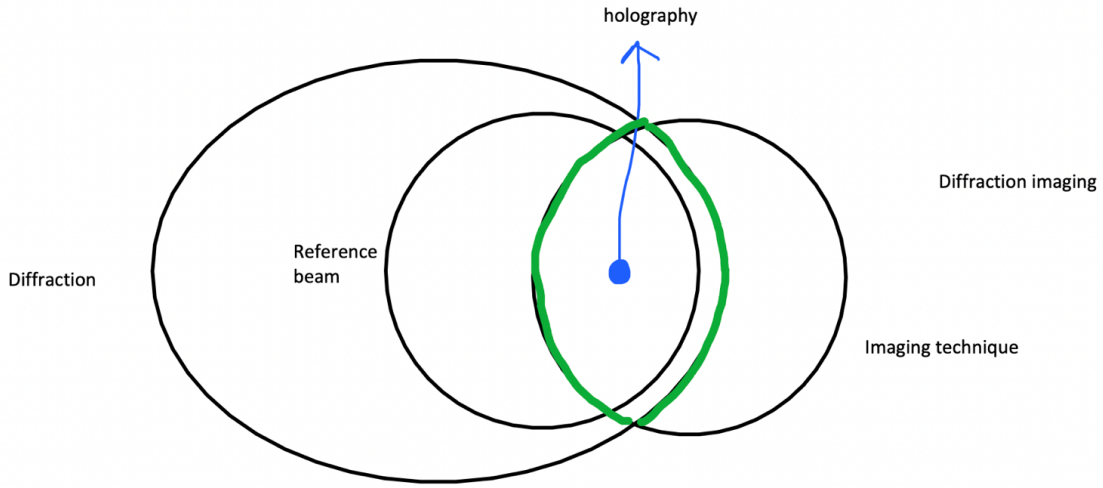
New subclass relationships Draft 7

These class-pairs should be interpreted as [parent class, child class].
The ones highlighted in green are the relationships that are likely correct. The ones in yellow require further expert validation. The ones in red are likely incorrect, resulting either from errors in the original PaNET or from overly strong logical assertions where equivalence axioms were inappropriately used instead of subclass axioms.

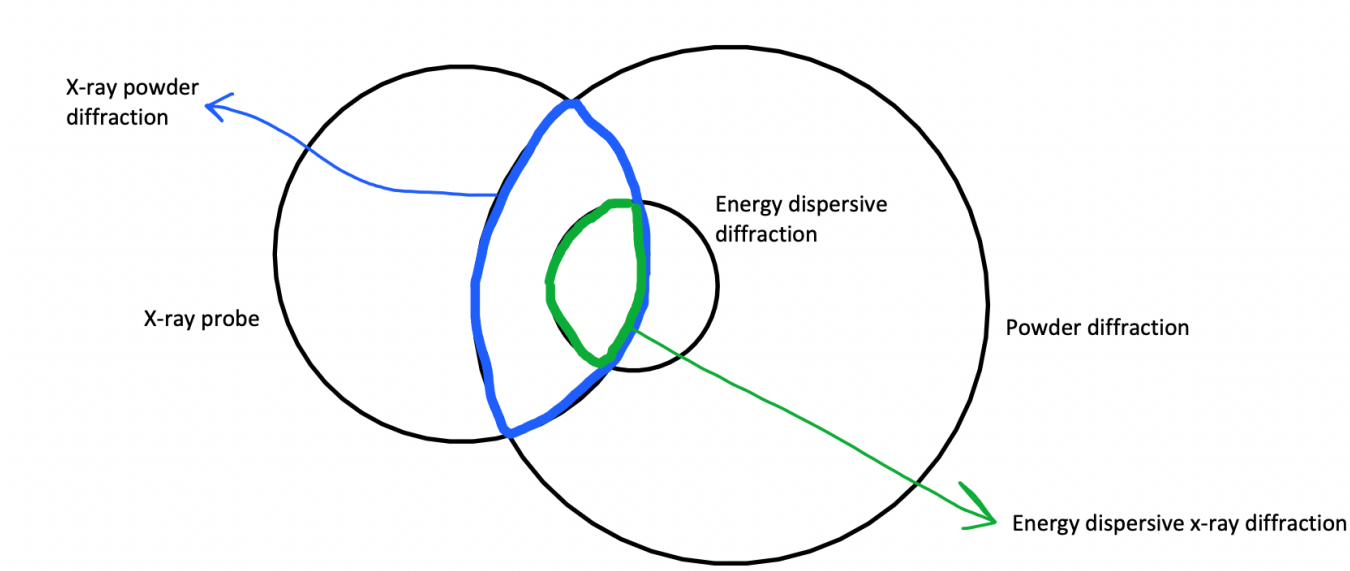
1. ['defined by purpose', 'magnetism_technique']
2. ['neutron_technique', 'neutron time of flight_technique']
3. ['scattering_technique', 'diffuse scattering_technique']
4. ['spatial map_technique', 'microscopy_technique']
5. ['photoemission spectroscopy_technique', 'angle resolved photoemission spectroscopy_technique']
6. ['fluorescence imaging_technique', 'fluorescence tomography_technique']
7. ['x-ray diffraction_technique', 'x-ray powder diffraction_technique']
8. ['x-ray diffraction_technique', 'x-ray single crystal diffraction_technique']
9. ['x-ray photoelectron spectroscopy_technique', 'hard x-ray photoelectron spectroscopy_technique']
10. ['photoemission spectroscopy_technique', 'high resolution photoelectron spectroscopy_technique']
11. ['electron spectroscopy_technique', 'high resolution photoelectron spectroscopy_technique']
12. ['diffraction imaging_technique', 'holography_technique']
    - <holography> is a subclass of <reference beam>, which is a subclass of <diffraction>.
    - <holography> is also a subclass of <imaging_technique>.
    - <diffraction imaging> is equivalent to <diffraction> and <imaging_technique>.



