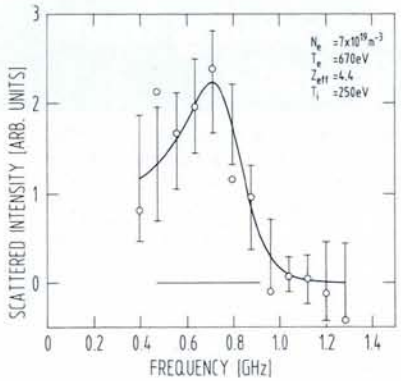

Fig. 9 — Measured scattering spectrum for a He plasma with an electron density N_e of 7×10^{19} m^{-3} recorded using a single laser pulse.

($<10^{-18}$ W/Hz). The heterodyne technique however, offers several unique opportunities:

— Sensitivity close to the quantum noise limit.

— Rapid detection for laser pulses lasting about 1 μs.

— Insensitivity to the noisy tokamak environment.

Successful experiments have recently been carried out by research groups at the Ecole Polytechnique Fédérale in Lausanne and at the University of Düsseldorf using a pulsed D_2O laser at 385 μm. A single laser shot was found to be sufficient to determine the ion temperature in H, D and He plasmas with electron densities N_e above 5×10^{19} m^{-3} (Fig. 9).

Conclusions

Since its introduction in astronomy, the sub-millimetre/far infrared heterodyne spectrometer has come to be widely used in other, very different, fields of research. A feature that allowed this extension was the demonstration of an airborne system that had proved itself in a hostile environment. Expected improvements in sensitivity, bandwidth and reliability combined with the capacity to operate at wavelengths smaller than 100 μm ensure an exciting future.

FURTHER READING

Astronomy:
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Atmospheric Physics:
Wattenbach R. *et al., J. Geophys. Res.* **89**, No. D5 (1984) 7285.
Plasma Physics:
Behn R. *et al., Phys. Rev. Lett.* **62** (1989) 2833.
Sub-mm/FIR techniques:
Chantry G.W., *Long-Wave Optics*, Vols 1 and 2 (Academic Press, London) 1984.

1990 Nobel Prize in Physics

The 1990 Nobel Prize in Physics has been awarded jointly to Professors Jerome Friedman and Henry Kendall, both of the Massachusetts Institute of Technology, Cambridge, MA, USA, and Richard Taylor of Stanford University, Stanford, CA, USA for their pioneering investigations of deep inelastic scattering of electrons on protons and bound neutrons which have been of essential importance for the development of the quark model in particle physics.

The three prizewinners were key members of the SLAC-MIT team which confirmed in 1968 clear signs that there exists an inner structure in the proton and neutron of the atomic nucleus. By 1972, interpretation of their results in terms of quarks was assured and work on neutrino scattering started to provide supporting evidence. Their findings therefore paved the way towards today's understanding of the constituents of matter.

An appreciation will be published next month.