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Electric field measurements in high-pressure environments via electric-field-induced coherent anti-Stokes Raman scattering in visible region

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Electric field measurements in high-pressure environments via electric-field-induced coherent anti-Stokes Raman scattering (E-CARS) in visible region will be presented. Although electric field is one of the most important parameters for understanding/controlling discharge plasma, the measurement in high-pressure environments are not simple. The reported ways by laser spectroscopy are mostly by electric-field-induced second harmonic generation (E-FISH), E-CARS in infrared region (E-CARSi), and E-CARS in visible region (E-CARSv). While E-FISH has various advantages, e.g. only single laser is needed, E-CARS has advantages by using resonant transitions. With E-CARSi, electric field measurements without knowing gaseous temperature can be achieved [1].

With E-CARSv (Figs. 1 and 2), more sensitive measurements can be designed and the demonstrations of E-CARSv will be presented with hydrogen and nitrogen environments [2,3]. In an atmospheric-pressure hydrogen, 0.5 V/mm could be detected, as shown in Fig. 3. Demonstration of E-CARSv for electric field measurements in discharge environments and for rotational temperature measurements will be also presented with near-atmospheric-pressure hydrogen discharge [4].

Further details will be presented in the conference.

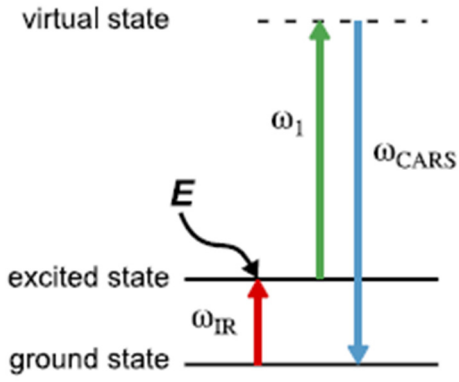

Figure 1. Schematic of the optical energy transition for E-CARSv [2].

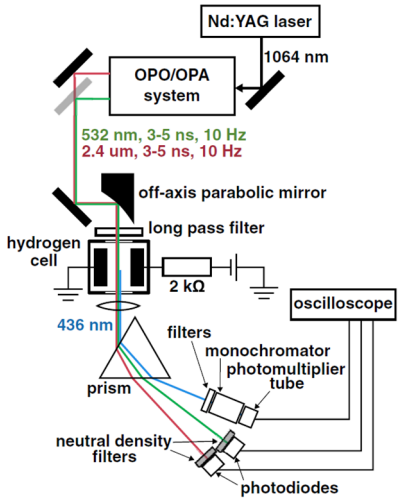

Figure 2. Schematic of the experimental setup for E-CARSv in a hydrogen environment without discharge generation [2].

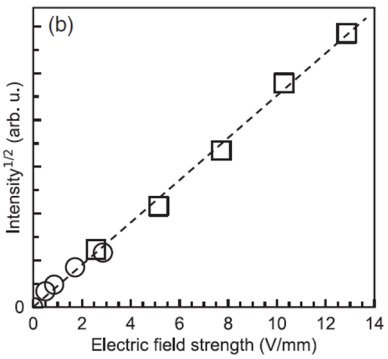

Figure 3. Square roots of the measured signals as functions of the externally applied electric field strength in hydrogen at 1 atm [2].

References

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[3] T. Koike, H. Muneoka, K. Terashima, and T. Ito, Jpn. J. Appl. Phys. **62**, SA1015 (2023).
[4] T. Koike, H. Muneoka, K. Terashima, and T. Ito, to be submitted.