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Imaging flow structure and species with atomic and molecular filters

Richard B. Miles, Lipeng Qian and Sohail H. Zaidi

Department of Mechanical & Aerospace Engineering, Princeton University, Princeton, NJ 08544, USA

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Abstract

Rayleigh and Raman scattering have not been widely used for flow field and combustion imaging because of their very low scattering cross-sections and because of interference from strong background light. With the use of sharp cut-off, atomic and molecular filters this background can be rejected while high throughput is maintained. The sharp cut-off edge of the filters provides for the possibility of using them for high-resolution spectral discrimination. Consequently, Rayleigh and Raman imaging are now becoming feasible and have the promise of providing quantitative images of temperature, velocity, pressure, density, species, and nonequilibrium phenomena. Because Rayleigh and Raman scattering arise from all molecules and are not affected by quenching, quantitative images can be taken of all dominant molecular species as well as thermodynamic and transport properties of complex flows, weakly ionized plasmas, and combusting fields.

Keywords: Filtered rayleigh scattering; Raman scattering; Atomic filters; Molecular filters; High-resolution spectroscopy