A Two-Optical-Path Laser Fluorescence
Signal Extraction Method

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ABSTRACT

Resonance Fluorescence of neutral hydrogen illuminated by $H_\alpha$ radiation has been used as a technique for spatially and temporally resolved density measurements of neutral hydrogen in high temperature plasmas. The fluorescence signal, very weak and buried in the background of stray laser light and $H_\alpha$ emission, is very difficult to extract and the measurement is inaccurate. This paper discusses a Two-Optical-Path signal extraction method. One optical path carries the fluorescence signal and the background (stray laser light and $H_\alpha$ emission), whereas the other path carries only the background signal. Combining these two signals a clean fluorescence signal can be isolated by subtracting out the background using a differential amplifier. The measurement is obtained instantaneously in one pulse rather than the double-pulse technique. This greatly improves the accuracy of the measurement as well as the time resolution.

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