A Laser Spot as a Line Thermal Gradient Sensor for Non-Equilibrium Complexes

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Refractive index of a liquid specifies its temperature. Here, I turn a real laser spot into a line light-source to probe the temperature variations along the incident line in a liquid complex. The line light is generated by shining a red laser spot onto a glass rod. The refractive index, hence the temperature, at a specific location in the liquid can be obtained. The temperature distribution of a liquid complex can be mapped by utilizing the amount of bending of the straight line light into a curved one, after passing through a thermally non-equilibrium liquid. Thermal conductivities of a NaCl (aq) at various temperatures were also measured by creating a temperature difference at the two ends of the solution, and map the time evolution of the curved line light upon exits the liquid. Surprisingly, the thermal conductivity of olive oil changes non-linearly with temperature. Temperature gradient within the liquid can act as a grating for separating light of different wavelengths, and the degree of temperature gradient can be used to adjust the grating efficiency. The present method can serve as a spectrometer to be potentially used for measuring the temperature of transparent materials in remote and to reveal its real time dynamics.