

# Measurement of localized CH<sub>4</sub> emissions using spectroscopic remote sensing

## MSc Thesis

### Contacts:

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### Project Overview:

Localized emissions of CH<sub>4</sub> from sources such as oil, gas, coal production, landfills and waste water treatment make up for a considerable fraction of the anthropogenic emission total. Some of these emissions occur intermittently and are a priori unknown since they originate from malfunctioning equipment or unknown processes. We have developed ground-based spectroscopic remote sensing techniques that can detect and quantify such emissions based on the molecular CH<sub>4</sub> absorption of sunlight in the shortwave infrared spectral range.

This MSc project will deploy our spectroscopic instruments (Löw et al., 2023; Knapp et al., 2023) at localized CH<sub>4</sub> sources and aim at identifying emission rates or determining upper limits based on the detection limits. A particular focus will be put on CH<sub>4</sub> emissions from lignite open pit mines in Western Germany. Recently, satellite images have been claimed to show unexpectedly high CH<sub>4</sub> enhancements which, however, needs to be verified.

### Skills and Requirements:

- Background in absorption spectroscopic measurements
- Experience with optical and electronic setups in the laboratory, ideally in the field
- Interest in atmospheric measurement techniques and climate change mitigation

### References:

Löw, B. A., Kleinschek, R., Enders, V., Sander, S. P., Pongetti, T. J., Schmitt, T. D., Hase, F., Kostinek, J. and Butz, A.: A portable reflected-sunlight spectrometer for CO<sub>2</sub> and CH<sub>4</sub>, *Atmos. Meas. Tech.*, 16(21), 5125–5144, doi:10.5194/amt-16-5125-2023, 2023

Knapp, M., Scheidweiler, L., Külheim, F., Kleinschek, R., Necki, J., Jagoda, P. and Butz, A.: Spectrometric imaging of sub-hourly methane emission dynamics from coal mine ventilation, *Environ. Res. Lett.*, 18(4), 044030, *Environ. Res. Lett.*, doi:10.1088/1748-9326/acc346, 2023