

Funded by the European Union

### UNIVERSAL SENSOR BASED ON ELECTRICALLY-PUMPED MID-INFRARED SPECTROMETER ON SILICON CHIPS (UNISON)

HORIZON-EIC-2023-PATHFINDEROPEN-01-01

**SISTER PROJECTS PROGRAM** 

**Overview of UNISON project** 



Sisters Projects Meeting - 28 May 2025 - online

# UNISON overview

- EIC Pathfinder open project
- Grant agreement : 101128598
- Start : 1st March 2024
- End : 29 February 2028
- 7 partners (2 associated)

- Coordinator CNRS
- EU Budget : 2 998 k€



## Context

#### Mid-Infrared (mid-IR) spectroscopy

To quantify chemical and biological substances





#### Benchtop devices versus integrated photonics





FTIR : Fourier transform Infrared Spectrometer Photonic integrated circuit (PIC)

#### Mid-infrared photonic circuits for :

- Low-cost, high performance
- Reduction of size, weight, power, robustness
- Accessibility to remote areas

#### **Impact : portable and low cost sensing systems**

Pollution monitoring : CO<sub>2</sub> ( $\lambda$ =4.25µm) , alcanes ( $\lambda$ =7-8µm)



Impact : mid-IR integrated absorption spectrometer for large scale utilization



Example of application : large-scale access to greenhouse gas detection : simultaneous detection of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and O<sub>3</sub>



Game changer technology with broad impact for sustainable development, healthcare, security, defense or science.

# Consortium contributions at a glance



SiGe PIC design, fabrication, characterization



Monolithic integration of QCL on SiGe PIC



ICL frequency comb developement Flip chip bonding of cascade sources on SiGe PIC





SiGe epi growths and material characterization



**UIT** The Arctic University of Norway

#### Integrated mid-IR sensor and gas sensing experiment

QCL frequency comb development

Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

#### SENSIRION

Dual comb experiment and proof of concept demonstration

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