# Investigating the Potential of UV-excited Photoluminescence Spectroscopy for the Identification of Plastics

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## 1. Introduction

### Background of this work

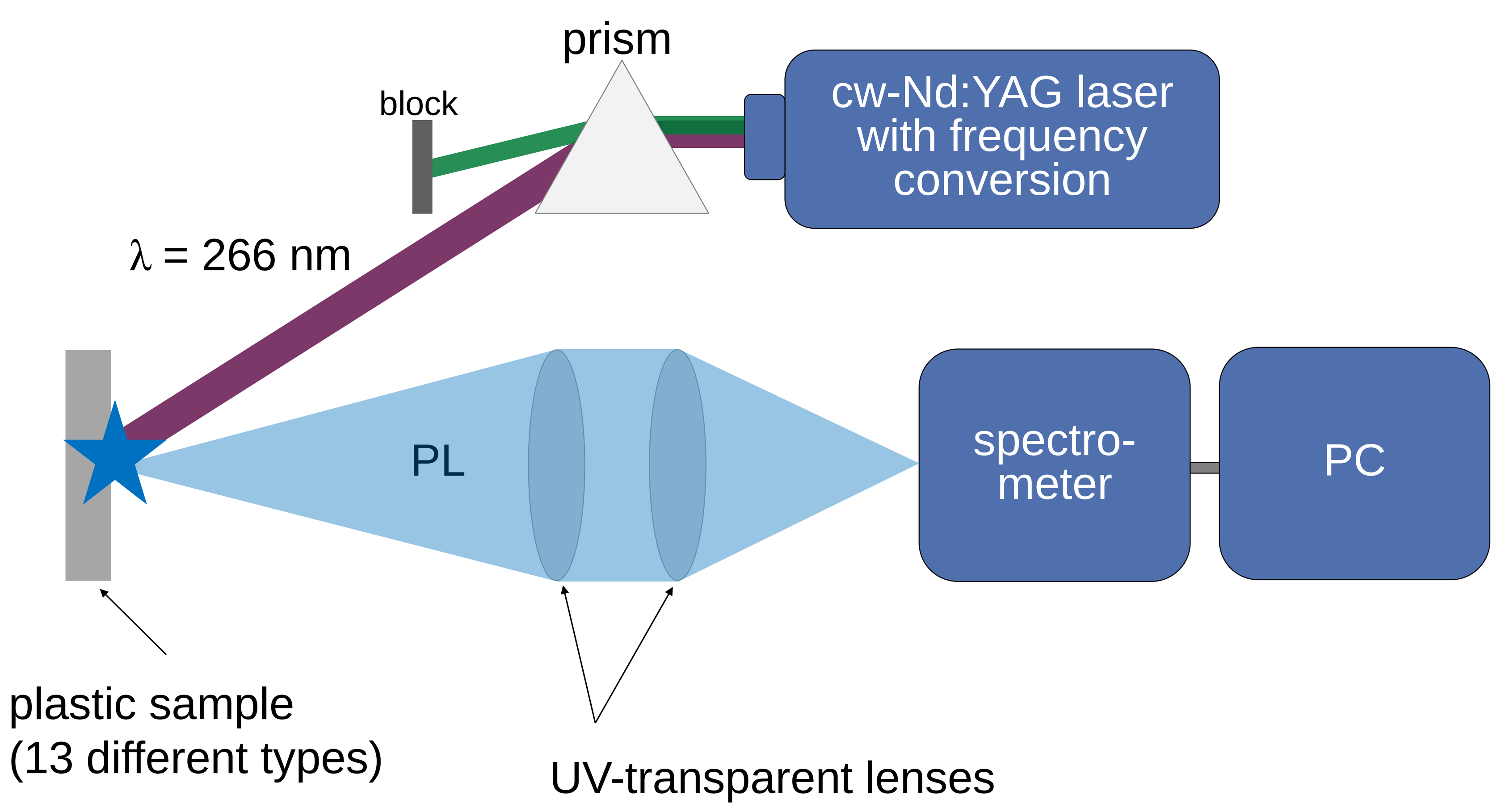
- A comprehensive microplastic risk assessment requires reliable and efficient techniques to identify and characterize plastic materials.
- Established methods like FTIR and Raman spectroscopy suffer from drawbacks like long integration times (Raman) or reduced efficiency when particles are irregular and scatter the light (FTIR)[1] which motivates us to explore alternative spectroscopic techniques.
- In photoluminescence spectroscopy, a sample is excited using a laser. The sample subsequently emits light with wavelengths longer than the excitation wavelength. The resulting spectrum contains material-specific information.

