FUTURE IMPACTS OF QUANTUM CASCADE LASERS ON SPECTROSCOPY

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Quantum cascade lasers were invented[a] in 1994. In the intervening years through the diligent efforts of several groups, they have been developed to a high degree of sophistication and are now reaching the point where they are beginning to offer exciting prospects as light sources for far- to mid-infrared spectroscopy. These lasers have always been far more powerful than ternary lead salt diode lasers with the most powerful quantum cascade lasers providing powers of hundreds of mW CW. Sub-MHz linewidths can be achieved merely through the use of power supplies with excellent current regulation. The central development thrusts have been increasing the maximum operating temperature from liquid nitrogen temperature to room temperature and developing broad tunability. An important economic issue that is also being addressed is reduction in fabrication costs. Because until very recently each device had a maximum tuning range of 2-3 cm^{-1}, applications until now have been limited almost exclusively to trace gas monitoring. Intensive work is underway that offers the prospect of increasing the tuning range from 2-3 cm^{-1} to over 100 cm^{-1}. When these efforts are successful, quantum cascade lasers will become a very important new tool for the field of high resolution spectroscopy.

[a] J. Faist, F. Capasso, D. L. Sivco, C. Sirtori, A. L. Hutchinson, A. Y. Cho, Science 264, 553 (1994)