

**University of Maryland Baltimore County - UMBC
Phys650 - Special Topics in Experimental Atmospheric Physics
(Spring 2009)**

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CLASS6 – 3/4/2009

Scanning Electron Microscopy

10:00-10:30 - Discussion of short reports and weekly activities.
10:30-10:45 - Station Manager Report
10:45-11:00 - Discussion on Langley Plot Calibration for the Sunphotometers
11:00-12:00 – Prof. Bob Reno's presentation on SEM
12:00-13:00 - Lunch
13:00-15:00 - Open Lab on microscope

Microscopes are used to make the smallest things visible to the naked eye.



Light microscopes do this using reflected or transmitted light which is detected by the eye, or sometimes a camera. Light microscopes can now magnify up to x1000

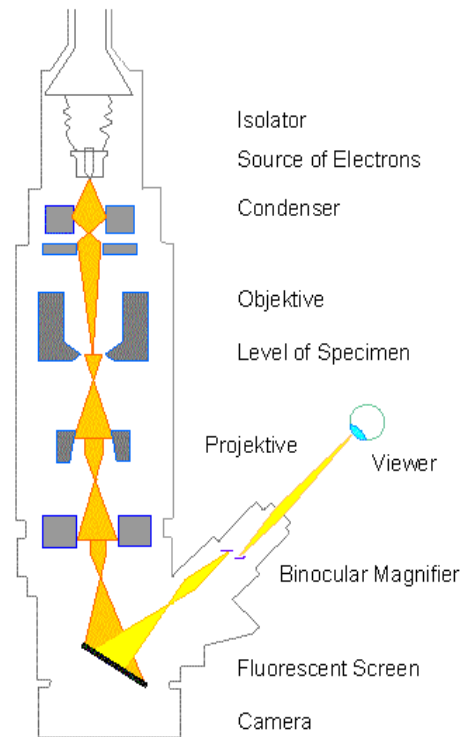


Electron microscopes make use of electrons to scan the sample. The interactions are sensed by detectors which create images of the sample. Electron microscopes can magnify x 100,000 or more.

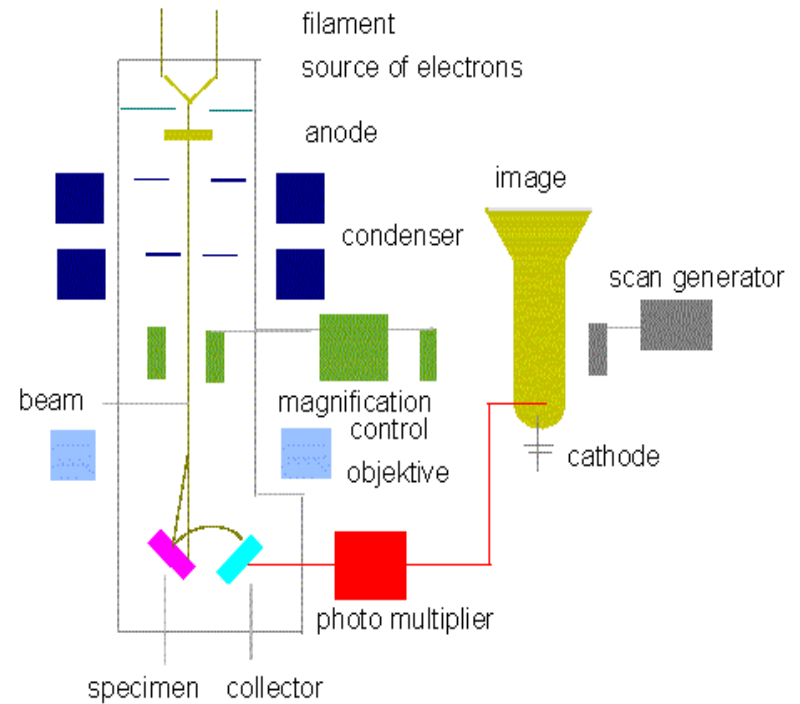


Light vs Electrons

- Electrons can be focussed using magnetic lenses
- Shorter wavelength than visible light allows “seeing” smaller objects



