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Building a Galactic Scale Gravitational Wave Observatory

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Pulsars are rapidly rotating neutron stars with phenomenal rotational stability that can be used as celestial clocks in a variety of fundamental physics experiences. One of these experiments involves using a pulsar timing array of precisely timed millisecond pulsars to detect perturbations due to gravitational waves. The low frequency gravitational waves detectable through pulsar timing will most likely result from an ensemble of supermassive black hole binaries. I will introduce the efforts of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), a collaboration that monitors over 50 millisecond pulsars with the Green Bank Telescope and the Arecibo Observatory, with a focus on our observation and data analysis methods. I will also describe how NANOGrav has joined international partners through the International Pulsar Timing Array to form a low-frequency gravitational wave detector of unprecedented sensitivity.