The basics of proper motion measurements

Pages 6-13 in
http://faculty.washington.edu/ivezic/Teaching/Astr511/lec8.pdf

Quick comments on homework #1

- what a mess of submission formats (my fault!)
- please don't use profanities in your code - it will follow you (btw, and don't send emails or post on FB after a few drinks)
- always ask: what did I learn from this plot?
- contour diagrams often need hand tuning to reveal structure (please look at Meredith's version with seaborn.kdeplot)
- w/o model expectation for pm, it's hard to interpret results; e.g. do you want log or linear scale for pm histograms?
- when plotting y=x test, plot instead y-x vs. x
- the use of comments highly heterogeneous ("code written once, but read many times")
- "I tried to use these robust bins, but it distored my plots. I used 150, but any ideas?": that formula was for 1D histograms - for 2D it gives too many bins; try approx. sqrt(150) per coordinate
- chi2 vs. chi2dof
- Meredith: did you produce hdf5 format for HLC files?

Homework #2 (due Jan 23)

1) Both groups:

If you are looking towards RA=0, Dec=0, at a sample of halo stars with Mr=5 and r = 21:

a) what is their heliocentric distance?
b) what is their galactocentric distance?
c) what is the median and rms for their observed pmRA and pmDec?
d) what is the median and rms for their observed radial velocity

Hint: use the solar motion from Schonrich, Binney & Dehnen (2010) and astropy tools. See also section 2.6 in http://faculty.washington.edu/ivezic/Publications/Bond10.pdf

2) In the following, use: Group 1: HLC data; Group 2: NSC data

a) please see the r vs. RA diagram for stars with 0.3<g-i<0.4, color-coded by the median FeH, in page 49 (top left corner) in http://faculty.washington.edu/ivezic/Teaching/Astr511/lec8.pdf

It motivates the following analysis: for stars with 20.5 < r < 21, 0.3<g-i<0.4, compare pm distribution for bins 25 < RA < 40 and 0 < RA < 15.

b) Estimate systematic proper motion errors in HLC and NSC by analyzing the proper motion distributions and chi=pm/pmErr distributions (in both coordinates) for galaxies; if the medians are significantly different from 0, plot them as functions of R.A.

c) Systematic errors in HLC, NSC (and joint) proper motions can be also be gauged using ~10,000 quasars from the catalog DR12Q.fits from http://www.sdss.org/dr12/algorithms/boss-dr12-quasar-catalog/

plot the median and sigmaG vs. RA for RA and Dec proper motion components for quasars with 17 < r < 20 from that file (~1 deg wide bins in RA, but try a factor of 3 smaller and larger bins and discuss).

3) both groups together
The projection effects on proper motion distribution can be gauged using a mock sample produced by Scott Daniel using Mario's Galfast code: …/project/Stripe82_Galfast.txt.gz

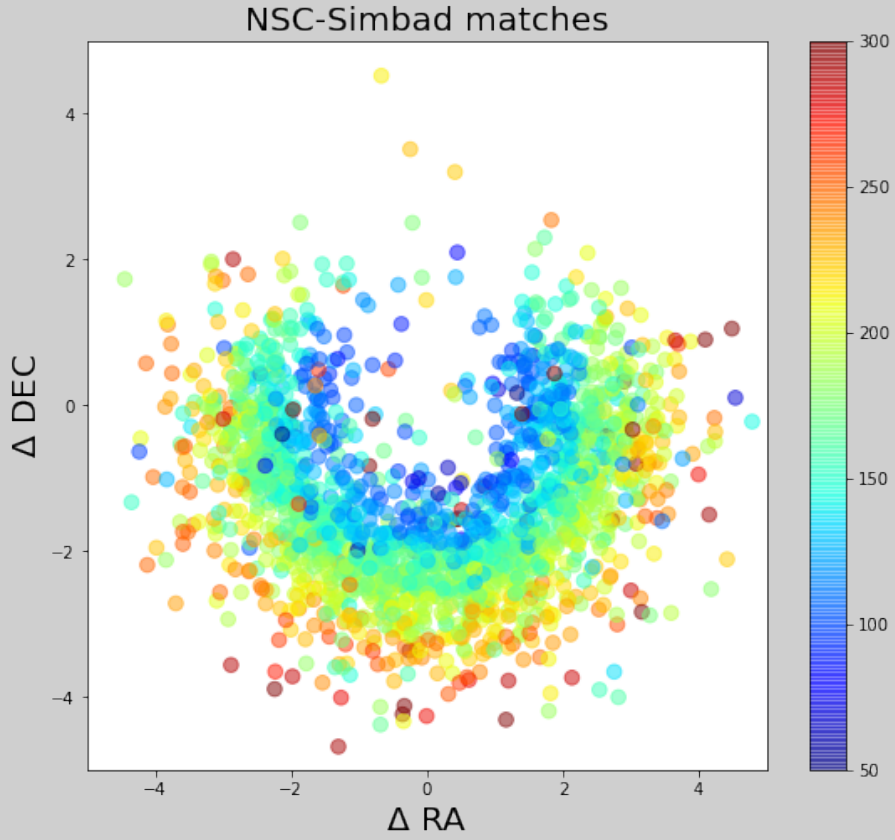
The content is described in the header (3,142,493 stars with $13 < r < 23$)