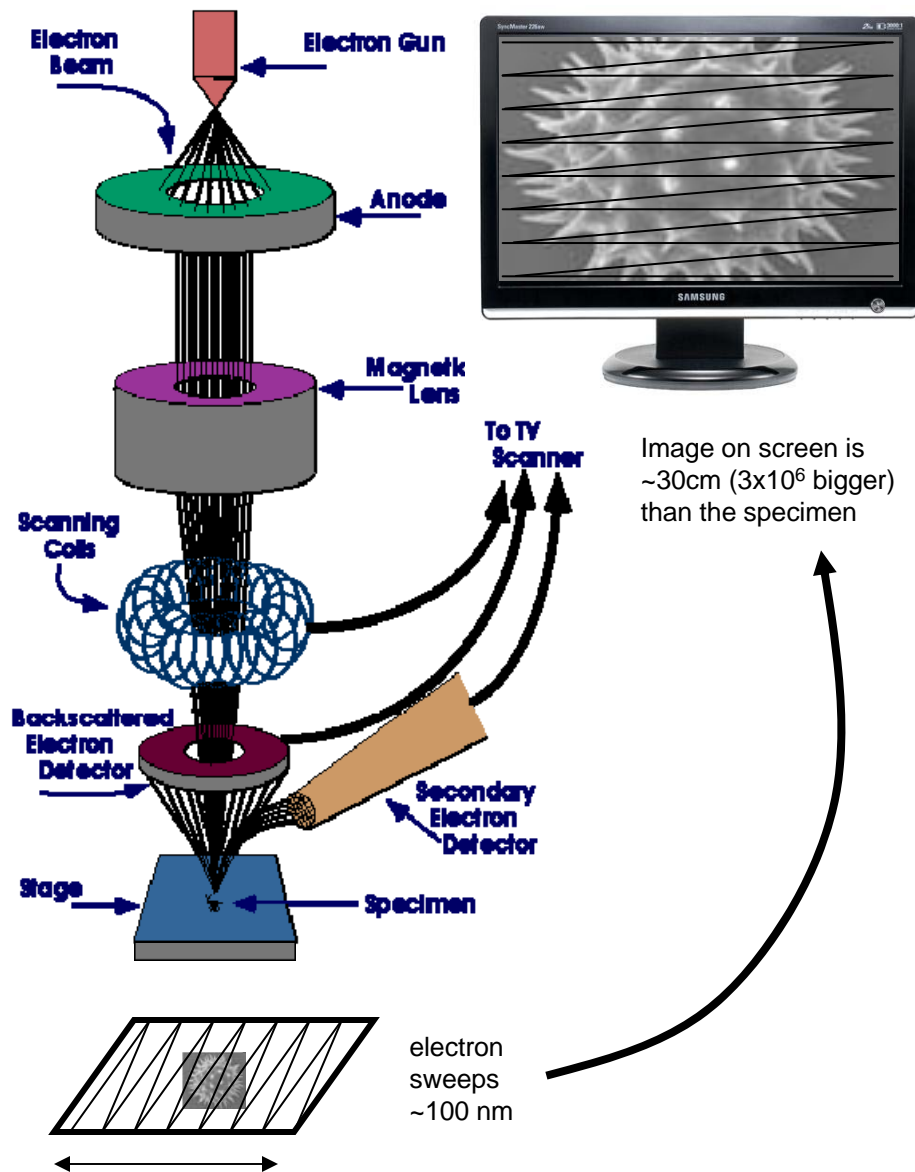
TEM



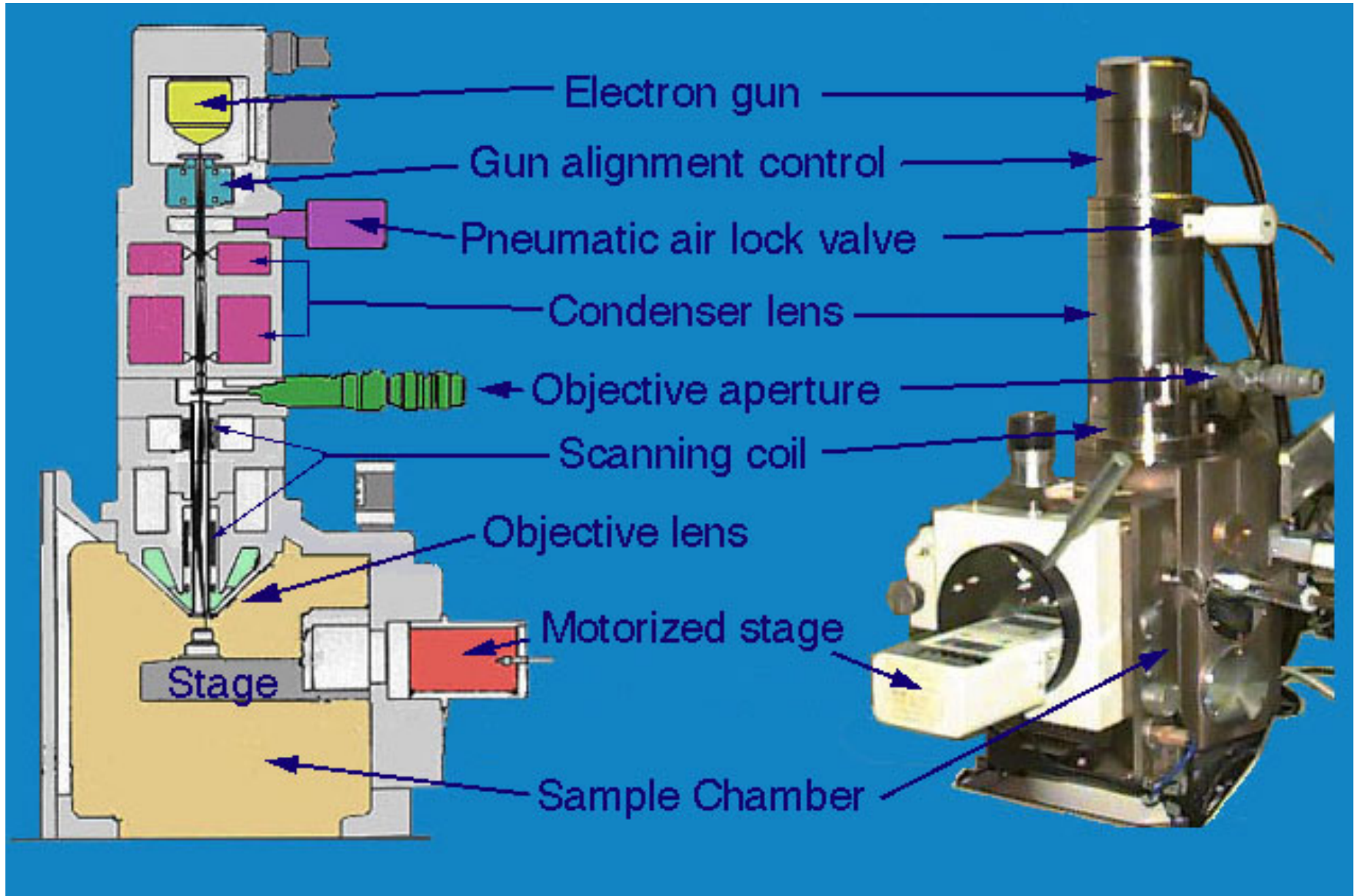
SEM

The electron microscope

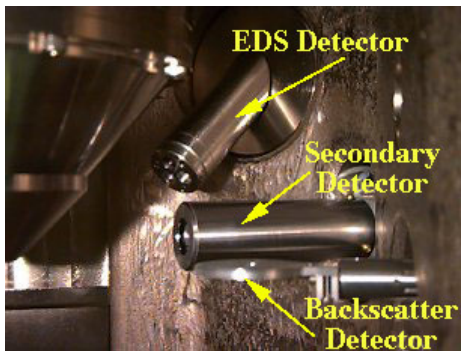
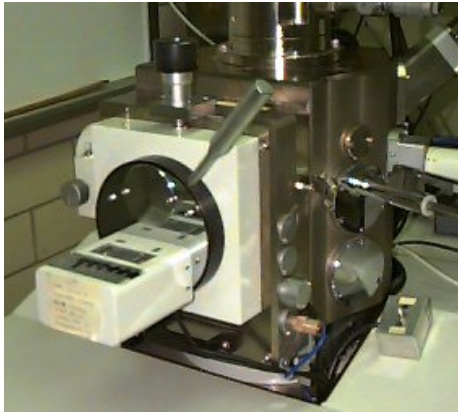
- Large depth of field
 - More of the sample is in focus at one time
- Higher resolution
 - Smaller features can be imaged
- Analysis
 - The electron beam interacts with the sample enabling information on composition to be collected using additional detectors



