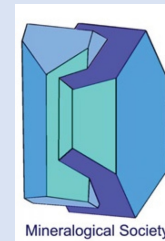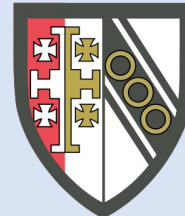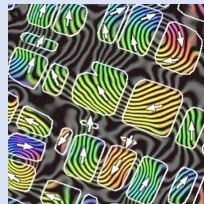# FORCs as indicator of Particulate Matter (PM)

Hassan A Sheikh[1], Po-yen Tung[1], Richard J Harrison[1]

[1]Department of Earth Sciences, University of Cambridge
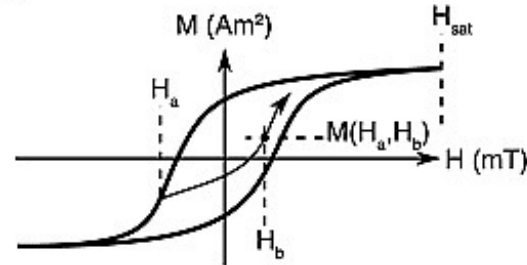
What are FORCs?

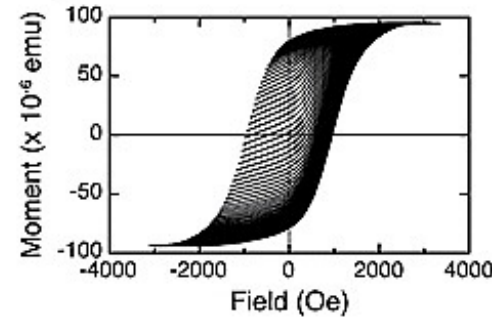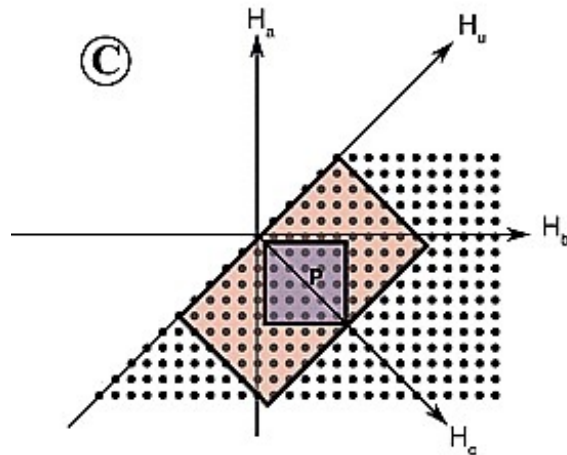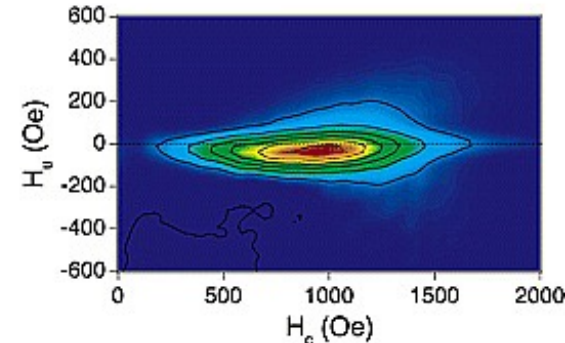
Harrison and Feinberg (2008)
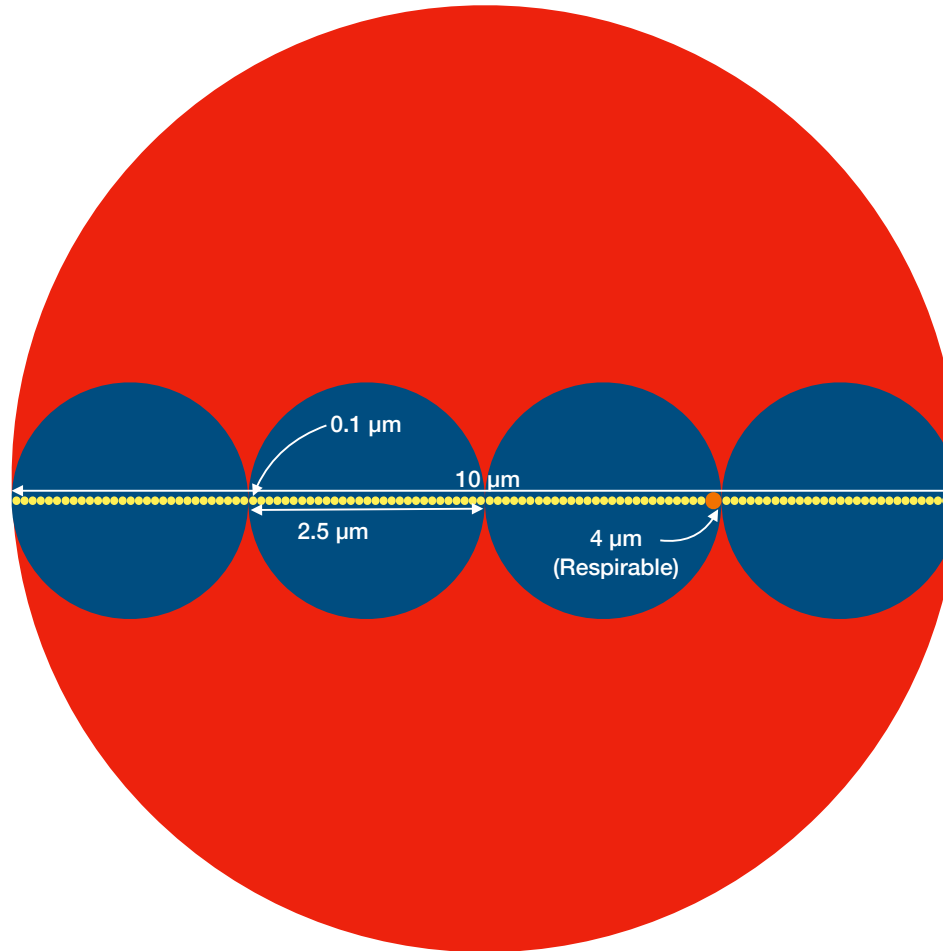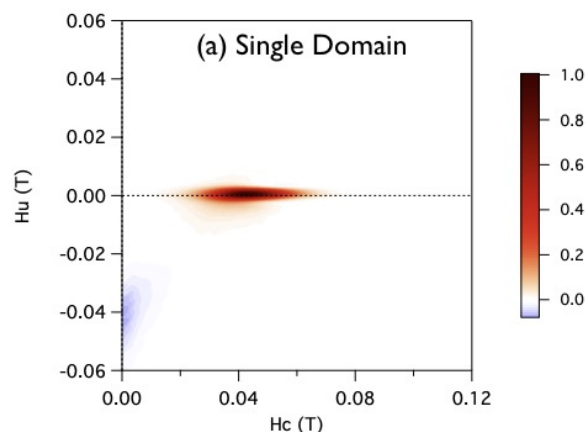
What is PM?

