



## Humans in Space *Colonizing the galaxy*

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To answer some of your questions you might have on this topic, we've decided to create a little question and answer session. Read on...


"What is this, science fiction? Colonizing the solar system I can believe, but colonizing the galaxy? Aren't there billions of stars out there?"

"Roughly 200 billion, according to current estimates. And yes, it would be possible to colonize the galaxy in a relatively short period of time."

100,000 light years in diameter and that we are 30,000 light years from the centre, the further star away from us is about 70,000 light years away. At one-fourth the speed of light, it'll take 280,000 years to get there."

"Okay, okay. But that's not what's important. How on Earth can this be done?"

"Think about it. It's likely, as we mentioned in *Interstellar Travel*, that any interstellar spacecraft will be powered by nuclear fusion. While nuclear fusion is not yet viable, it may well be within the



**Two hundred billion stars. One hundred thousand light year diameter.**

**Just how on Earth do we think we can colonize the Milky Way galaxy?**

"How short is relatively short?"

"Well, we're talking on geological and cosmological timescales here. Consider the fact that a million years to a star is less than one five thousandth of its entire life."

"You're avoiding the issue here. How long?"

"Possibly just less than 300,000 years, so long as you travel at about 25% the speed of light."

"How did you work that out?"

"Considering that the Milky Way galaxy is roughly

next few decades. Fusion requires helium-3 as fuel, and we have very little helium-3 on Earth."

"Ah, so we won't have enough fuel, right?"

"Wrong. There are large amounts of helium-3 on the Moon, and vast quantities of helium-3 in Uranus."

"Yeah, you say 'vast' but there can't possibly be enough for even a hundred interstellar spacecraft."

"Really? It's been worked out that just one percent of the helium-3 on Uranus would be enough to send one ship to every single star in the galaxy, and each of those ships could carry a billion people. Generation ships? More like world-ships."



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"I don't believe it!"

"It's true. Although I have to admit I haven't been completely honest with you on all the facts."

"Ah, just as I thought. The whole thing is a sham."

"No, it isn't. While there might be enough helium-3 on Uranus to fuel two hundred billion interstellar craft, we'd never be able to build all of those ships with the resources in the Solar System. And as you know there aren't enough people alive to send a decent number to every star in the galaxy. So what would probably happen is that a first wave of automatic, unmanned interstellar probes would be sent to a small number of stars. Those probes would self-replicate and mine their systems of resources to produce habitats for humans. Finally, they would then produce more probes, mine more helium-3 and travel to another system. Once that's done, humans can come along and settle down in the ready-made habitats. If you plot a conservative exponential chart of this process, it would only take ten to a hundred million years to colonize the entire galaxy."

"A bit longer than 280,000 years, eh?"

"Yes, just slightly."

"Wait, hold on a second. Self-replicating probes? Interstellar travel? Isn't this all a bit science fiction?"

"Going to the Moon was science fiction in 1900, wasn't it?"

"Hmm. Fair enough."

"Of course, all of this talk is based on the assumption that faster than light travel is not possible. If we did somehow manage to travel faster than light, maybe using stabilized wormholes with

negative mass matter, then it's a completely different ball game."

"Absolutely. Yet is this really going to happen? Do you really think that we'll send self-replicating interstellar probes to other stars?"

"It's a possibility. It's always very difficult to predict the future. In fifty or a hundred years time, the world will be a completely different place. We'll have artificial intelligences that are magnitudes of times more intelligent than us. We'll be able to effectively live for at least 200 years or more. Computers will be unimaginably powerful - we might even be able to download ourselves into computers. Will we still want to colonize the galaxy in that sort of world? I don't know."

"Hold it. Exactly why did we want to colonize the galaxy in the first place?"

"That's an interesting question. We wouldn't necessarily be colonizing the galaxy - I find it hard to believe we'll even colonize one percent of all the stars. We'll be exploring, looking for other intelligent life. And surely it's worth anything to be able to go and encounter aliens? Imagine what we could learn and what we could see on those journeys..."

"Stop going all poetic on me."

"Sorry. Also, if the galaxy turns out to be tragically lifeless, by colonizing the galaxy we would be spreading it with life and richness. Wouldn't a living galaxy be a more interesting and better place than a sterile, dead galaxy?"

So there you go, colonizing the galaxy in under a hundred million years.

Image on previous page: Infrared photograph of the Milky Way galaxy taken by the COBE space telescope. Courtesy NASA/COBE.