### Aim of this work

- To explore the potential of UV-excited photoluminescence to identify and characterize plastic materials for an application in microplastic analysis

## 2. Methods

### Photoluminescence (PL) set-up




### Excitation

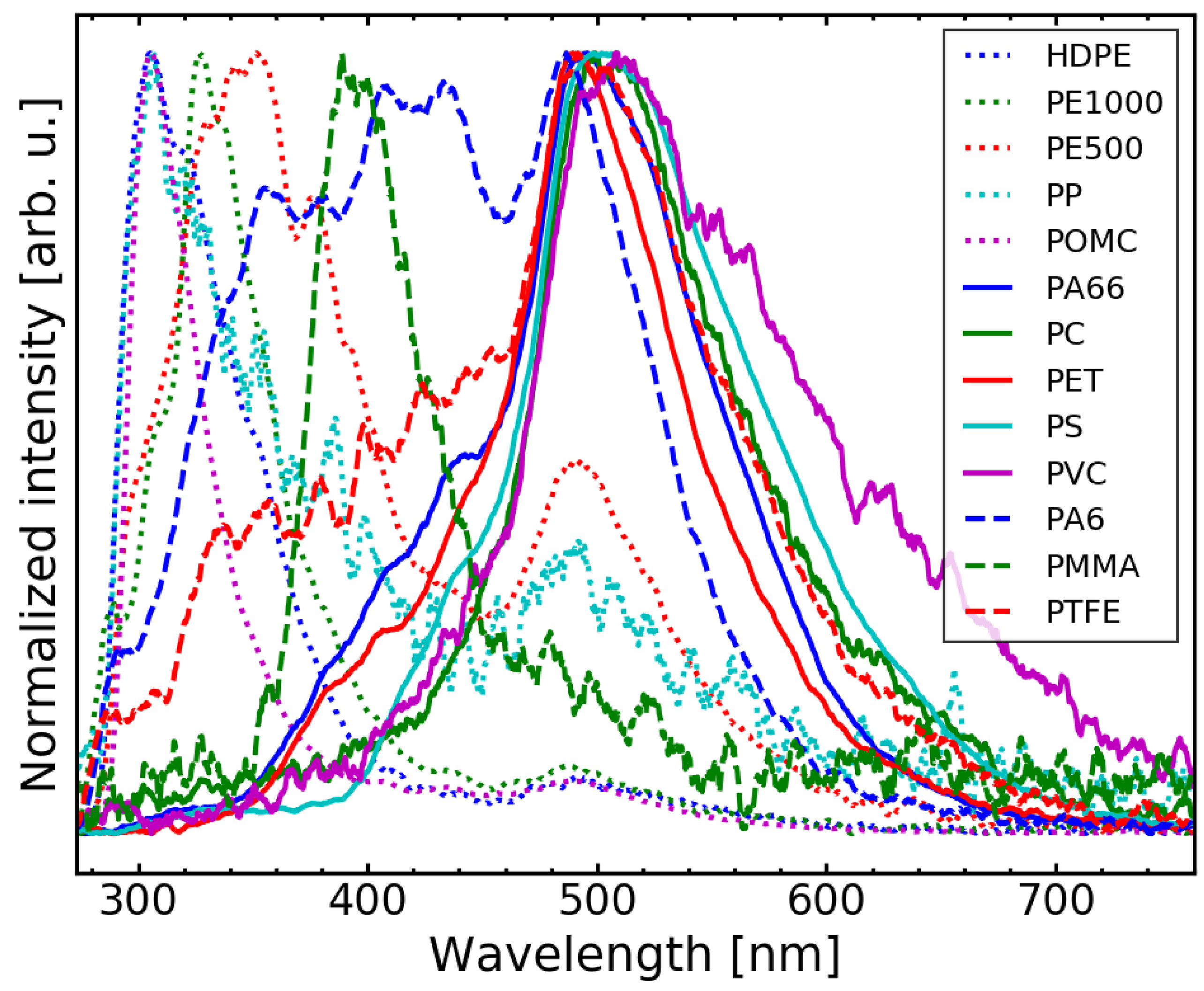
- A TOPTICA TopWave266 frequency-quadrupled cw-Nd:YAG laser was operated at 266 nm.
- To this end, the second harmonic at 532 nm was removed using a prism.

