How interstellar beacons could help future astronauts find their way across the universe

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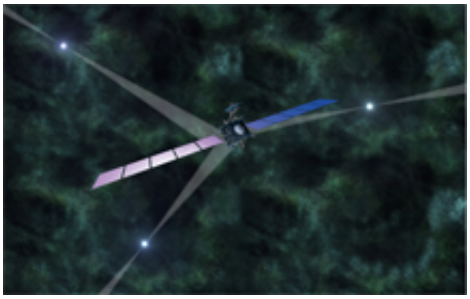

Artist's impression of pulsar-based navigation in deep space. The characteristic time signatures of strongly magnetised and fast spinning neutron stars, called pulsars, are used as natural navigation beacons to determine the position and velocity of a spacecraft. Credit: Pictures of spaceships: Rosetta (courtesy of ESA), Star Trek spaceship Enterprise.

(PhysOrg.com) -- The use of stars, planets and stellar constellations for navigation was of fundamental importance for mankind for thousands of years. Now a group of scientists at the Max-Planck Institute for Extraterrestrial Physics in Garching, Germany have developed a new technique using a special population of stars to navigate not on Earth, but in voyages across the universe. Team member Prof. Werner Becker presented their work at the National Astronomy Meeting in Manchester on Friday 30 March.

Have you ever asked yourself how the starship Enterprise in the TV series Star Trek found its way through the depths of space? Cosmic

lighthouses called pulsars might be the key to this interstellar navigation - not only in science fiction but also in the near future of space flight.

When stars much more massive than our Sun reach the end of their lives, their final demise is marked by a dramatic supernova explosion that destroys most of the star. But many leave behind compact, incredibly dense remnants known as neutron stars. Those detected have strong magnetic fields that focus emission into two highly directional beams. The neutron star rotates rapidly and if the beam points in the direction of the Earth we see a pulse of radiation at extremely regular intervals – hence the name pulsar.

Prof. Becker and his team are developing a novel navigation technology for spacecraft based on the regular emission of X-ray light from pulsars. Their periodic signals have timing stabilities comparable to atomic clocks and provide characteristic time signatures that can be used as natural navigation beacons, similar to the use of GPS satellites for navigation on Earth.

By comparing the arrival times of the pulses measured on board the navigator spacecraft with those predicted at a reference location, the spacecraft position can be determined with an accuracy of few kilometres, everywhere in the solar system and far beyond.

At the moment even the fastest spacecraft would take thousands of years to travel to the nearest star and far longer to explore the wider Galaxy so we are unlikely to see journeys like this happen for many centuries. Nonetheless, the pulsar-based navigation system could be in use in the near future.

Professor Becker gives two examples: “These X-ray beacons could augment the existing GPS/Galileo satellite navigation systems and provide autonomous navigation for interplanetary space probes and

future manned missions to Mars."

He adds: "Looking forward, it's incredibly exciting to think that we have now the technology to chart our route to other stars and may even be able to help our descendants take their first steps into interstellar space."

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