- Suggestion: Revert <diffraction imaging> back to a subclass of <diffraction> and <imaging_technique>.

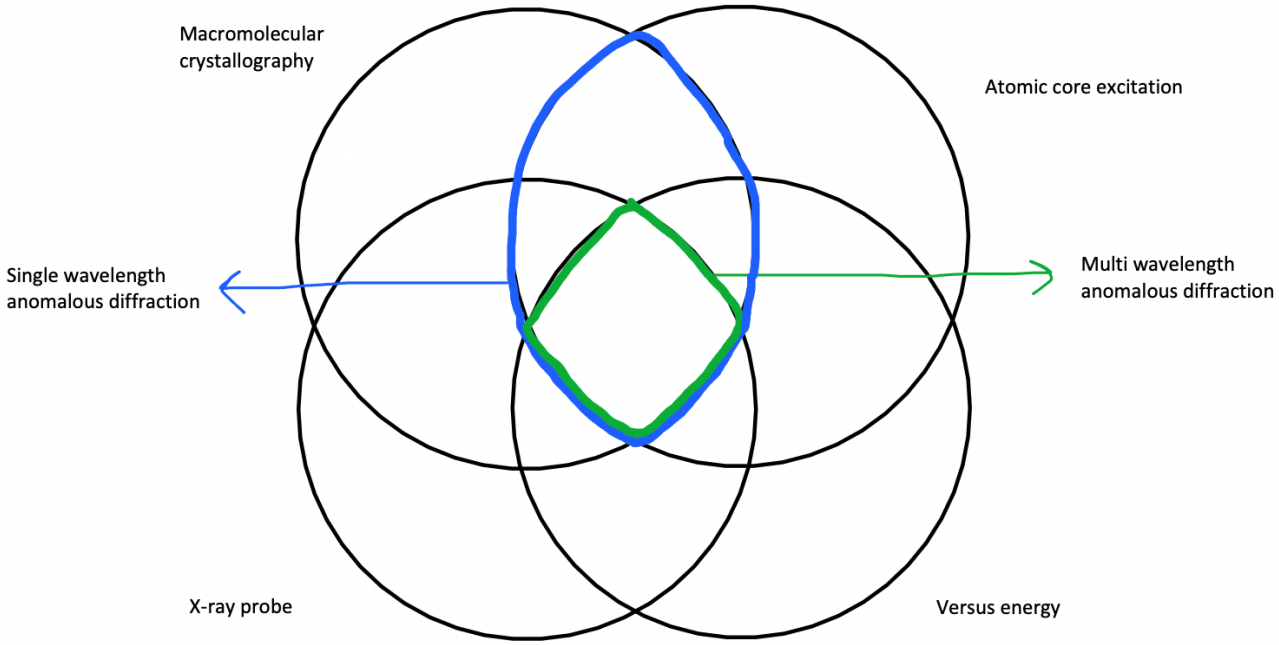
13. ['infrared microscopy_technique', 'infrared microspectroscopy_technique']
14. ['obtain high resolution spatial map_technique', 'fluorescence microscopy_technique']
15. ['reflectometry_technique', 'polarised reflectivity_technique']
16. ['neutron scattering_technique', 'quasielastic neutron spin echo scattering_technique']
17. ['absorption contrast imaging_technique', 'scanning transmission microscopy_technique']
18. ['scanning probe microscopy_technique', 'scanning transmission microscopy_technique']
19. ['neutron scattering_technique', 'spin echo resolved grazing incidence scattering_technique']
20. ['neutron scattering_technique', 'spin echo small angle scattering_technique']
21. ['magnetic circular dichroism_technique', 'x-ray magnetic circular dichroism_technique']
22. ['x-ray absorption_technique', 'x-ray magnetic circular dichroism_technique']
23. ['circular dichroism_technique', 'magnetic circular dichroism_technique']
24. ['circular dichroism_technique', 'natural circular dichroism_technique']
25. ['obtain high resolution spatial map_technique', 'electron microscopy_technique']
26. ['photoelectron emission_technique', 'photoemission electron microscopy_technique']
27. ['obtain high resolution spatial map_technique', 'scanning probe microscopy_technique']
28. ['reflectometry_technique', 'x-ray reflectivity_technique']
29. ['absorption contrast imaging_technique', 'absorption tomography_technique']
30. ['phase contrast imaging_technique', 'propagation phase contrast tomography_technique']
31. ['microtomography_technique', 'nanotomography_technique']
32. ['phase contrast imaging_technique', 'absorption and phase contrast nanotomography_technique']
33. ['absorption microtomography_technique', 'absorption and phase contrast nanotomography_technique']

