

Example of an outstanding review

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A new technique (PF-LIF) for the detection of the methyl radical in different plasma environments is introduced in this paper. PF-LIF is a recent variation of fluorescence techniques based on the photofragmentation of methyl, which is itself subject to predissociation, thus precluding conventional LIF techniques. The high spatial and temporal resolution of the current implementation of PF-LIF is highly relevant to a number of application areas in plasma applications in combustion, CO₂ conversion, and materials science, among other areas. The non-resonant nature of the PF-LIF scheme is also appropriate for measurements near surfaces, which is another advantage over conventional LIF of methyl. Moreover, the PF-LIF bench may be complex, but it lends itself to additional measurements such as LPIF and LIF. The plasmas investigated in this paper are all commonly used; the authors chose their case studies well.

My main question concerns the difference between LPIF and PF-LIF. On page 2, it is stated that LPIF of methyl at 212.8 nm was developed to take advantage of the high laser energies of Nd:YAG lasers. Subsequently, PF-LIF was developed to further improve the sensitivity of the measurement. It would be helpful to discuss the degree of improvement, particularly for the current plasma experiments. This seems important for a cost-benefit analysis of performing LPIF versus PF-LIF, given the additional cost and complexity of the latter.

Furthermore, on page 11 the authors introduce the measurement of A-X fluorescence by both LPIF at 212.8 nm and PF-LIF at 212.8 nm and 390 nm, the former process creating CH(A) via the photodissociation of CH₂ and the latter by EET from CH(B). Both apparently can occur simultaneously, and in this case what is the contribution of each process to CH(A) emission at 430 nm? What is the justification for assuming that all of the emission results from PF-LIF?

Specific remarks:

Page 3, last sentence: "...these resonant schemes result in lower LIF signals", this should read "non-resonant"?

Page 11, lines 20-22: "...the presence of 390 nm scattering in the PF-LIF scheme interferes with the A-X decay traces..." But if A-X is a non-resonant transition emitting at 430 nm, doesn't the 430 nm bandpass filter (page 11, lines 5-6) remove the 390 nm scattering?

Page 11, lines 27-28: "...scattering from the 390 nm laser is spatially separated from the PF-LIF signals in the discharge gap." Why is this the case if both the 212.8 nm and 390 nm beams overlap well, as described in section 3.1?

Figure 6(left): What is the origin of the oscillations in the PMT response after 50 ns?

Figure 8: Unlike for Figure 14, it isn't specified here whether the images are single-shot or averaged over several frames for a given pulse in the burst sequence.

Page 13, lines 51-52: "...the discharge itself is highly uniform..." Following up on the preceding remark, it is unclear whether the discharge is uniform in a single-shot or average sense.

Figures 9 and 10: Is it really necessary to have separate figures showing essentially the same information? Could there just be one figure, with the mole fraction scale/color bar simply be placed underneath that for density?

Page 15, lines 9-11: "...Horizontal stripes...are residual inhomogeneities in the laser beam profiles..." The stripes are very straight and very sharply defined. If these features were physical in nature, I would expect a bit more irregularity and less abruptness. Could this not be due to a technical issue with the detector array?

Figure 13: Why is the methyl and formaldehyde spatial distribution less uniform here than in Figure 10?