



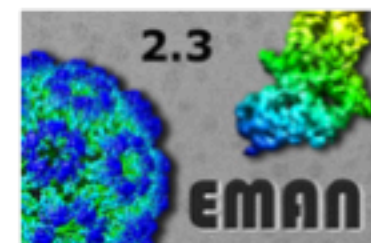
# Quick Survey of CryoEM Software

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5/2019, Ludtke, UTMB

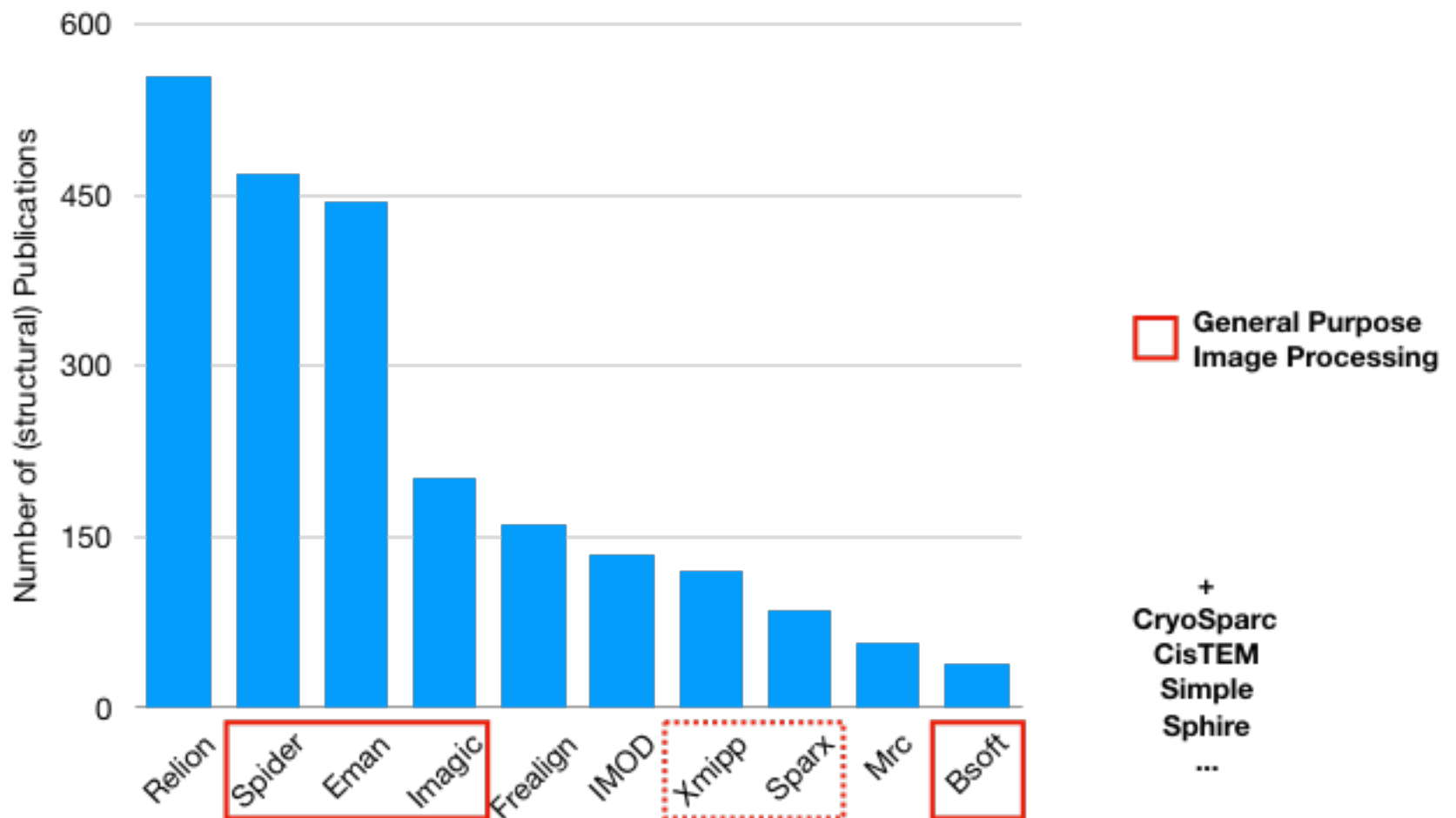




# History

- 1999 - EMAN1 released
    - First to do Fourier-based reconstruction, full CTF correction, GUI
  - 2003 - Started development of EMAN2
    - Python Focus, redesign from scratch
    - SPARX = EMAN2/PHENIX crossover, Pawel Penczek
  - 2008 - Grant supporting SPARX ends -> Pawel changes its focus
  - 2005 - 2009 Various pre-releases of EMAN2/SPARX
  - 2010 - EMAN2.0/SPARX