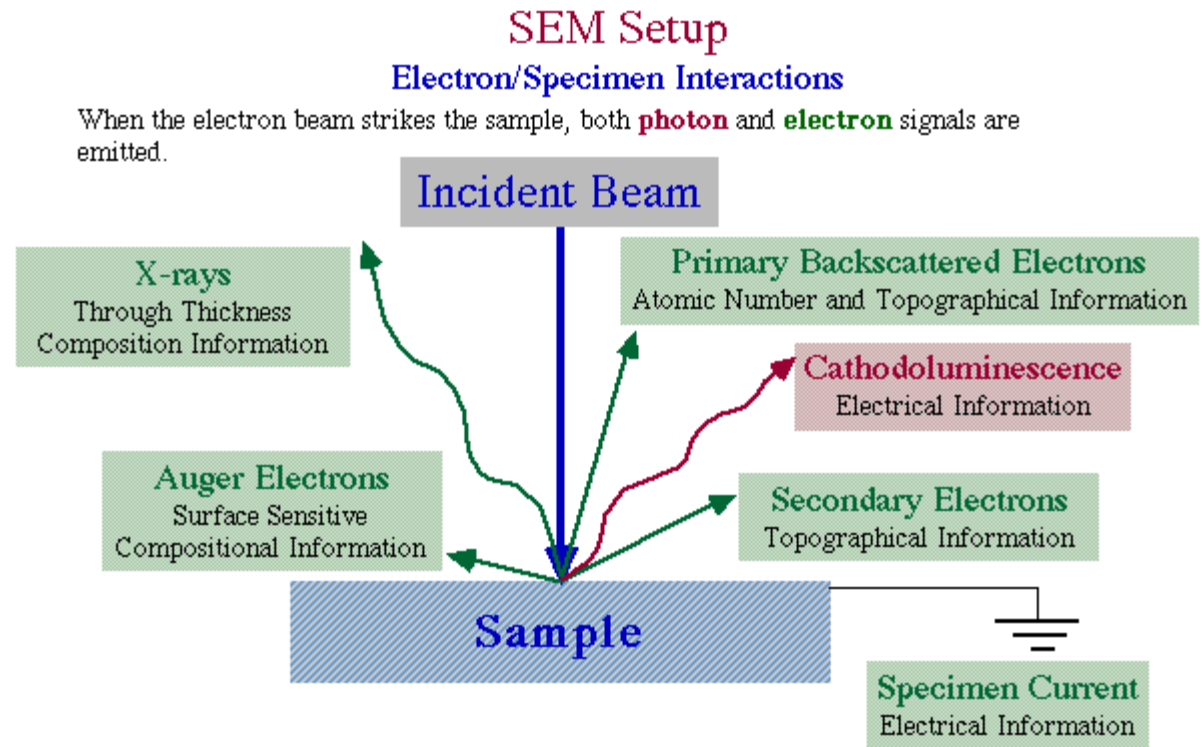
The electron microscope



The electron microscope: e⁻ interactions



X ray detector