### Detection

- OceanOptics HR4000 spectrometer (range: 196–1102 nm)
- Room temperature
- Acquisition time: 1 s

## 3. Results

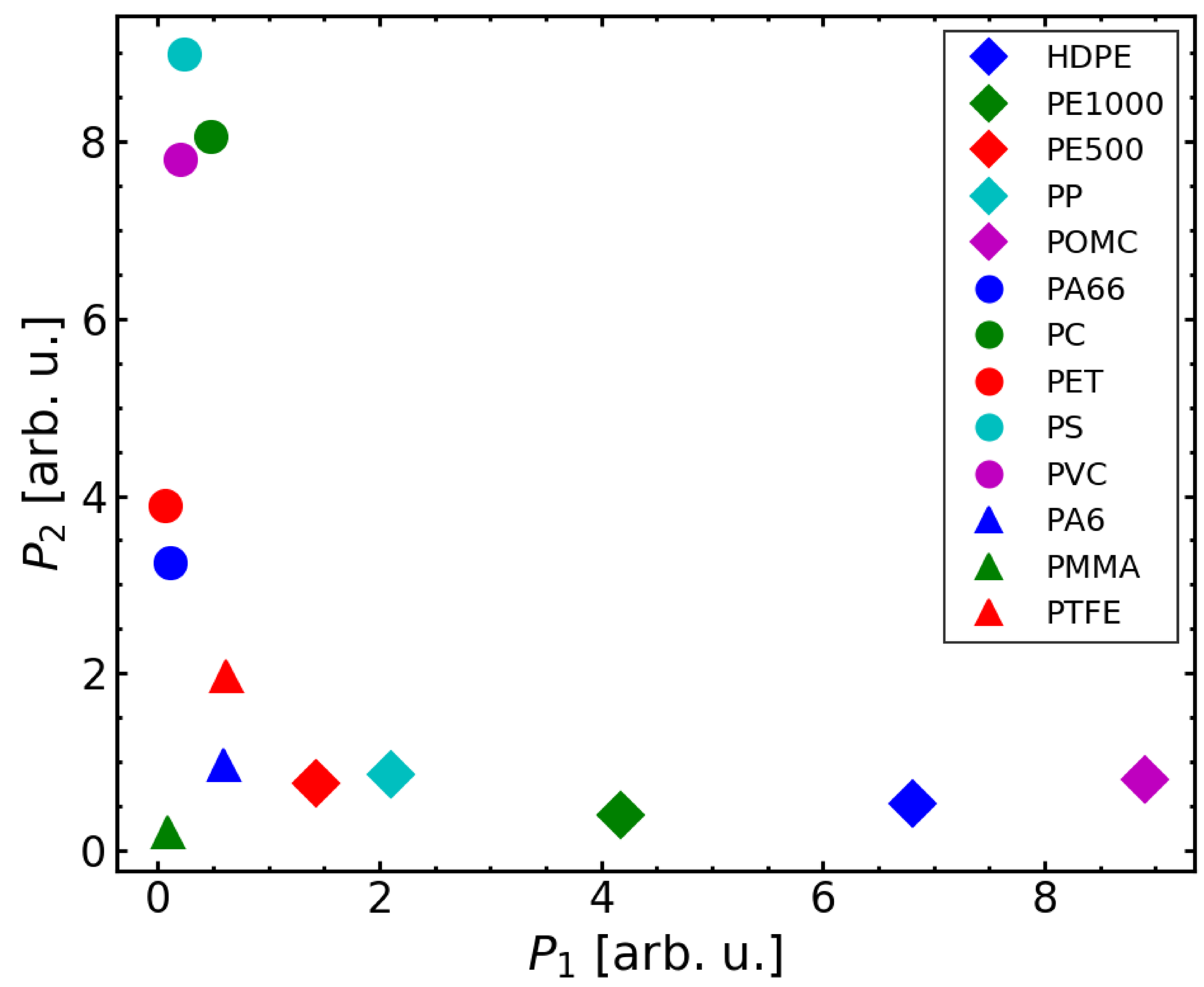
### Photoluminescence spectra of investigated plastics




Almost all spectra have a dominant peak at about

- **325 nm** (HDPE, PE-1000, PE-500, PP and POM-C) **or**
- **500 nm** (PA-66, PA-6, PC, PET, PS, PVC and PTFE)

### Differentiation of spectra by means of their intensity ratios




$$P_1 = \frac{I_{325}}{I_{400}} \text{ and } P_2 = \frac{I_{500}}{I_{400}}$$

- High $P_1$ → emission in the short-wavelength region
- High $P_2$ → emission in the long-wavelength region

## References

[1] Harrison J. P., Ojeda J. J., Romero-González M. E. (2012), The applicability of reflectance micro-Fourier-transform infrared spectroscopy for the detection of synthetic microplastics in marine sediments, *The Science of the Total Environment*, 416, 455–463.

## 4. Conclusions

- First data on UV-excited photoluminescence of plastic materials are shown. Investigated plastic materials seem to be distinguishable by means of their intensity ratios.
- In the future, we will test a higher number of samples to perform statistical analysis and study the influence of color, salt water and biofilms on the photoluminescence spectra.

## Acknowledgments

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