    - ← Simple first release
    - ← Relion first release
  - 2014 - EMAN2.1
  - 2016 - SPHIRE - first beta
  - 2017 - EMAN2.2
    - ← CryoSPARC first release
    - ← CISTEM first release
- ← ~1980 SPIDER & IMAGIC
- ← Frealign first release

# EMDB Publications by Software



# Spider

(typical method, late 70s, Pub 1981)

Extract Particles



Determine Orientations



3-D Reconstruction



Interpret Map

Initial Model



Projections



Particles



Determine Orientations



3-D Reconstruction

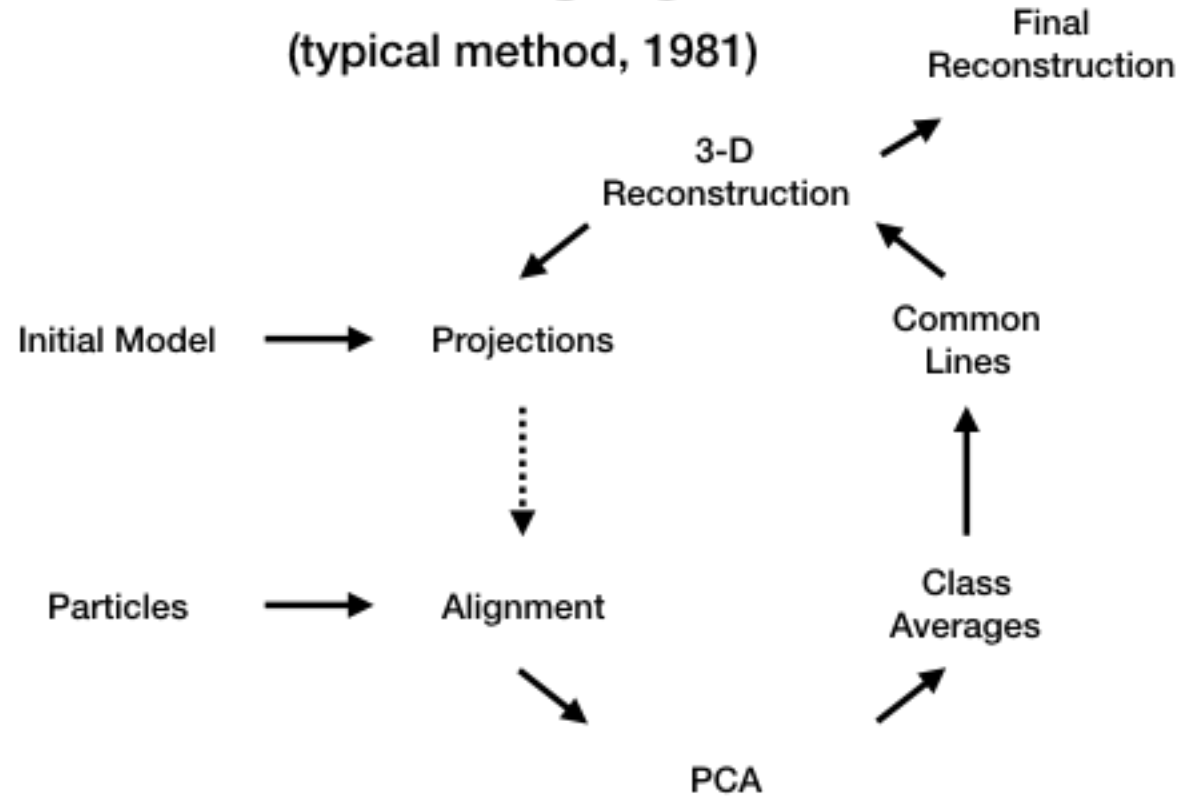
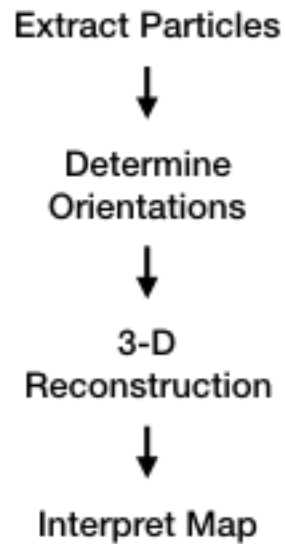