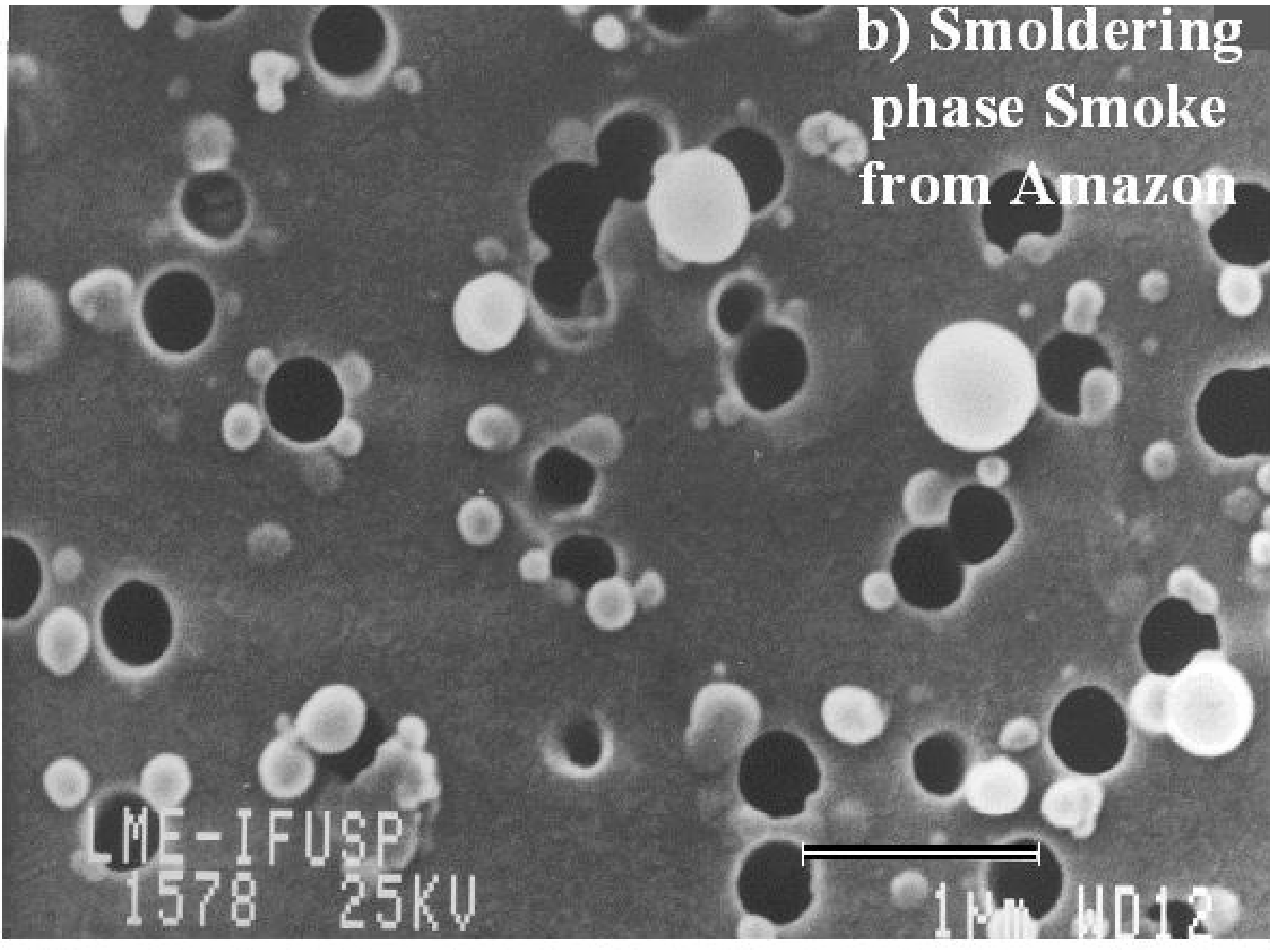


Electron beam charges the sample...
The specimen must be conductive.
Usually coated with some metallic or carbon film