Hint: It's not Japanese flag

What is PM?

(a) Single Domain

<PM$_{0.1}$

(c) Multi Domain

PM$_{10}$, PM$_{2.5}$, PM$_1$

(b) Pseudo Single Domain

PM$_{0.07}$ to PM$_{0.7}$

(d) Strong Interactions
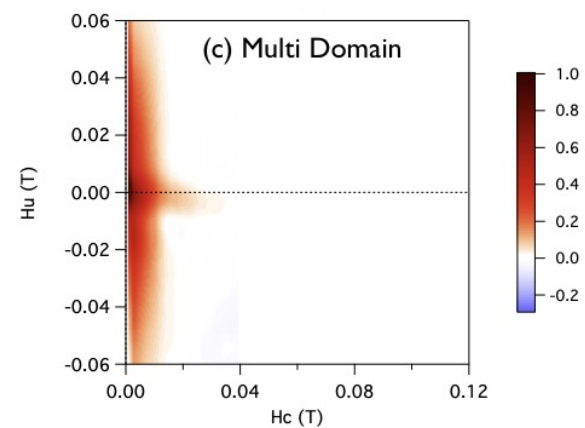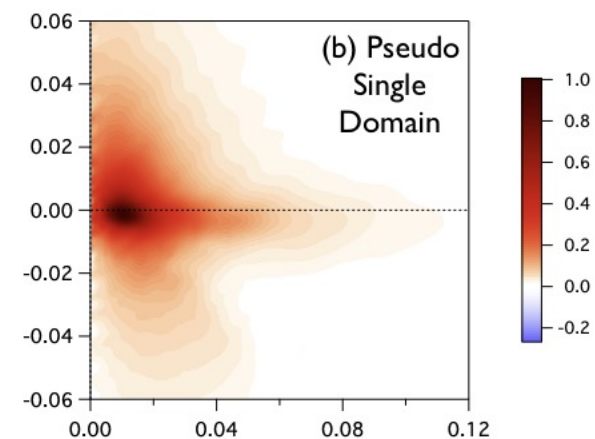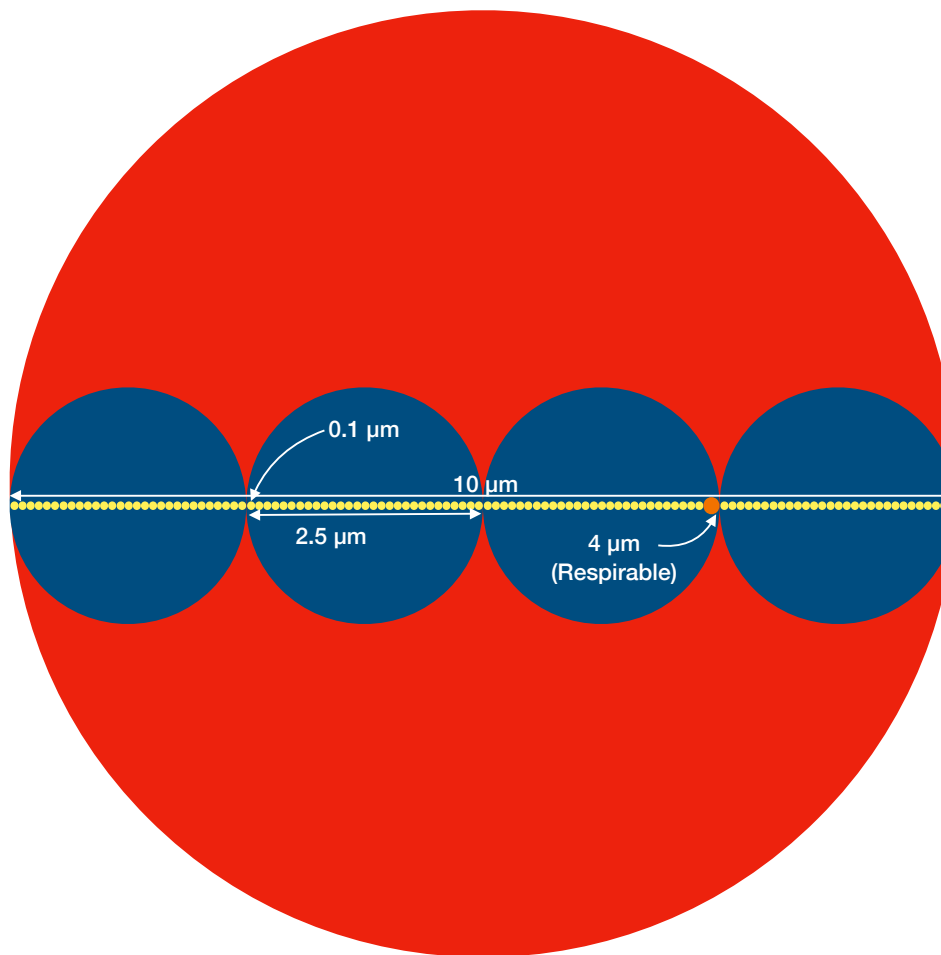
What are we trying to do?

