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# GLOBAL RAINBOW THERMOMETRY FOR AVERAGE TEMPERATURE MEASUREMENT OF SPRAY DROPLETS

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**ABSTRACT**

Global Rainbow Thermometry is presented. It is a new technique for measuring average size and temperature of spray droplets. For data inversion, a global rainbow pattern is employed, which is formed by constructive interference of laser-light scattering spherical droplets. The non-spherical droplets and liquid ligaments provide a uniform background and thus do not influence the interference pattern from which average size and temperature is derived. This is a large improvement with respect to standard rainbow thermometry, investigated since 1988, which is strongly influenced by particle shape. Moreover, the technique is applicable for smaller droplets than the standard technique because the global pattern is not spoiled by a ripple structure. Data inversion schemes based on inflection points, minima and maxima are discussed with respect to spray dispersion and droplet flux. The temperature derivation from inflection points appears to be independent of spray dispersion. Preliminary measurements in a water spray are reported. The mean diameter obtained from the rainbow pattern is smaller than the arithmetic mean diameter measured by phase-Doppler Anemometry. The accuracy of the temperature measurement by global rainbow thermometry is shown to be a few degrees Celsius.

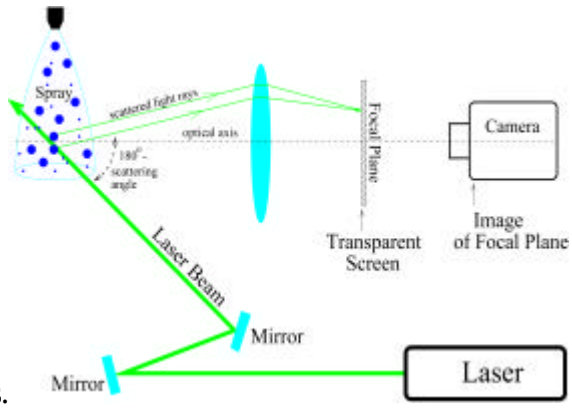


*Fig. 1 Outline of the optical configuration for global rainbow thermometry. The global rainbow pattern is projected on the transparent screen that is filmed from the other side.*

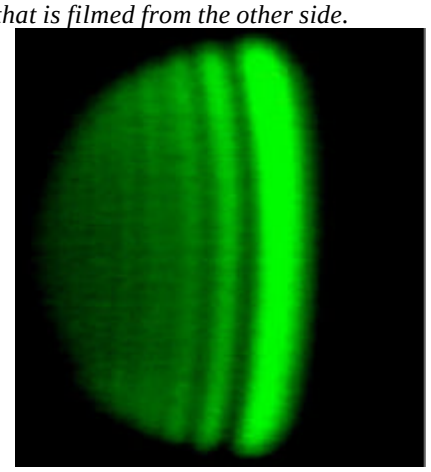

*Fig. 2 A typical global rainbow pattern in a water spray recorded by a video camera.*