Why is Andromeda coming toward us?

January 23 2015, by Fraser Cain

The Andromeda Galaxy will collide with the Milky Way in the future. Credit: Adam Evans

I don't want to alarm you, but there's a massive galaxy heading our way and will collide with us in a few billion years. But aren't most galaxies speeding away? Why is Andromeda on a collision course with the Milky Way?

I don't want to freak you out, but you should be aware that there's a

gigantic galaxy with twice our mass headed right for us. Naw, I'm just kidding. I totally want to freak you out. The Andromeda galaxy is going to slam head first into the Milky Way like it doesn't even have its eyes on the road.

This collision will tear the structure of our galaxy apart. The two galaxies will coalesce into a new, larger elliptical galaxy, and nothing will ever be the same again, including your insurance premiums. There's absolutely nothing we can do about it. It's like those "don't text and drive commercials" where they stop time and people get out and have a conversation about their babies and make it clear that selfish murderous teenagers are really ruining everything for all of us all the time.

And now that we know disaster is inbound, all we can do is ask WHY? Why this is even happening? Isn't the Universe expanding, with galaxies speeding away from us in all directions? Shouldn't Andromeda be getting further away, and not closer? What the hay, man!

Here's the thing, the vast majority of galaxies are traveling away from us at tremendous speed. This was the big discovery by Edwin Hubble in 1929. The further away a galaxy is, the faster it's moving away from us. The most recent calculation by NASA in 2013 put this amount at 70.4 kilometers per second per megaparsec. At a billion light-years away, the expansion of the Universe is carrying galaxies away from us at 22,000 km/s, or about 7% of the speed of light. At 100 million light-years away, that speed is only 2,200 km/s.

Which actually doesn't seem like all that much. Is that like Millenium Falcon fast or starship Enterprise Warp 10 fast? Andromeda is only 2.5 million light-years away. Which means that the expansion of the Universe is carrying it away at only 60 kilometers per second. This is clearly not fast enough for our purposes of not getting our living room stirred into the backyard pool. As the strength of gravity between the

Milky Way and Andromeda is strong enough to overcome this expansive force. It's like there's an invisible gravity rope connecting the two galaxies together. Dragging us to our doom. Curse you, gravity doom rope!

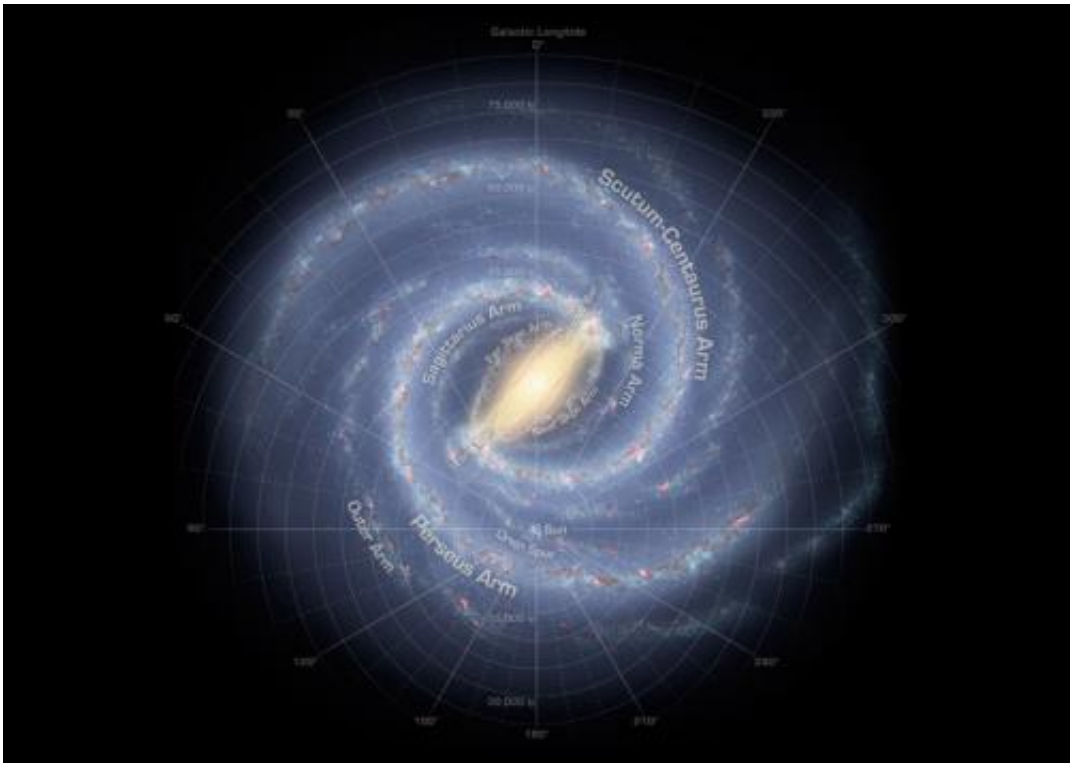
Andromeda is speeding towards us at 110 kilometers per second. Without the expansion of the Universe, I'm sure it would be faster and even more horrifying! It's the same reason why the Solar System doesn't get torn apart. The expansion rate of the Universe is infinitesimally small at a local level. It's only when you reach hundreds of millions of light-years does the expansion take over from gravity.

You can imagine some sweet spot, where a galaxy is falling towards us exactly as fast as it's being carried away by the expansion of the Universe. It would remain at roughly the same distance and then we can just be friends, and they don't have to get all up in our biz. If Andromeda starts complaining about being friend-zoned, we'll give them what-for and begin to re-evaluate our friendship with them, because seriously, no one has time for that.

The Hubble Space Telescope's extreme close-up of M31, the Andromeda Galaxy. Picture released in January 2015. Credit: NASA, ESA, J. Dalcanton, B.F. Williams, and L.C. Johnson (University of Washington), the PHAT team, and R. Gendler

The discovery of dark energy in 1998 has made this even more complicated. Not only is the Universe expanding, but the speed of expansion is accelerating. Eventually distant galaxies will be moving faster away from us than the speed of light. Only the local galaxies, tied together by gravity will remain visible in the sky, eventually all merging together. Everything else will fall over the cosmic horizon and be lost to us forever.

All things in the Universe are speeding away from us, it's just that gravity is a much stronger force at local levels. This is why the Solar System holds together, and why Andromeda is moving towards us and in about 4 billion years or so, the Andromeda galaxy is going to slam into the Milky Way.



This annotated artist's conception illustrates our current understanding of the structure of the Milky Way galaxy. Credit: NASA

So, if by chance you only watched the first part of this video, freaked out, sold your possessions and joined some crazy silver jumpsuit doomsday cult, and are now, years later watching the conclusion… you may feel a bit foolish. However, I hope that you at least made some lifelong friendships and got to keep the jumpsuit.

Really, there's nothing to worry about. Stars are spread so far apart that individual stars won't actually collide with each other. Even if humanity is still around in another 4 billion years or so, which is when this will all go down. This definitely isn't something we'll be concerned with.

Source: Universe Today