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Pulsar Timing Arrays: Building a Low-Frequency Gravitational Wave Detector

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Pulsars are rapidly rotating neutron stars with phenomenal rotationalstability that can be used as celestial clocks inavariety of fundamentalphysics experiments. One of these experiments involves usinga"pulsar timing array" ofprecisely timed millisecond pulsars to detect perturbations due togravitationalwaves. The low-frequencygravitationalwavesdetectable through pulsartiming will most likely result from an ensemble of supermassive black holebinaries. I will introduce the efforts of theNorthAmericanNanohertzObservatoryforGravitationalWaves(NANOGrav),acollaborationwhich monitors an array of over 70 millisecond pulsars with the Green BankTelescope and AreciboObservatory, withafocus on our observation and data analysis methods. I will also describe how NANOGrav works with international partners through the International Pulsar Timing Array to buildalow-frequency gravitational wave detector of higher sensitivity than any one pulsar timing array.