Movie: An introduction to electron microscopy

<http://www.youtube.com/watch?v=IrXMIghANbg>

**b) Smoldering
phase Smoke
from Amazon**

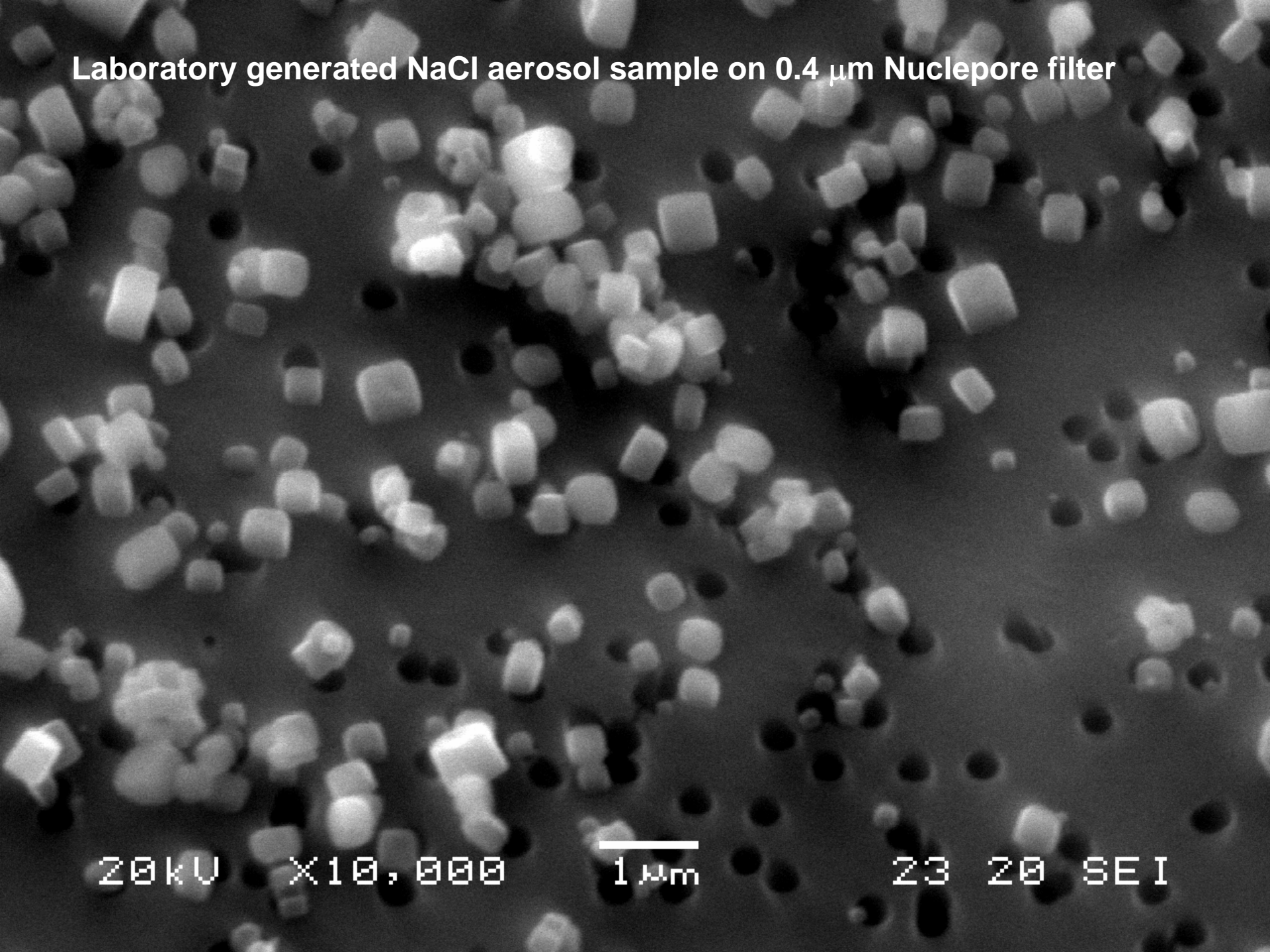


LME-1FUSP
1578 25KV



1 μm WD12

Laboratory generated NaCl aerosol sample on 0.4 μm Nuclepore filter



20kV

X10,000

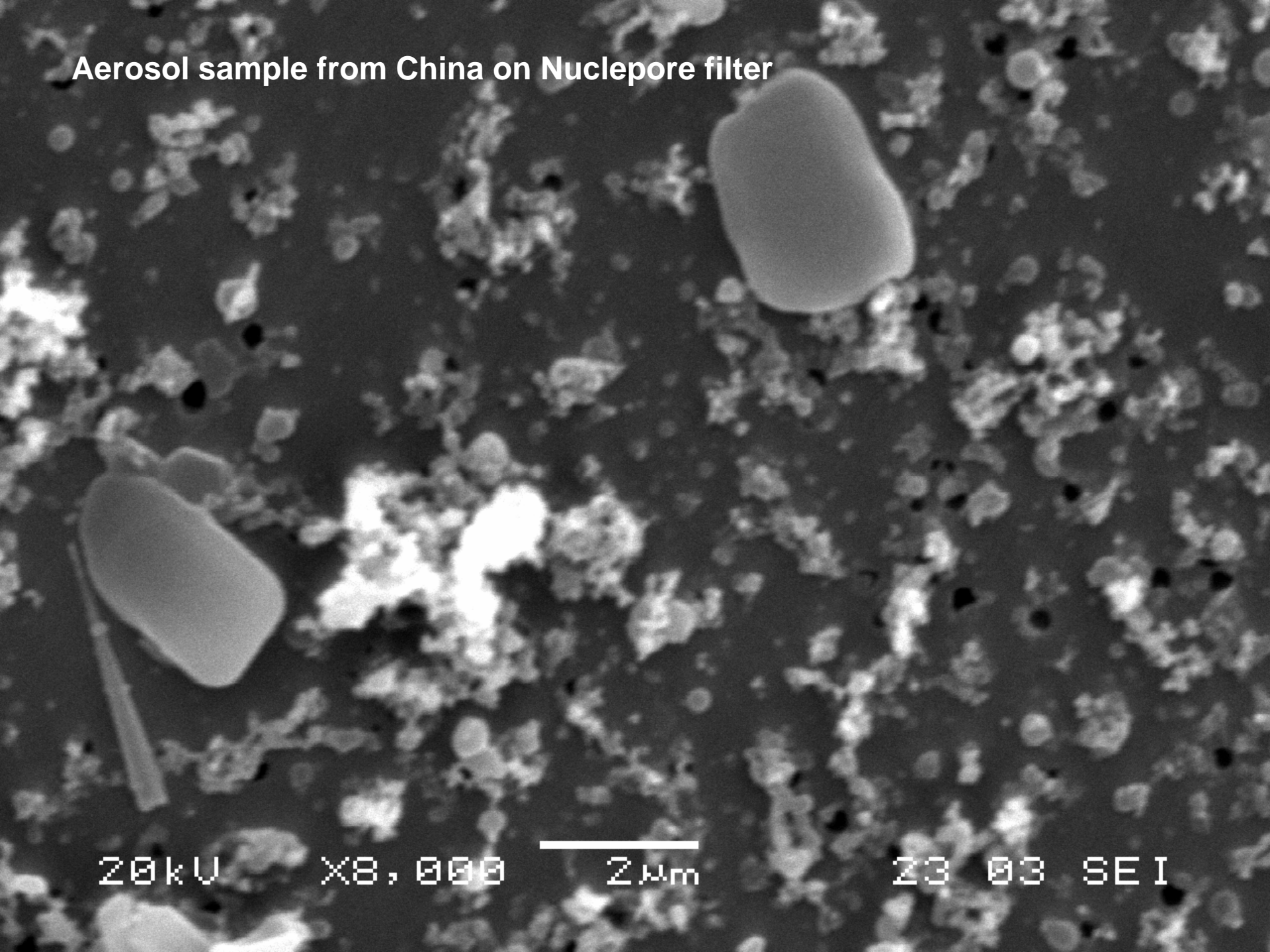
1 μm

23

20

SEI

Aerosol sample from China on Nuclepore filter



20kV

X8,000

2µm

23 03 SEI

This week's activities:

1. Langley plot for your sunphotometer
2. Make your own SEM image of
 - a) UMBC aerosol sample
 - b) A laboratory NaCl aerosol sample
3. Determine the size and mass distribution of 2 given aerosol images:
 - Laboratory generated NaCl sample
 - Ambient aerosol collected on Nuclepore filter (e.g. Smoke from Biomass Burning in the Amazon)