How to find a quasar?

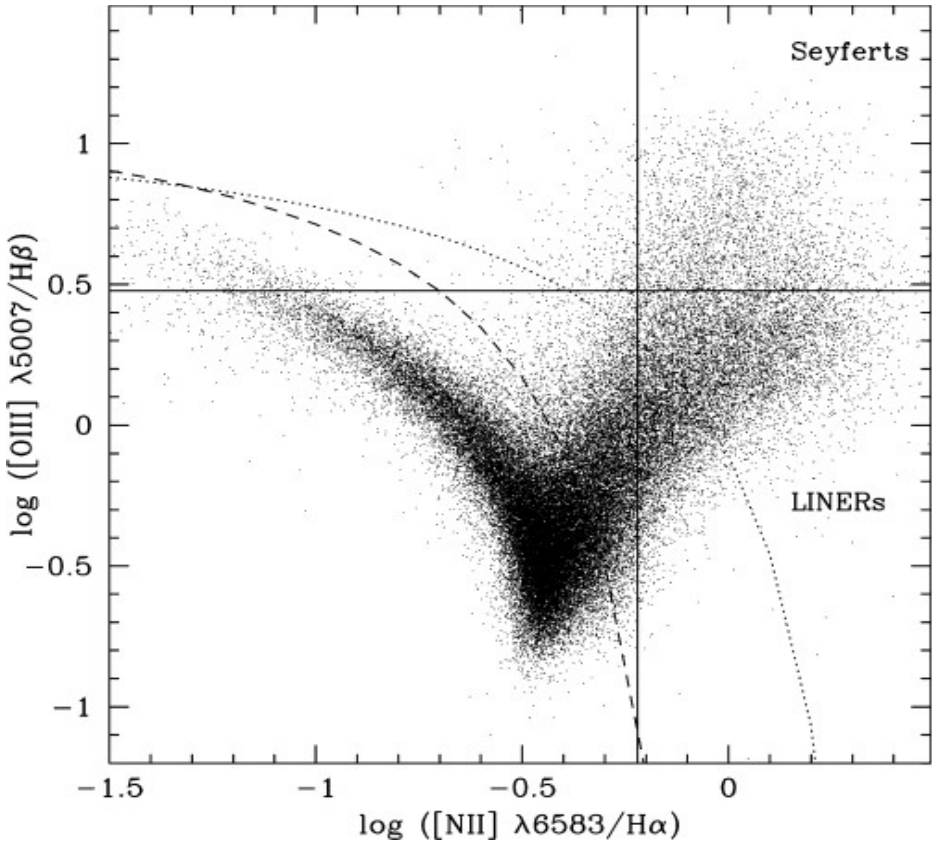
Part I: BPT Diagram

1. Use SDSS DR18 SQL search to find all galaxies which have only the narrow emission lines (FWHM<500 km/s), high median signal to noise ratio in g band (S/N>40), and fluxes of lines: [O III] 5007, Hβ, Hα and [N II] 6583 larger than 5 e-17 erg/s/cm^2. Set criteria so that the fluxes are larger than errors in flux multiplied with 5 in order to get good results. SQL output should be the fluxes of these lines.

2. For the obtained sample make the diagnostic BPT (Baldwin, Philips and Terlevich) diagram. This diagram determines the dominant ionization source for the objects: accretion disk (AGN) or hot emission stars (H II - star-burst region). For the BPT diagram use the flux ratios of the lines: [O III] 5007/Hβ vs. [N II]6583/Hα.

For the separation curves use the theoretical curve from the paper *Kewley et al. 2001, ApJ, 556, 121* (dot line in the graph) and empirical curve from the paper *Kauffmann et al. 2003, MNRAS, 346, 1055 (dashed line in the graph)*.

Example of the BPT diagram for the large number of objects:



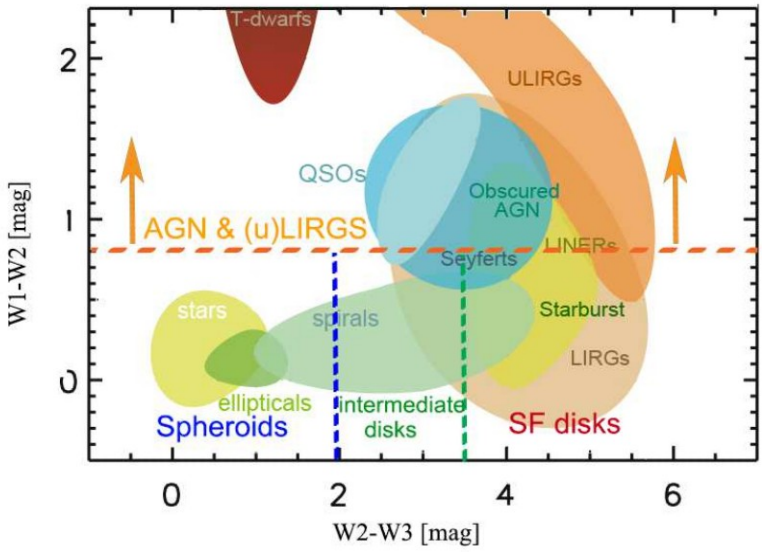
Part II: Classification of galaxies using mid-IR colors

1. For the sample of galaxies selected from SDSS database in Part I, find the corresponding WISE colors. Adapt the following query example to find WISE fluxes needed for obtaining colors: https://skyserver.sdss.org/dr16/en/help/docs/realquery.aspx#wisexmatch

2. Assign classes (AGN & (u)LIRGS, Spheroids, Intermediate disks and SF disks) to all objects in the sample using the thresholds from the image on the bottom right (dashed lines). How do these classes compare to ones obtained using BPT diagram from Part I?

3. Locate one random object on the WISE color-color plot having W1–W2>=0.8 (Assef et al. 2013) and address the following:

   - Where is the object located in this plot? Mark it clearly on the graph.
   - Does it agree with the optical classification from BPT diagram?
   - Draw some conclusions about the type of AGN using the WISE color-color plot.



WISE color-color diagram from Jarrett et al. (2017) showing location of different galaxy types defined by Wright et al. (2010).

Please submit your report by April 28th 2023, 23:59h.

References:

Assef et al. 2013, http://adsabs.harvard.edu/abs/2013ApJ...772...26A
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Jarrett et al. 2017, https://iopscience.iop.org/article/10.1088/0004-637X/772/1/26/pdf
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