Final Reconstruction



# IMAGIC

(typical method, 1981)



# EMAN

(1998)

Extract Particles



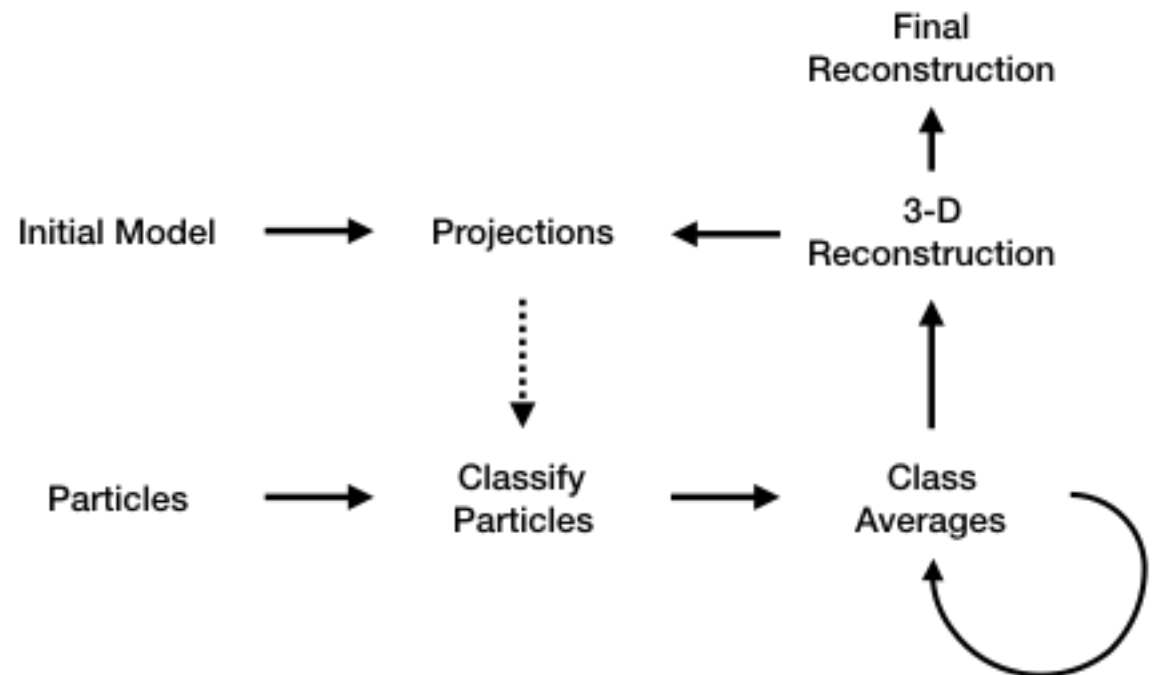
Determine  
Orientations



3-D  
Reconstruction



Interpret Map





# Relion

(2012, adapted from XMIPP)