34. ['x-ray powder diffraction_technique', 'energy dispersive x-ray diffraction_technique']
    - <energy dispersive x-ray diffraction> ⇔ <energy dispersive diffraction> and <x-ray probe>
    - <energy dispersive diffraction> is subclass of <powder diffraction>
    - <x-ray powder diffraction> ⇔ <x-ray probe> and <powder diffraction>
    - Suggestion: Revert <x-ray powder diffraction> back to a subclass of <x-ray probe> and <powder diffraction>



35. ['x-ray scattering_technique', 'grazing incidence x-ray diffraction_technique']
36. ['grazing incidence x-ray diffraction_technique', 'grazing incidence small angle x-ray scattering_technique']
37. ['x-ray single crystal diffraction_technique', 'multi wavelength anomalous diffraction_technique']

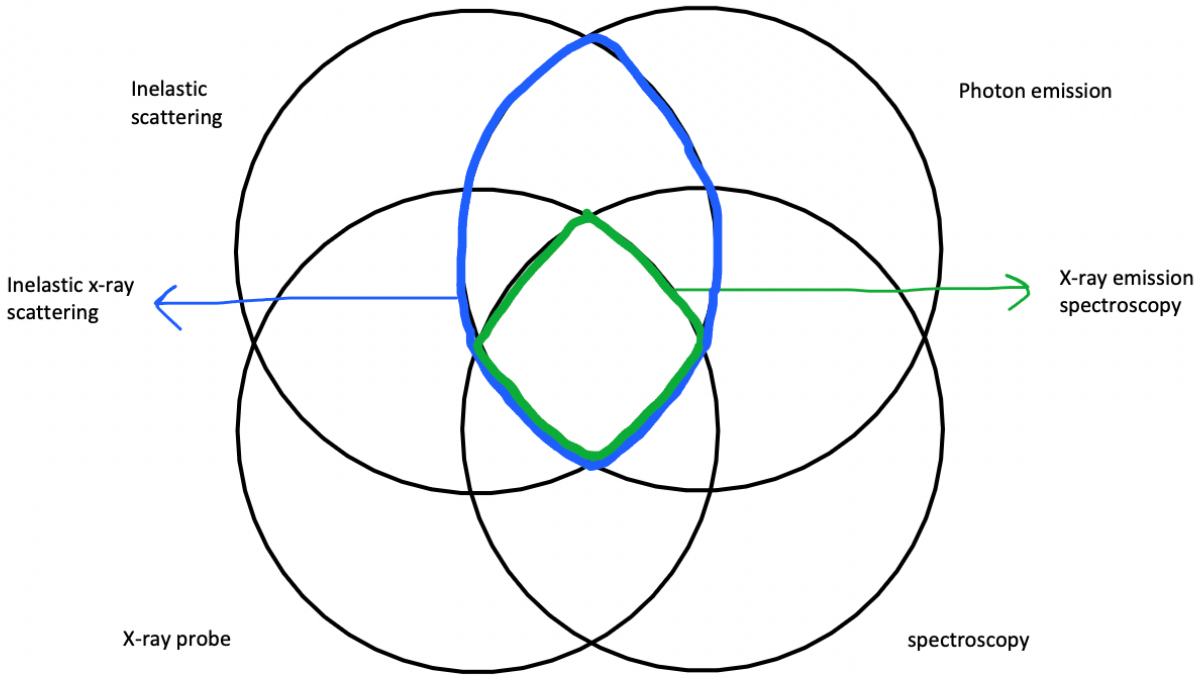
38. ['single wavelength anomalous diffraction_technique', 'multi wavelength anomalous diffraction_technique']
    - <Multi wavelength anomalous diffraction> ⇔ <macromolecular crystallography> and <versus energy> and <atomic core excitation> and <x-ray probe>
    - <Single wavelength anomalous diffraction> ⇔ <macromolecular crystallography> and <atomic core excitation>



    - Suggestion: Revert <Single wavelength anomalous diffraction> back to a subclass of <macromolecular crystallography> and <atomic core excitation>

39. ['photoelectron emission_technique', 'photoelectron diffraction_technique']
40. ['serial synchrotron crystallography_technique', 'serial femtosecond crystallography_technique']
41. ['x-ray diffraction_technique', 'surface x-ray diffraction_technique']
42. ['x-ray diffraction_technique', 'x-ray standing wave_technique']
