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Status of lasers for next generation gravitational wave detectors with cryogenic silicon optics[1]

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The hunt for gravitational waves with interferometric gravitational wave detectors is one of the most important research areas in today's experimental physics. After the first direct observation of gravitational waves in Fall of last year, the door to a new field of gravitational wave astronomy has been opened. However, an advanced next generation of gravitational wave detectors will be required in order to systematically probe the universe and to make the step from the detection of gravitational waves to routinely observing them. The next generation of gravitational wave detectors is envisioned to increase its sensitivity by going to cryogenic optics to reduce the thermal noise of the mirrors of the interferometer. Those mirrors, constituting the test masses that sense the gravitational waves passing by, will be made from silicon because of the superior noise properties of silicon at cryogenic temperatures. The change of material will lead to a change in the light wavelength that can be used with the next generation detectors. The wavelength needs to be increased to 1.5 μm or longer to avoid absorption in the silicon test masses. The talk will present the state of the art of 1.5 and 2 μm laser systems using fiber amplifier technology. Stabilization techniques and challenges, as well as the prospects for future power increases of the laser systems will also be addressed.

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