Extract Particles



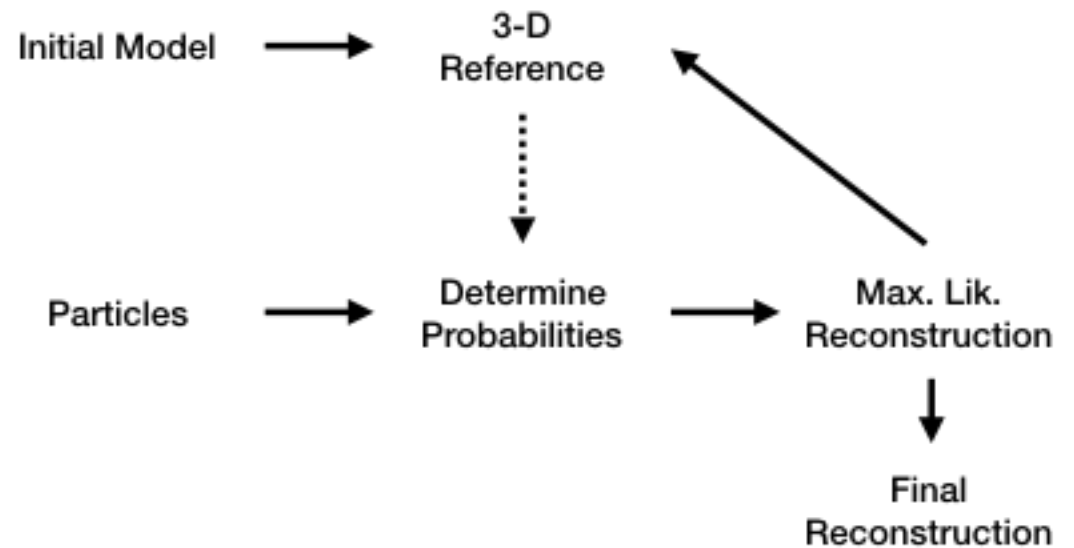
Determine Orientations



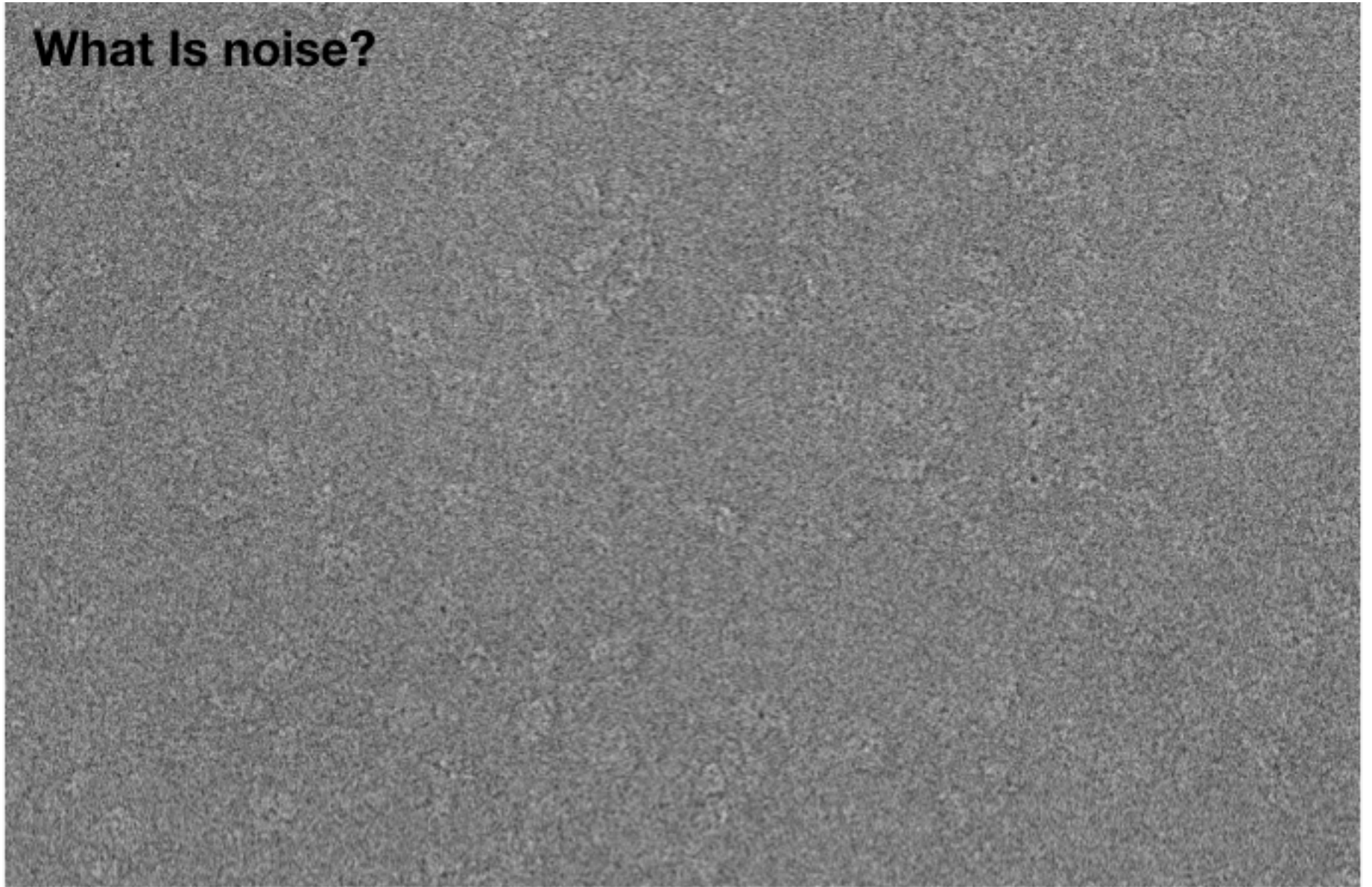
3-D Reconstruction



