Calculating the time it will take spacecraft to find their way to other star systems

December 27 2019, by Bob Yirka

Artist's concept of NASA's Voyager spacecraft. Credit: NASA/JPL-Caltech

A pair of researchers, one with the Max Planck Institute for Astronomy, the other with the Jet Propulsion Laboratory at CIT, has found a way to estimate how long it will take already launched space vehicles to arrive at other star systems. The pair, Coryn Bailer-Jones and Davide Farnocchia have written a paper describing their findings and have uploaded it to the arXiv preprint server.

Back in the 1970s, NASA sent four unmanned space probes out into the solar system—Pioneer 10 and 11, and Voyager 1 and 2—which, after

completion of their missions, kept going—all four are on their way out of the solar system or have already departed. But what will become of them? Will they make their way to other star systems, and if so, how long might it take them? This is what Bailer-Jones and Davide Farnocchia wondered. To find some possible answers, they used the Gaia space telescope. It was launched by the European Space Agency back in 2013 and has been stationed at a point just outside of Earth's orbit around the sun. It has been collecting information on a billion stars, including their paths through space. The latest dataset was released just last year on 7.2 million stars.

With data describing the paths of the four spacecraft and data describing the paths of a host of stars in hand, the researchers were able to work out when the paths of the four spacecraft might approach very far away star systems.

The researchers found that the four spacecraft will come somewhat close to approximately 60 stars over the course of the next 1 million years—and will come within two parsecs of approximately 10 of them. They also found that Pioneer 10 will likely be the first to pass by a star system—one called HIP 117795. It sits in the constellation Cassiopeia. Their calculations show that the spacecraft will pass within 0.231 parsecs of the star in approximately 90,000 years. They also found that all four of the spacecraft will travel for a very long time before they collide with or are captured by a star system—on the order of 10^{20} years.

More information: Coryn A. L. Bailer-Jones et al. Future Stellar Flybys of the Voyager and Pioneer Spacecraft, *Research Notes of the AAS* (2019). DOI: 10.3847/2515-5172/ab158e

Future stellar flybys of the Voyager and Pioneer spacecraft, arXiv:1912.03503 [astro-ph.EP] arxiv.org/abs/1912.03503