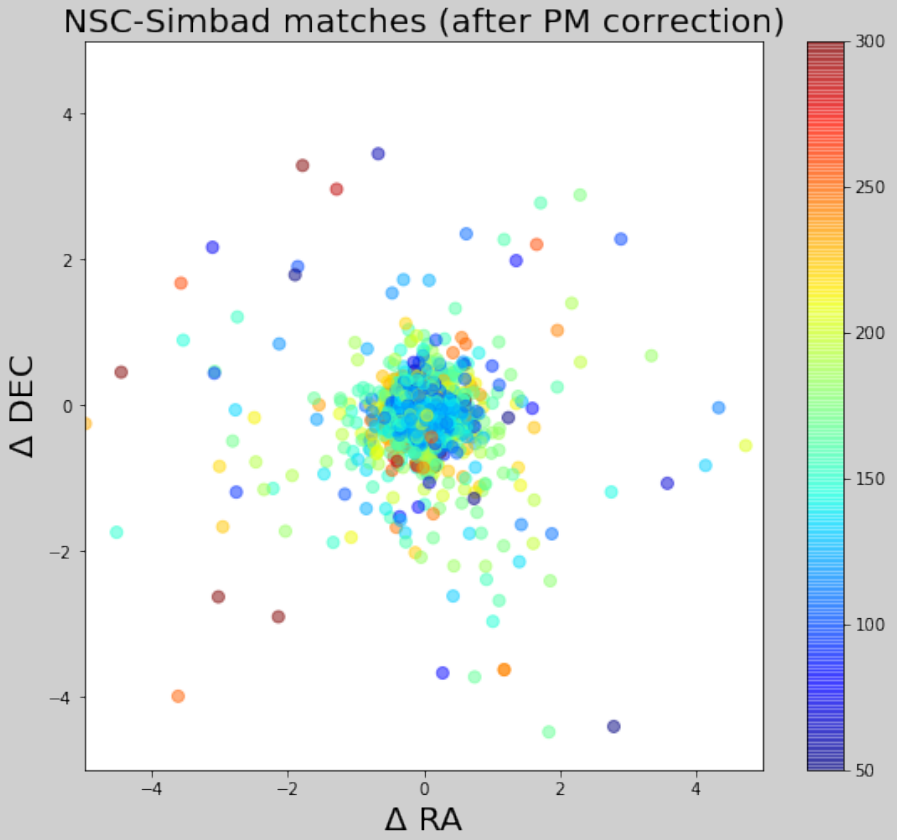
Compare the proper motion distributions for Stripe 82 stars with $20.5 < r < 21$, $0.3<g-i<0.4$, and RA bins $25 < RA < 40$ and $0 < RA < 15$.

4) both groups together

Match positionally the HLC and NSC catalogs; analyze whether the two sets of proper motions are statistically consistent. In particular, test whether accounting for proper motions decreases positional discrepancies, and whether HLC or NSC pm's are better in this case.

Hint: need to decide on matching radius, be careful about the faint limit, non-gaussianity, does chi2dof become ~1?…





NSC analysis by Arjun Dey (NOAO) and Joan Dey

Name your submissions HW2_lastname.ipynb
where “lastname” can also be group1 or group2’

If it’s easier, you can break it up into 4 notebooks,
HW2-part[1-4]_lastname.ipynb

Please do not push additional files and directories,
unless they are required to run the notebook!