Key Motivation: describe and distinguish magnetic air pollution particulate sources using first order reversal curves (FORCs)
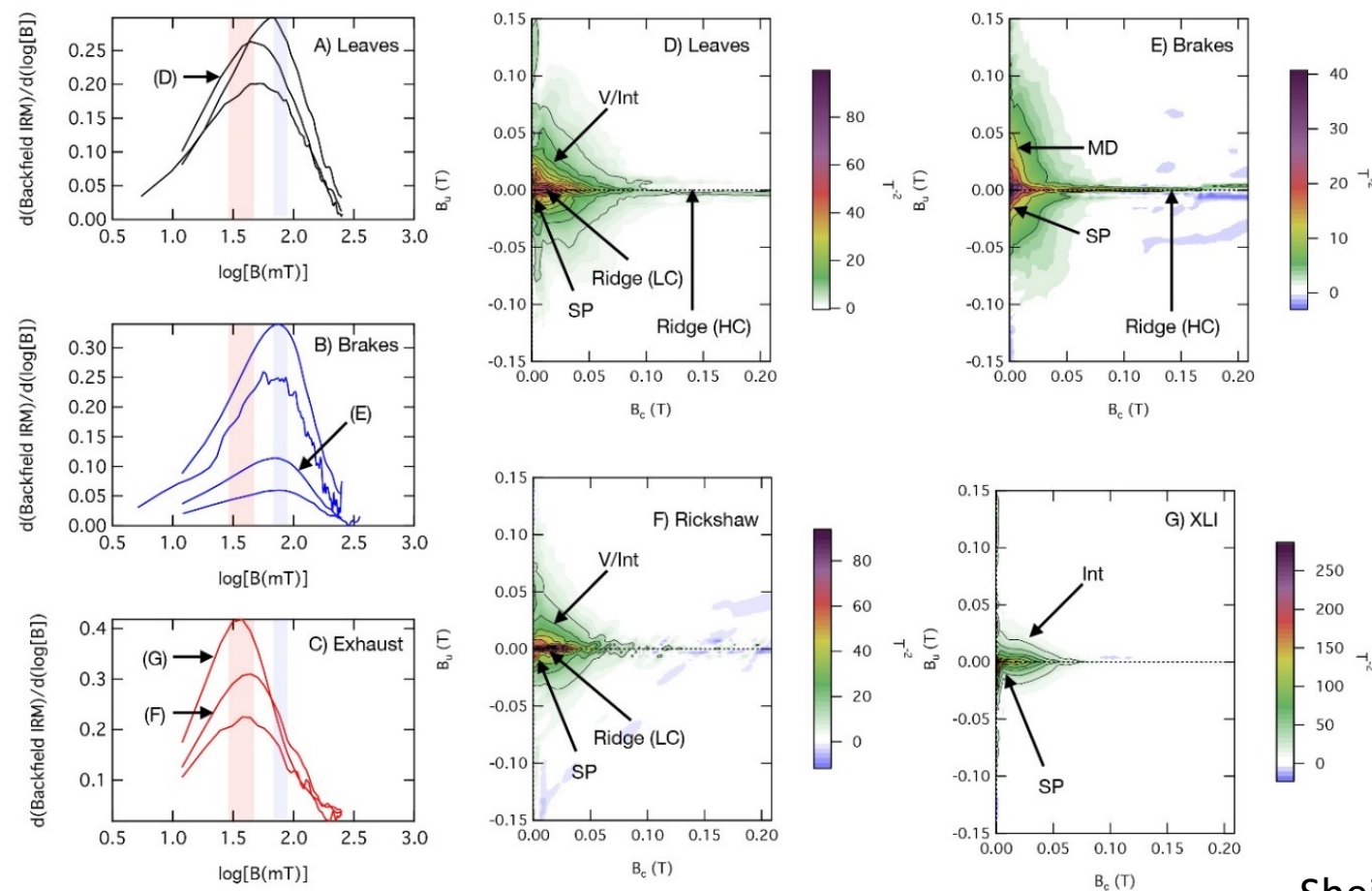
Sheikh et al., 2022

