

Diode Lasers for Quantitative Fluid Diagnostics

Sean O'Byrne

School of Engineering and IT, UNSW Canberra, A.C.T. 2600, AUSTRALIA
s.obyrne@adfa.edu.au

ABSTRACT

Lasers have been used for more than fifty years to investigate fluid behaviour, because of their many quantifiable characteristics, which makes them versatile enough to measure a number of state variables. In the author's research field of hypersonic flows, the ability to change the laser properties rapidly is of paramount importance, because the flow conditions change rapidly and the flows are of very limited duration. Diode lasers have very narrow linewidth combined with the ability to wavelength tune rapidly with few or no moving parts, making them both cost-effective for tunnel testing and effective in flight testing. Tuneable diode laser absorption spectroscopy is a well-proven measurement technique, and diode laser fluorescence provides very interesting opportunities in these flows. The talk will cover the use in our laboratory of these very flexible measurement systems in investigating high-speed flows, short-duration plasmas, electric discharge breakdown of fuels and determining viscosities of gases on a micro scale. Efforts to overcome the line-of-sight and wavelength limitations of these systems will also be discussed.