Pulsar survey could help find gravitational waves

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With a recently announced $6.5 million grant over five years from the National Science Foundation (NSF), an international consortium of researchers and institutions hopes to find and use the galaxy's most precise pulsars as tools for detecting gravitational waves.

The project, funded under the Partnership for International Research and Education (PIRE) program, will use telescopes around the world, including the Cornell-managed Arecibo Observatory, to survey and monitor the sky for millisecond pulsars. (Pulsars are rapidly spinning neutron stars that emit lighthouse-like beams of radio waves.)

By monitoring the pulsars over five or more years, the researchers hope to find evidence of gravitational waves through tiny perturbations in the spacing of the pulsars' beams.

Gravitational waves are a key prediction of Einstein's theory of general relativity, but they have never been directly detected. Among other sources, they are thought to be caused when black holes within merging galaxies spiral in toward each other and collide.

"We're essentially certain that they're out there," said James Cordes, professor of astronomy and a senior collaborator in the PIRE project. But because the waves are extremely long (possibly with periods of five years or more) and have amplitudes less than 100 nanoseconds, finding evidence of their existence requires highly precise detectors -- and patience.

"The goal right now is to simply detect the presence of gravitational waves, which would be a first, and then make more detailed measurements -- to understand the astrophysics of merging black holes; and also to detect more exotic sources of gravitational waves, such as from cosmic strings," Cordes said.

The project brings together the resources of the North American NanoHertz Observatory for Gravitational waves (NANOGrav) and collaborations in Australia, Europe and India. The study of gravitational waves is also a key project for the planned Square Kilometer Array, for which Cordes is principal investigator for the U.S. Technology Development Program.

Provided by Cornell University