43. ['x-ray absorption_technique', 'x-ray standing wave_technique']
    - <x-ray standing wave> is subclass of <absorption technique>
    - <x-ray standing wave> is subclass of <x-ray probe>
    - <x-ray absorption> ⇔ <absorption technique> and <x-ray probe>
    - Already suggested to remove <absorption technique> as a parent class of <x-ray standing wave>. Can submit as an issue to PaNET group in the future.
44. ['diffraction imaging_technique', 'coherent diffraction imaging_technique']
45. ['infrared microspectroscopy_technique', 'infrared nanospectroscopy imaging_technique']

46. ['UV circular dichroism_technique', 'UV circular dichroism imaging_technique']
47. ['obtain high resolution spatial map_technique', 'infrared microscopy_technique']
48. ['obtain high resolution spatial map_technique', 'optical microscopy_technique']
49. ['obtain high resolution spatial map_technique', 'x-ray microscopy_technique']
50. ['x-ray imaging_technique', 'x-ray microscopy_technique']
51. ['x-ray scattering_technique', 'inelastic x-ray scattering_technique']
52. ['raman spectroscopy_technique', 'inelastic x-ray scattering_technique']
53. ['resonant x-ray scattering_technique', 'resonant inelastic x-ray scattering_technique']
54. ['x-ray scattering_technique', 'small angle x-ray scattering_technique']
55. ['x-ray diffraction_technique', 'wide angle x-ray scattering_technique']
56. ['inelastic x-ray scattering_technique', 'x-ray emission spectroscopy_technique']
    - <x-ray emission spectroscopy> ⇔ <inelastic scattering> and <x-ray probe> and <photon emission> and <spectroscopy>
    - <inelastic x-ray scattering> ⇔ <x-ray probe > and <inelastic scattering>

