Christmas Trees are Made of Stars?

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It's that time of year again, when the Christmas trees go up as part of the holiday celebrations. Now a group of astronomers have suggested that an astronomical effect may lead to Christmas trees in the night sky! The effect causes stars to arrange themselves into a shape that was dubbed "The Christmas Tree", after its discovery in computer simulations around Christmas 2011 by Paulina Assmann, an astronomer from the University of Concepci'on, Chile, and Pavel Kroupa, from AIFA in Bonn University, Germany. Until now, the reason for this behaviour was a mystery. A new study, published this month in the Monthly Notices of the Royal Astronomical Society, has solved the riddle.

"The stars that make up our Galaxy, and the millions of others in our Universe, are known to be born in groups, called clusters, within huge gas clouds. The most massive of these stars can blow away the remaining gas cloud, either with a high-energy "wind" of emitted particles, or by exploding in a supernova. Without the gas cloud there is less mass and so less gravity holding the cluster together: the stars fly away from each other in all directions," says lead author of the new study, Graeme Candlish, also from the University of Concepci'on. In other words, the cluster "pops". But the stars are not truly free: the gravitational force from the Galactic disk begins to pull them back. The recent study used simulations and mathematical analysis to see how these stars would move after the cluster pops. "We found that the distribution of stars takes on a very familiar, seasonal appearance!" said Brad Gibson, of the University of Central Lancashire, UK.

So what happens after the cluster pops? All the cluster stars oscillate up and down, flying through the disk of the Galaxy, but the further a star flies away from the disk the longer it takes to fall back. So after a short time of just a few hundred million years, the stars begin to go out-of-sync with each other: rather than seeing the whole cluster expanding and flattening together, we would start to see "waves" of stars moving up and down through the disk. If we then make a diagram (see below) of how many stars we see at each height above and below the disk, we would see... a Christmas tree! The closer a wave of stars is to the disk, the more stars lie within the wave, so the highest branches are the closest waves. As the waves move, the Christmas tree changes shape, with more, less pronounced, branches over time.

Unlike the highly visible Christmas trees on Earth however, these have yet to be seen. "These are not constellations that look like Christmas trees in the sky," said Rory Smith, from Concepci'on, "so finding them will be a very hard task." Detecting the effect will require precision measurements of many stars from a cluster caught at just the right time. If found, however, they will aid us in our understanding of the formation and properties of our Galaxy. "Our Galaxy contains thousands of star clusters and observations with powerful new space-based telescopes, such as the European Space Agency's Gaia mission, scheduled

to launch on 19th December, may allow us to find this effect," said Brad. Soon we might see this symbol of the season of goodwill in the stars!

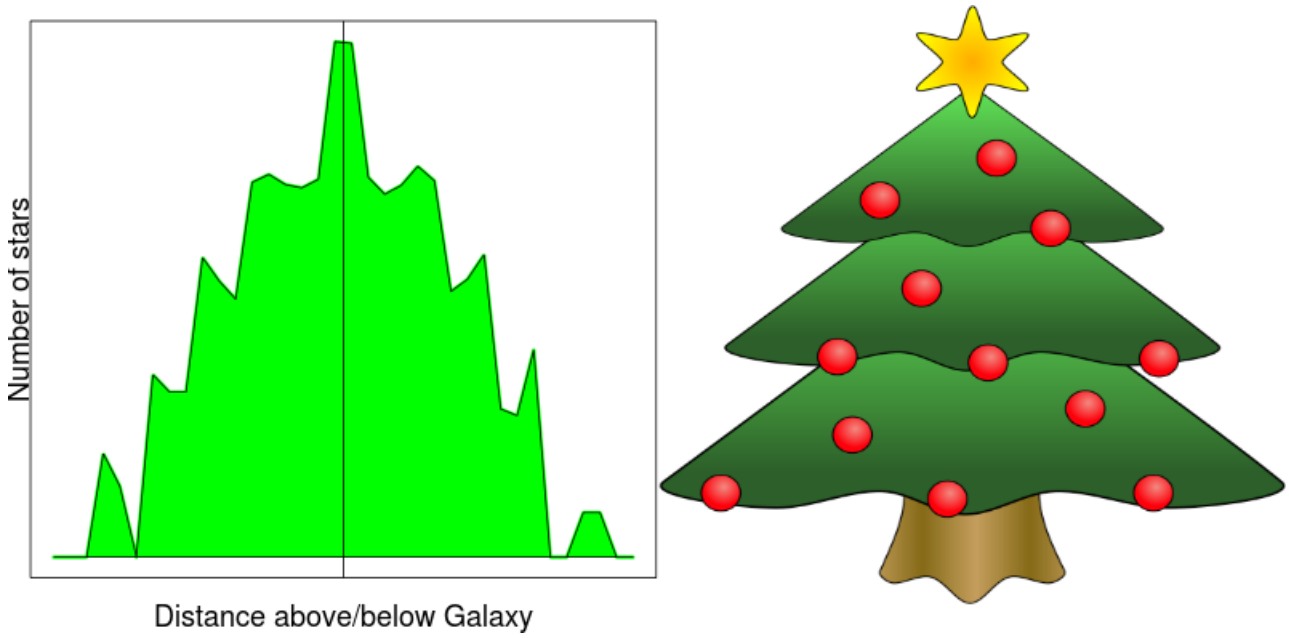

Figure 1: Christmas trees! Well... can YOU tell the difference?