ASTR 5460, Fall 2013: Homework 7

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Directions: This homework is, I hope, our last research project, and will end in a publishable result (although it may still require more followup work). Working in groups of your choosing is fine. Due: Last class day, Dec. 5, or earlier.

Based on the last project, you should be able to pick a relatively narrow range in C IV equivalent width (EW) that can be found at all redshifts (z) in the SDSS Shen et al. (2012) catalog. That is, we want a sample that has the same average EW and shows no correlation with z. Find one and quantitatively show it has no variation with z (a number of ways: correlation coefficient, a linear fit with slope consistent with zero, etc.). Try to keep as many objects as possible, but the average should not change. Also check to see if the distribution is symmetric (or similarly shaped) for all z. Plot/tabulate the results from the above work.

Now we can skip all the dangerous line fitting and assume that the Baldwin effect will give us no correlation between continuum luminosity and z for this sample of "standard candles." Check it. I expect the scatter will be increased, however. Plot it and provide the numbers from the checks.

If there is a correlation with L-cont and z for this sample, check with me before proceeding. This part should be very easy for you by now, so do this early!

OK, now what we need to do is to compute luminosity distances for each object for different cosmologies. Confirm that you can calculate the luminosity distance for the Shen et al. (2012) cosmology (essentially the benchmark), and get their numbers. Then calculate luminosity distances for the alternative cosmologies presented in Reiss et al. (1998) for comparisons like they did. Plot the expected luminosity differences for these (3) models against redshift, normalizing them at some redshift (e.g. 2).

Now repeat the plot of Luminosity vs. z for your C IV EW sample, for each of the other 2 cosmologies. Is there now a significant correlation with redshift consistent with the cosmology change? Characterize this in a manner similar to Reiss et al.

Extra: we might be able to reduce the scatter in the luminosity of this sample if we also restrict FWHM in the restricted EW sample. There's a give and take here, as we want to keep as many objects as possible, but cut out outliers in FWHM. If we're not getting a clear, significant result with only restrictions in EW, try restricting the FWHM range as well.

Write up enough documentation I can tell what you've done. Remember that we probably still want to throw out BALQSOs, very noisy/uncertain objects, very red quasars, etc.

If we get a clear result, I'll lead an effort to write it up between semesters involving all of you as you have available time, but all will be co-authors. If there's no clear result, well, that happens doing real research, too.