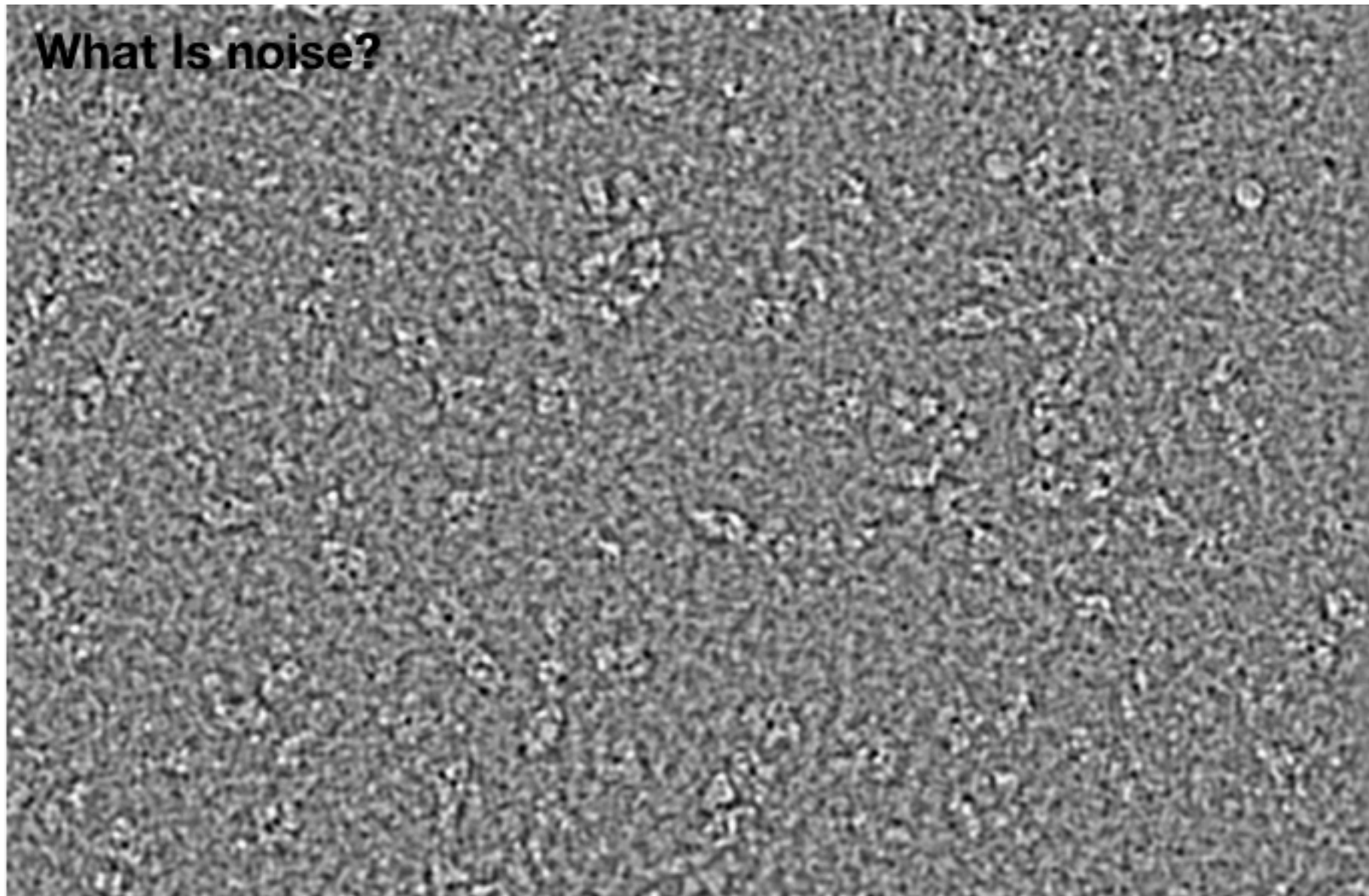
Interpret Map



**What Is noise?**



**What Is noise?**



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