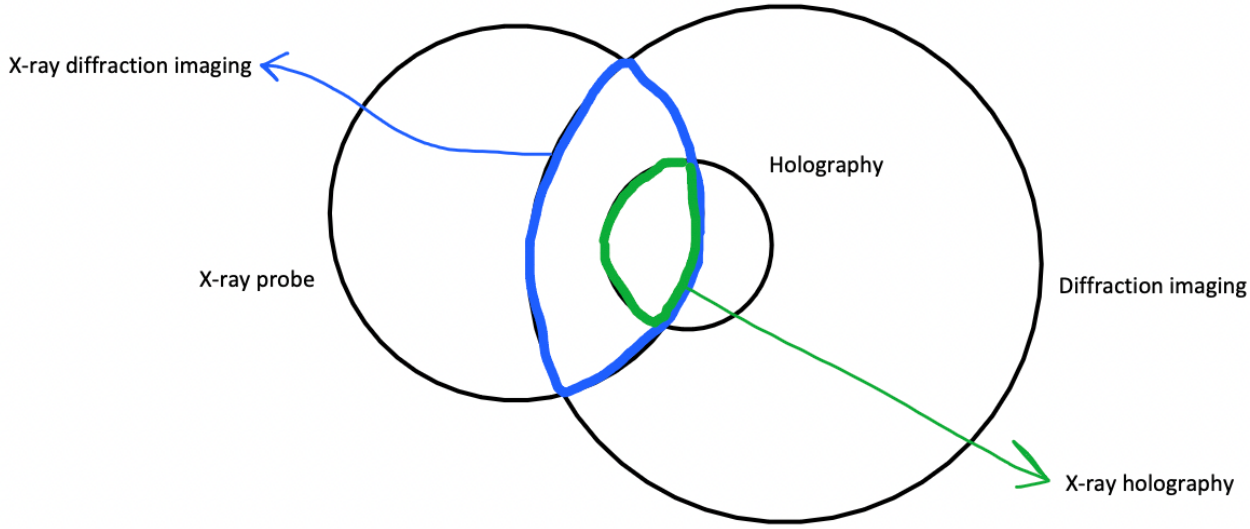


- Suggestion: Revert <inelastic x-ray scattering> back to a subclass of <x-ray probe > and <inelastic scattering>

57. ['photoelectron emission_technique', 'photoelectron spectroscopy_technique']
58. ['x-ray photoelectron emission_technique', 'x-ray photoelectron spectroscopy_technique']
59. ['x-ray diffraction_technique', 'x-ray photon correlation spectroscopy_technique']
60. ['microscopy_technique', 'microtomography_technique']
61. ['x-ray imaging_technique', 'x-ray tomography_technique']
62. ['x-ray microscopy_technique', 'x-ray microtomography_technique']
63. ['x-ray tomography_technique', 'x-ray microtomography_technique']
64. ['absorption tomography_technique', 'absorption microtomography_technique']
65. ['microtomography_technique', 'propagation phase contrast microtomography_technique']
66. ['microtomography_technique', 'ultrafast microtomography_technique']
67. ['x-ray scattering_technique', 'x-ray diffraction_technique']
68. ['neutron scattering_technique', 'neutron diffraction_technique']
69. ['x-ray absorption_technique', 'scanning transmission x-ray microscopy_technique']
70. ['x-ray scanning microscopy_technique', 'scanning transmission x-ray microscopy_technique']
71. ['x-ray photoelectron emission_technique', 'XMCD total electron yield_technique']
72. ['neutron scattering_technique', 'ultra small angle neutron scattering_technique']
73. ['small angle x-ray scattering_technique', 'ultra small angle x-ray scattering_technique']
74. ['polarised reflectivity_technique', 'polarized neutron reflectometry_technique']
75. ['neutron scattering_technique', 'inelastic neutron spectroscopy_technique']
76. ['thermal neutron spectroscopy_technique', 'cold neutron spectroscopy_technique']
77. ['absorption contrast imaging_technique', 'neutron transmission radiography_technique']
78. ['microscopy_technique', 'high-resolution neutron imaging _technique']
79. ['obtain high resolution spatial map_technique', 'THz near field microscopy_technique']
80. ['x-ray absorption_technique', 'x-ray magnetic linear dichroism_technique']
81. ['phase contrast imaging_technique', 'x-ray refraction imaging_technique']
82. ['x-ray imaging_technique', 'x-ray refraction imaging_technique']
83. ['x-ray tomography_technique', 'x-ray refraction tomography_technique']
84. ['x-ray refraction imaging_technique', 'x-ray refraction tomography_technique']