FORC signatures of vehicular sources

Motivation: Determine fingerprints of traffic-related sources

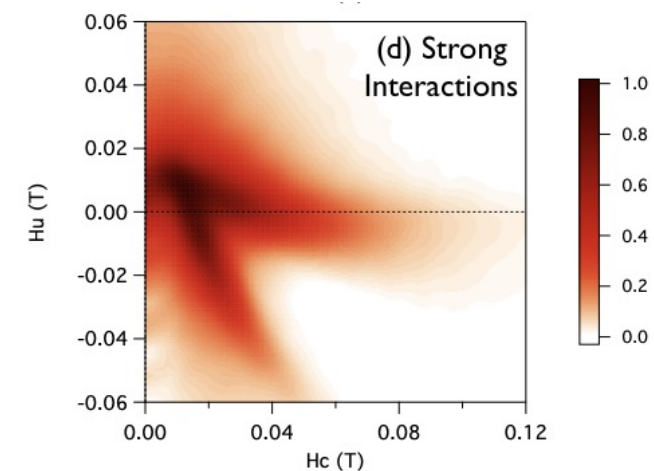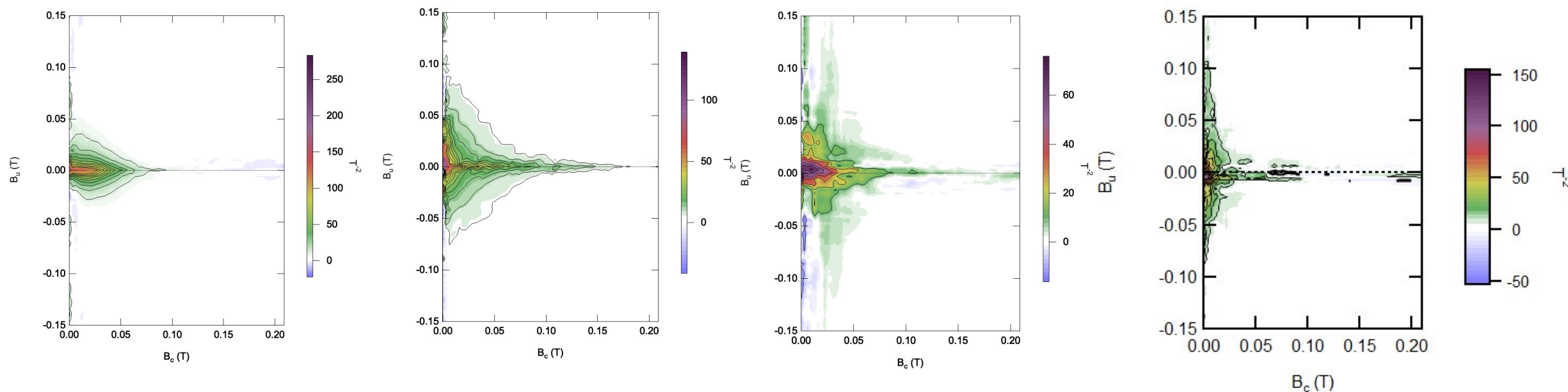| Petrol exhaust	Brake abrasion dust	Diesel exhaust	9.5T lorry (Road and tyre wear)
