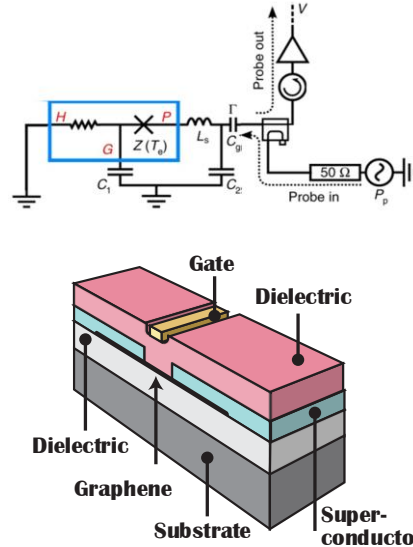
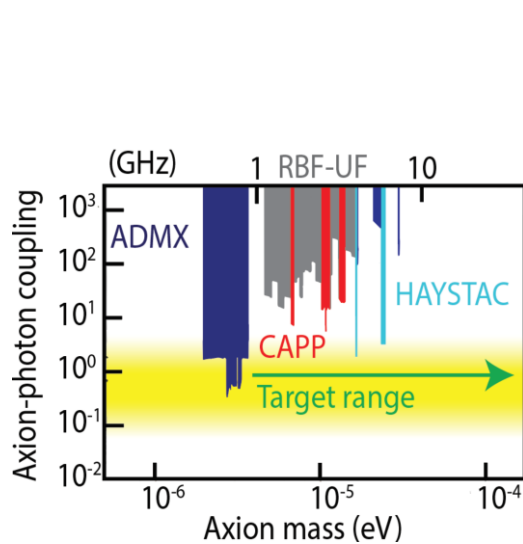


# **CVD graphene based superconducting transistor technology: toward ultrasensitive thermal detectors for axion research**

**Klaara Viisanen, Andrey Generalov, Heorhii Bohuslavskyi,  
Lehtisalo Markus, Mika Prunnila, Jian Ma, and Mikko Möttönen**

**29/06/2025    VTT – beyond the obvious**

# Graphene bolometers for dark matter detection



- Axion mass could be in the GHz range!
- Graphene bolometers based on JoFETs

[Semertzidis and Youn, Sci. Adv. 8, eabm9928 (2022)]

[Kokkonen et al., Nature 586, 47–51(2020)]

- Wafer-scale fabrication platform for superconducting graphene electronics

[A. Generalov et al., Appl. Phys. Lett. 125, 012602 (2024)]

# VTT and Quantum sensors-team

## VTT Technical Research Centre of Finland Micronova Research Infrastructure

**2,600 m<sup>2</sup> cleanroom area**

Joint facility operated by VTT & Aalto University

Research and Pilot scale production

**Quantum and cryogenic characterisation laboratory**

RF and DC measurements down to 10 mK temperatures



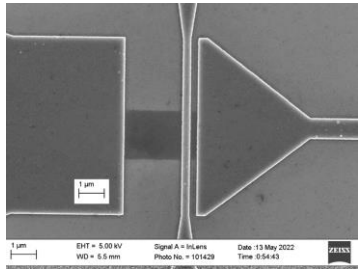
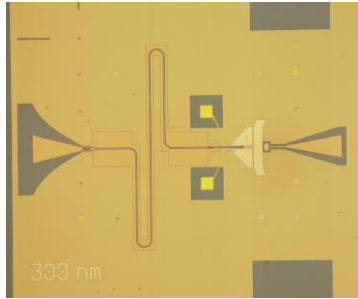
## Quantum sensors -team

Team leader: Eija Tuominen

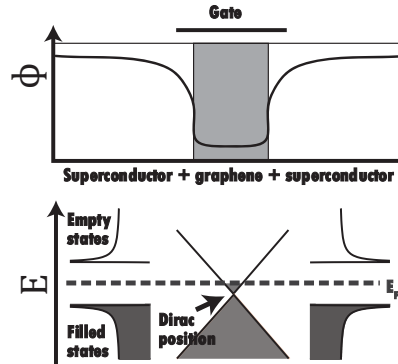
Topics: JoFETs (graphene and other materials),  
Solid state coolers, quantum devices



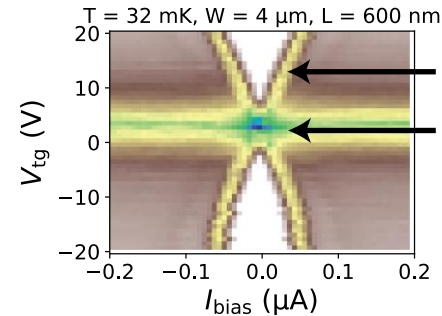
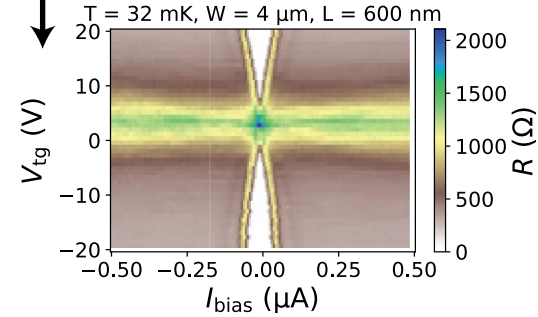
# Graphene bolometer



- Graphene absorber
- SGS-Josephson junction thermometer, embedded in an LC oscillator



## Cryogenic voltage-current characteristics of a JoFET



**The superconducting gap can be closed completely by tuning the gate volt-**

# Wafer scale JoFET fabrication

- First platform for scalable graphene based JoFETs with local electrostatic gate tunability
- 98 % yield of devices