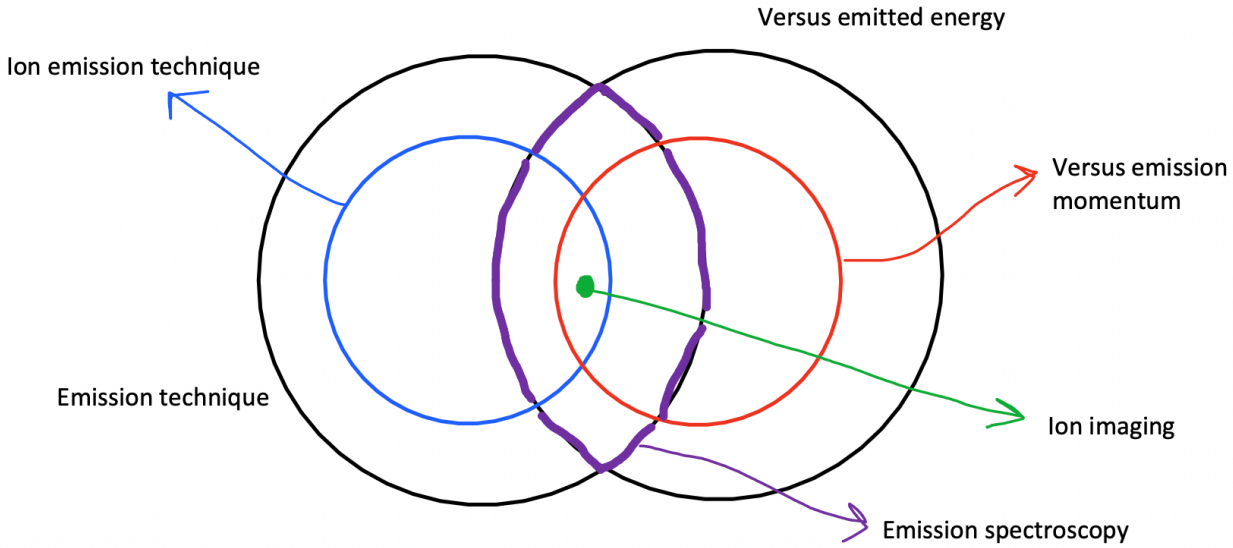
85. ['x-ray diffraction imaging_technique', 'x-ray holography_technique']

- <x-ray holography> ⇔ <x-ray probe> and <holography>
- <holography> is subclass of <diffraction imaging>
- <x-ray diffraction imaging> ⇔ <x-ray probe> and <diffraction imaging>



- Suggestion: Revert <x-ray diffraction imaging> back to a subclass of <x-ray probe> and <diffraction imaging>

86. ['emission spectroscopy_technique', 'ion imaging_technique']
    - <ion imaging> ⇔ <ion emission technique> and <photon technique> and <versus emission momentum>
        - <ion emission technique> is subclass of <emission_technique>
        - <versus emission momentum> is subclass of <versus emitted energy>
    - <emission spectroscopy> ⇔ <emission_technique> and <versus emitted energy>