V/Int grains and an SP ridge	SP signal, MD+ HC SD ridge	SP+ LC ridge	MD

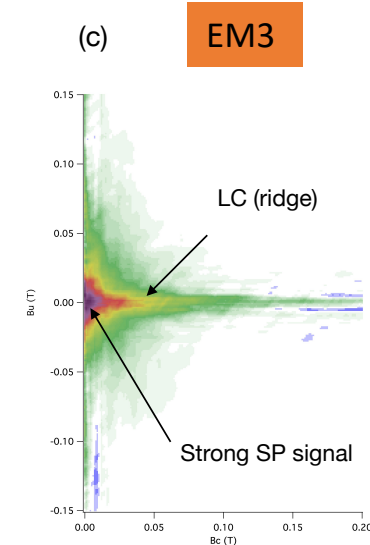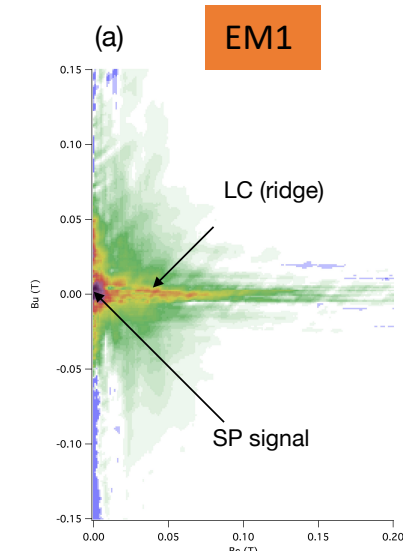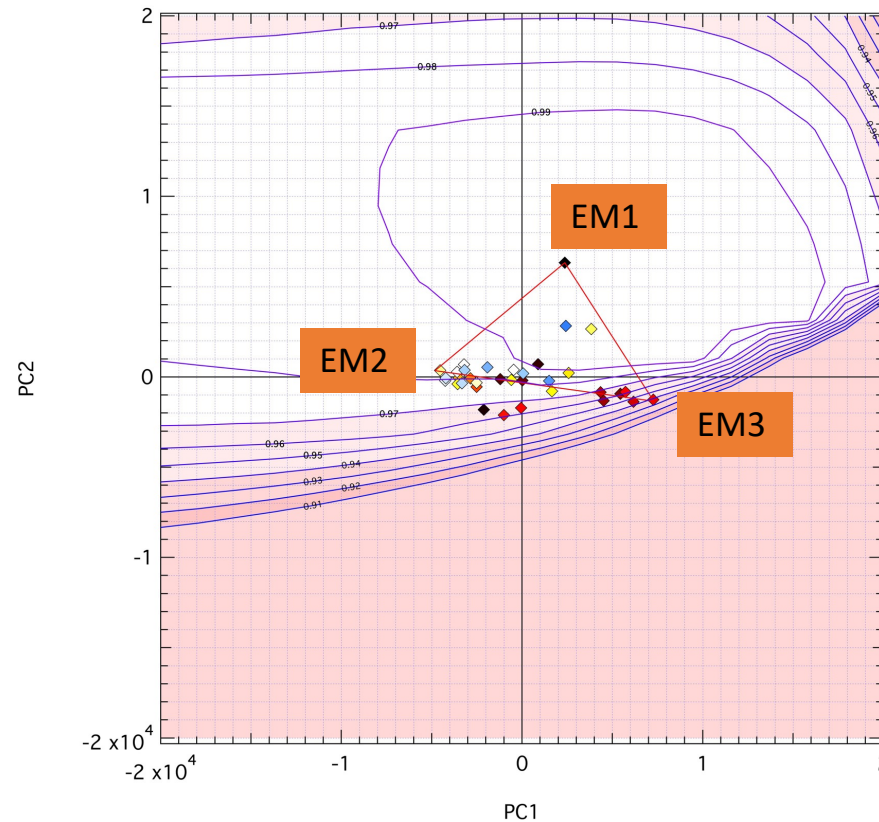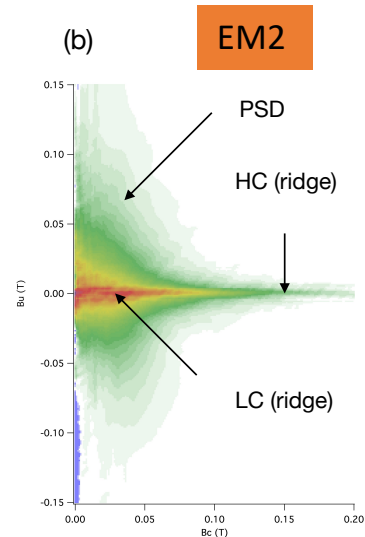# Case study: London Underground

