

# Single Molecule Spectroscopy

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References: “Spectrochemical Analysis”, J. D. Ingle and S. R. Crouch, 1988  
Various supplementary journal articles

- Topics:
- 1 Properties of light
  - 2 Physical optics, spectrometers
  - 3 Spectrograph problem set, light sources, fiber optics
  - 4 The laser, lasers for sensitive measurements
  - 5 Detectors, photoelectric, arrays
  - 6 Photoacoustic spectroscopy, thermal lens spectroscopy
  - 7 Fluorescence and phosphorescence
  - 8 FT-IR instrumentation
  - 9 Raman spectroscopy – normal, resonance enhanced, surface enhanced
  - 10 Spectroscopic measurements in small samples, laser-excited atomic fluorescence, laser-enhanced ionization
  - 11 Single Atom Detection
  - 12 Single molecule detection – principles and single fluorophors
  - 13 Biological imaging – dyes, beads, nanoparticles and quantum dots
  - 14 Single molecule detection – physical dynamics
  - 15 Single molecule detection – reactions
  - 16 Single molecule detection – molecular motors
  - 17 Microscopy for single cell imaging – bright/dark field, phase contrast, fluorescence, confocal, multiphoton, polarization
  - 18 Biological imaging – FRET, FRAP, GFP, antibodies, aptamers
  - 19 Biological imaging – DIC, native fluorescence, chemiluminescence
  - 20 Near-field Microscopy
  - 21 Super resolution, CARS, STED, STORM
  - 22 Microfluidics for single cell and single molecule manipulation

22 2-hour lectures, 1 self-study problem set (graded), 1 literature report with 15 min class presentation (graded)