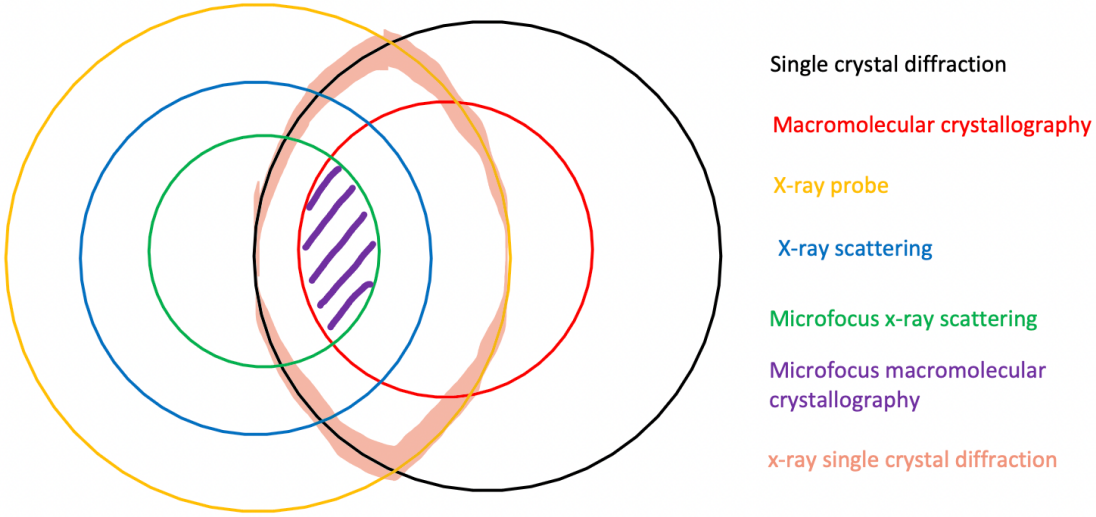
- <photon technique> was not included in the above diagram to make it less cluttered, but the logic still holds
- Suggestion: Revert <emission spectroscopy> back to a subclass of <emission_technique> and <versus emitted energy>

87. ['small angle x-ray scattering_technique', 'anomalous small angle x-ray scattering_technique']
88. ['x-ray diffraction_technique', 'anomalous small angle x-ray scattering_technique']
89. ['resonant elastic x-ray scattering_technique', 'anomalous small angle x-ray scattering_technique']
90. ['neutron time of flight_technique', 'time of flight small angle neutron scattering_technique']
91. ['ultra small angle neutron scattering_technique', 'very small angle neutron scattering_technique']
92. ['small angle x-ray scattering_technique', 'diffuse small angle x-ray scattering_technique']
93. ['inelastic small angle scattering_technique', 'inelastic x-ray small angle scattering_technique']

94. ['x-ray diffraction_technique', 'soft x-ray diffraction_technique']
95. ['x-ray photoelectron emission_technique', 'x-ray photoelectron diffraction_technique']
96. ['x-ray microtomography_technique', 'micro small angle x-ray scattering tomography_technique']
97. ['fluorescence imaging_technique', 'scanning x-ray fluorescence_technique']
98. ['soft x-ray probe_technique', 'soft x-ray imaging_technique']
99. ['x-ray diffraction_technique', 'x-ray diffraction imaging_technique']
100. ['x-ray imaging_technique', 'x-ray diffraction imaging_technique']
101. ['scanning photoelectron microscopy_technique', 'scanning angle resolved photoemission spectromicroscopy_technique']
102. ['x-ray microscopy_technique', 'x-ray photoemission electron microscopy_technique']
103. ['x-ray photoelectron emission_technique', 'x-ray photoemission electron microscopy_technique']
104. ['neutron scattering_technique', 'elastic neutron scattering spectroscopy_technique']
105. ['x-ray absorption_technique', 'x-ray linear dichroism_technique']
106. ['x-ray linear dichroism_technique', 'x-ray natural linear dichroism_technique']
107. ['x-ray single crystal diffraction_technique', 'long wavelength crystallography_technique']

108. ['x-ray single crystal diffraction_technique', 'microfocus macromolecular crystallography_technique']

- <microfocus macromolecular crystallography> ⇔ <macromolecular crystallography> and <microfocus x-ray scattering>
  - <macromolecular crystallography> is subclass of <single crystal diffraction>
  - <microfocus x-ray scattering> ⇔ <microfocussed probe> and <x-ray scattering>
    - <x-ray scattering> ⇔ <scattering> and <x-ray probe>
- <x-ray single crystal diffraction> ⇔ <x-ray probe> and <single crystal diffraction>



- I tried to make the diagram as simple as possible, but basically, <microfocus macromolecular crystallography> is a subclass of both <x-ray probe> and <single crystal diffraction>, which makes it a subclass of <x-ray single crystal diffraction>
  - <microfocus macromolecular crystallography> ⊆ <macromolecular crystallography> ⊆ <single crystal diffraction>
  - <microfocus macromolecular crystallography> ⊆ <microfocus x-ray scattering> ⊆ <x-ray scattering> ⊆ <x-ray probe>
- Suggestion: Revert <x-ray single crystal diffraction> back to a subclass of <x-ray probe> and <single crystal diffraction>