A unique microenvironment: abundant source of Fe-bearing nanoparticles from tracks, brake block abrasion; resuspended dust and poor ventilation

Motivation: Understand the nature of the particulates and its health implications on commuters

Oxford circus station
Main ticket hall
0.59 mg/m3
Mrs/mass ratio: 0.0386

Oxford circus station
Ticket hall
0.78 mg/m3
Mrs/mass ratio: 0.0436

Oxford circus station
Central line W/B platform
1.07 mg/m3
Mrs/mass ratio: 0.0576

Oxford circus station
Central line E/B 1.27 mg/m3
Mrs/mass ratio: 0.0804

Increasing dust conc and stronger magnetic signal
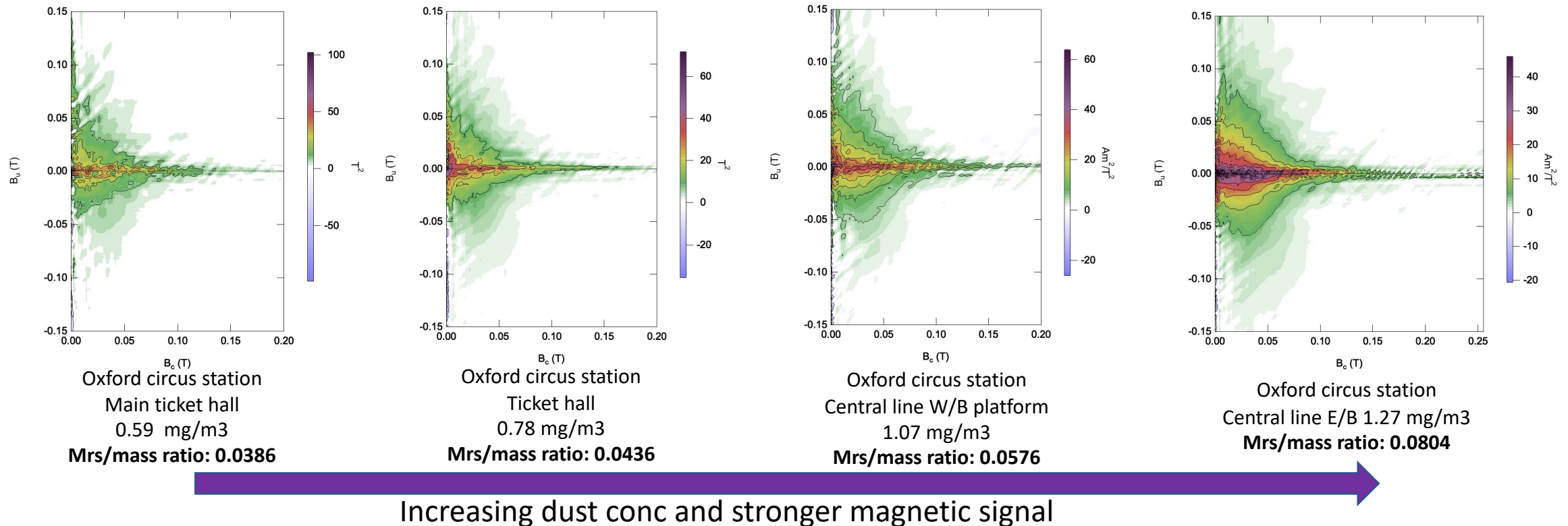
London Underground- PCA

