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Plans for Advanced LIGO Instruments

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The proposed Advanced LIGO detector will have an increase in sensitivity over initial LIGO by a factor of ten, with an increased bandwidth in the region of highest sensitivity and the ability to tune for specific astrophysical sources. Advanced LIGO will achieve the equivalent of the one-year integrated observation time of initial LIGO in just several hours, allowing observation of astrophysical gravitational waves on a regular basis. The Advanced LIGO detector will replace the existing detector at the LIGO Observatories while retaining the existing building and vacuum system infrastructure. The new instruments build on the initial LIGO Fabry-Perot Michelson Interferometer layout and take advantage of significant advances in technology since the design of initial LIGO in the 1990's. Signal strength/sensitivity will be improved by increasing the laser power, lowering optical absorption, and adding signal recycling to the Fabry-Perot arm cavities. Stray forces on the test masses will be controlled by reducing thermal noise sources in the suspensions and optics and using a multi-staged seismic isolation system with inertial sensing and feedback control. The LIGO laboratory, the LIGO Science Collaboration, and international partners have undertaken a structured program of research and development, including testing of full-scale prototypes in context. Significant progress has been made on several of the detector subsystems. The Advanced LIGO project has been through National Science Foundation peer review and the National Science Board has recommended it for funding. Based on a proposed funding start in 2007, detector installation will begin in 2010, with observations at an advanced level of commissioning in 2013.