cosmology is very dependent upon assumptions of dark matter used in the equations of state to define the minimum Jeans mass. This again is conjecture, not fact.

The existence of Population III stars remains untested. 'Although the search for Population III stars has proved elusive so far, upcoming CMB anisotropy probes (MAP/Planck) will study their signature, and NGST might be able to directly image them.'<sup>1</sup>

Star formation in stellar evolution theory is a topic that needs to be critically examined. Some of the

mechanisms invoked by evolutionists to explain star formation appear plausible when extrapolated over millions and billions of years. However, current theory based upon observations of molecular gas clouds like M42 breaks down when applied to the origin of Population III stars. Other components of the theory, such as the minimum Jeans mass and stellar mass distribution, indicate that, contrary to the impression we are given, evolutionists are far from solving the origin of the myriad stars we do observe.

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