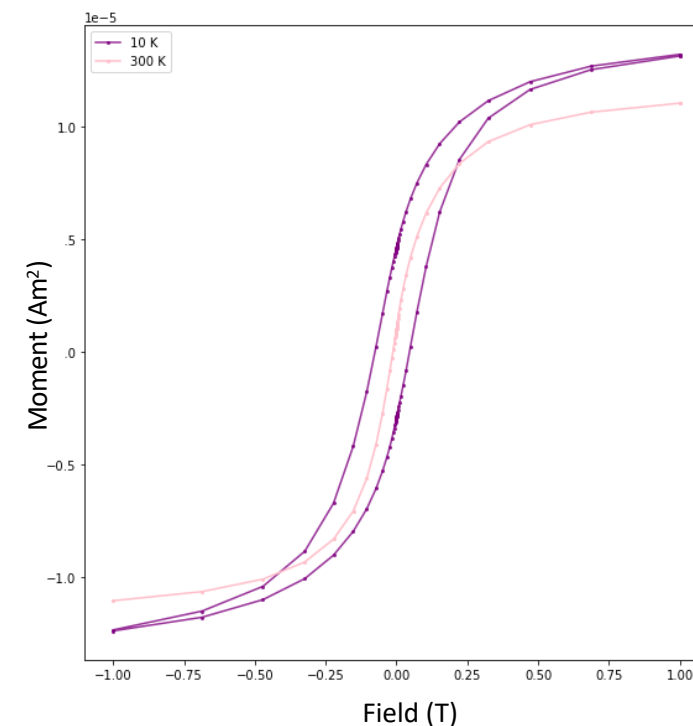# What's the future?

Individual particles (about <5 nm) form bigger clusters of particles sometimes with aerodynamic diameter > 500 nm

