**A recipe to create gold in space: Collide two dead stars**

Salman Hameed

The announcement was short. It lasted only a fraction of second – a blink of an eye. But a spacecraft in Earth's orbit, keeping an eye on such events, captured it on June 3rd of this year. The announcement may have been brief, but it told us that two exotic dead stars, called neutron stars, have collided with each other. This is a relatively rare event, but it bears good news for the merchants in the *Sona Bazaar*. This collision has created gold – lots of gold.

But before you head over to *Sona Bazar*, you should know that this particular collision happened in a galaxy so far away that it has taken light – traveling at a stupendous speed of 186 thousand miles every second - four billion years to reach us! In astronomical terms, this collision happened in a galaxy 4 billion *light-years* away. In comparison, light from our Sun gets to us in 8 minutes, and is therefore only 8 *light-minutes* away. The distance of billions of light-years doesn't intimidate astronomers, as they routinely study events and objects that even farther away than this particular galaxy. The significance of this event, however, resides in the fact that for the first time, astronomers have been able to study light from collisions that may help us understand the way elements like gold are created in the universe.

Before we get too caught up in glimmer of gold, we should remember that almost all of the elements that make our bodies were cooked up inside the stars: the carbon in our DNA, oxygen in our lungs, and iron in our blood. Hydrogen in the water molecule, on the other hand, is a leftover from processes in the early history of the universe. The classic quote from the late astronomer Carl Sagan is indeed true: "We are made up of star stuff".

But for years, astronomers had been seeking an explanation for elements like gold, lead, platinum etc. It was thought that most of these elements would form when large stars – stars that are ten times the size of our Sun – die in large explosions called *Supernovae*. However, calculations showed that supernovae in the universe could only account for a fraction of these elements. There must be another way to make gold in the universe.

Now we know how.

Here is the recipe: You take two stars that are orbiting each other. This is not as hard as it seems. Nearly half of all stars in our own Galaxy have at least one other star in its system. But make sure that both of these stars are at least 10 times bigger than our Sun. Then wait about 10 million years. This is the average lifetime of big stars. They will eventually exhaust all their fuel and explode in their individual supernovae. All that will be left of them will be their cores called neutron stars. These are some of the strangest objects in the universe. Each of the neutron star contains mass equal to that of our Sun, but all packed in a size no greater than a city

like Karachi. This means that they have very high density. A teaspoon of neutron star material would weigh as much as a mountain. Now you have two of these neutron stars orbiting each other. But orbits for such exotic objects are unstable. The two stars will eventually collide with each other – and this collision will result in the creation of gold and other rare elements.

However, in an act of ultimate charity, these elements are spread into the surrounding space.

By the time our Solar system was born, many such collisions had enriched our Galaxy with gold (and other elements). The gas cloud that formed the Sun and the Earth already contained these elements. Some of this gold became part of the Earth. Four and a half billion years later, this rare element caught the attention of bipedal species and it became an object of desire and envy.

So the next time when you wear a gold ring or a golden necklace, just pause for a minute and appreciate the role of the cosmos in the production of your jewelry.

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**Figure Caption:**
This gold – and all the other gold on the Earth - was produced in a collision of two neutron stars.