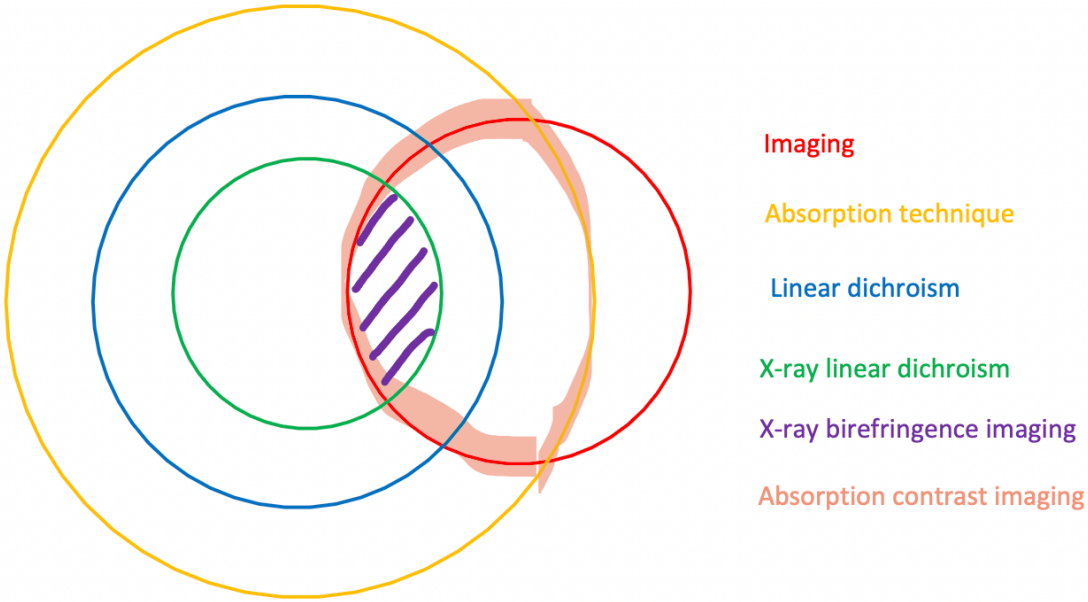
109. ['microfocus macromolecular crystallography_technique', 'nanofocus macromolecular crystallography_technique']

110. ['time resolved serial synchrotron crystallography_technique', 'time resolved serial femtosecond crystallography_technique']

111. ['grazing incidence x-ray diffraction_technique', 'grazing incidence wide angle scattering_technique']

112. ['obtain high resolution spatial map_technique', 'atomic force microscopy_technique']

113. ['infrared microspectroscopy_technique', 'atomic force microscope infrared spectroscopy_technique']
114. ['microfocus spectroscopy_technique', 'microfocus x-ray absorption spectroscopy_technique']
115. ['x-ray single crystal diffraction_technique', 'borrmann effect_technique']
116. ['absorption contrast imaging_technique', 'x-ray birefringence imaging _technique']
    - <x-ray birefringence imaging> ⇔ <birefringence technique> and <x-ray linear dichroism> and <imaging>
        - <x-ray linear dichroism> ⇔ <x-ray probe> and <linear dichroism>
            - <linear dichroism> ⇔ <absorption technique> and <versus photon linear polarization> and <dichroism>
    - <absorption contrast imaging> ⇔ <absorption technique> and <imaging>



- Again, this is quite complicated, so I trimmed down the diagram to make it more understandable.
- <x-ray birefringence imaging> is a subclass of <absorption technique> and <imaging>, which makes it a subclass of <absorption contrast imaging>
    - <x-ray birefringence imaging> ⊆ <x-ray linear dichroism> ⊆ <linear dichroism> ⊆ <absorption technique>
    - <x-ray birefringence imaging> ⊆ <imaging>
- Suggestion: Revert <absorption contrast imaging> back to a subclass of <absorption technique> and <imaging>

117. ['x-ray refraction imaging_technique', 'x-ray birefringence imaging _technique']