Significant **SP contribution (60-80 %)** observed at low temperature hysteresis and ZFC-FC experiments
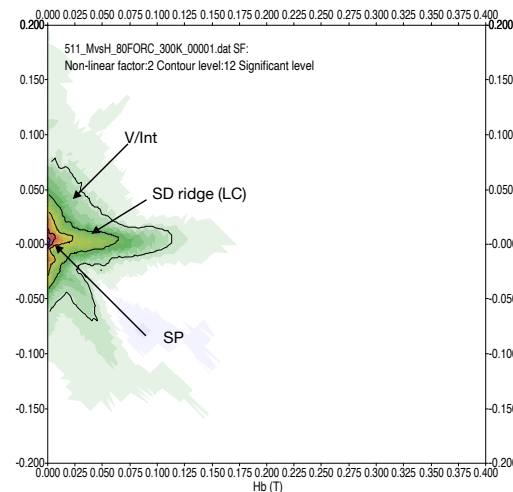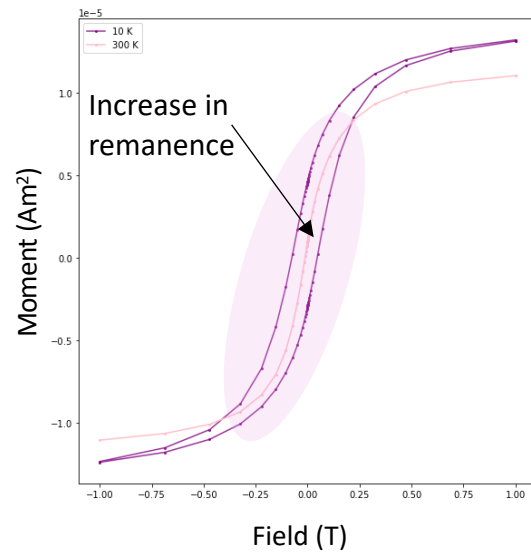
High resolution microscopy coupled with magnetic measurements to characterise the more **dangerous** particles
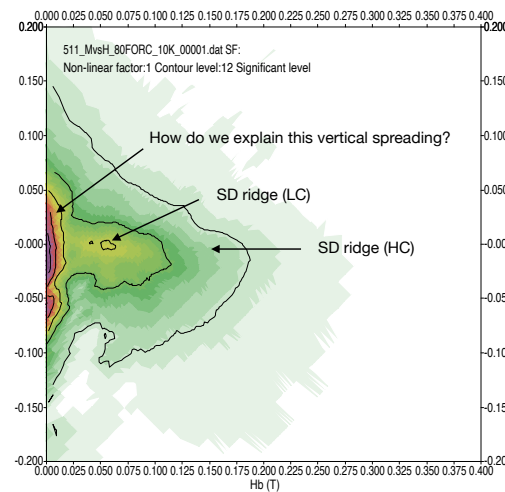
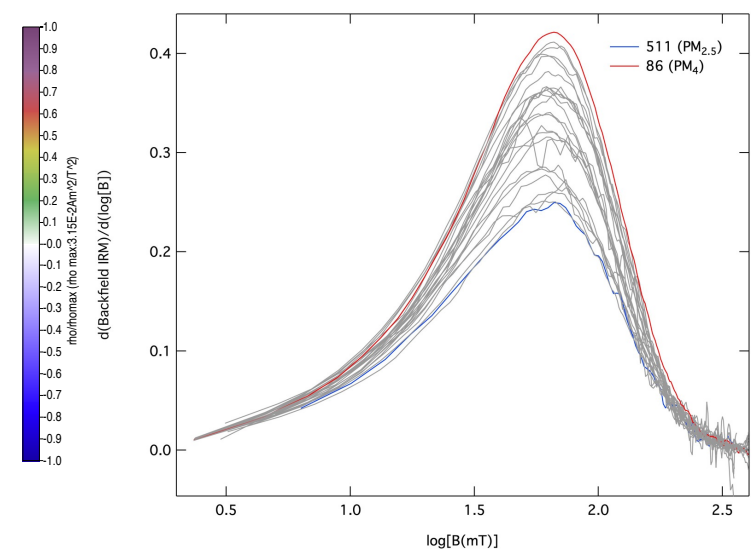Aggregates of **5-10 nm** particles forming larger clusters
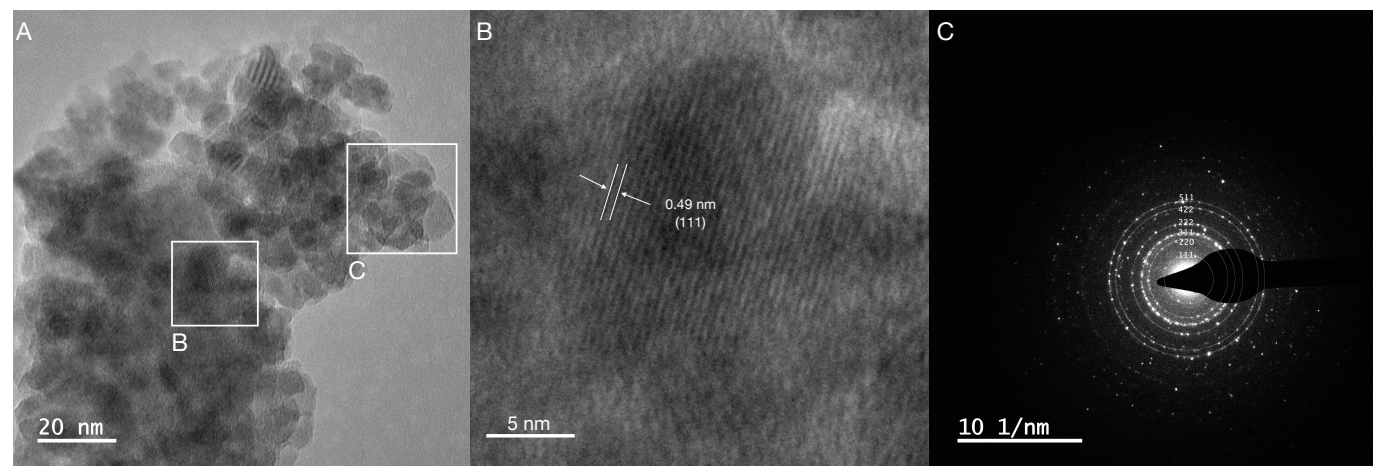
What's the future?

300 K

10 K

Thank You for listening!

If you're interested in reading my first paper from earlier this year on air pollution particulate characterisation!