

ERRATUM: “THE EIGHTH DATA RELEASE OF THE SLOAN DIGITAL SKY SURVEY: FIRST DATA FROM SDSS-III” (2011, *ApJS*, 193, 29)

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Section 3.5 of Aihara et al. (2011) described various sources of systematic error in the astrometry of the imaging data of the Sloan Digital Sky Survey (SDSS). In addition to these sources of error, there is an additional and more serious error, which introduces a large systematic shift in the astrometry over a large area around the north celestial pole. The region has irregular boundaries but in places extends as far south as declination $\delta \approx 41^\circ$. The sense of the shift is that the positions of all sources in the affected area are offset by roughly 250 mas in a northwest direction. We have updated the SDSS online documentation⁷² to reflect these errors, and to provide detailed quality information for each SDSS field.

In the Seventh Data Release of the SDSS (Abazajian et al. 2009), the astrometric calibration was performed with respect to the second data release of the United States Naval Observatory (USNO) CCD Astrograph Catalog (UCAC2; Zacharias et al. 2004), and a supplemental set of UCAC results in an internal USNO product known as “r14.” The UCAC r14 data were used for declinations northward of approximately 40° – 50° depending on right ascension. However, in the SDSS Eighth Data Release (DR8), we did not use the UCAC r14 catalog at high declination, but instead used the USNO-B catalog (Monet et al. 2003). The UCAC and USNO-B systems have a relative systematic offset of about 250 mas. The UCAC system is in much better agreement with the Tycho-2 system (Høg et al. 2000) of the *Hipparcos* astrometric satellite.

We have performed a detailed comparison of the large-scale differences in astrometry between the SDSS DR8 and the UCAC catalogs. In the regions not covered by UCAC2 (starting northward of roughly 41° declination), the DR8 astrometry is offset in the mean 240 mas to the north and 50 mas to the west relative to the r14 catalog. On scales of about $0.25'$, the rms scatter around this offset is about 80 mas in the declination direction and 94 mas in the right ascension direction. Some of that scatter is coherent on larger

⁷² <http://www.sdss3.org>

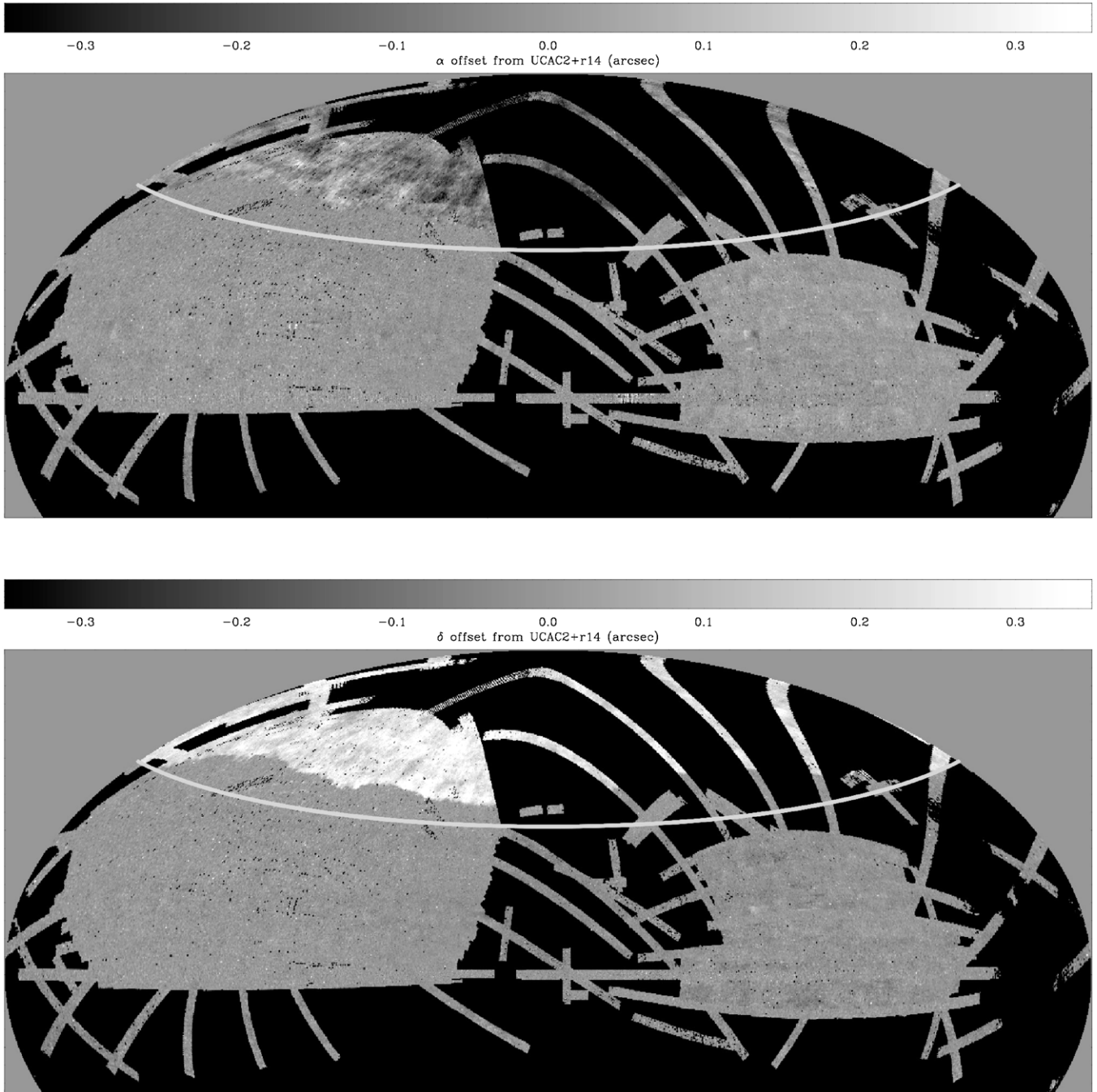


Figure 1. Difference between the coordinates of stars in the SDSS DR8 and those in UCAC2 (mostly south of $\delta = 41^\circ$) and r14 (mostly north of $\delta = 41^\circ$), represented in gray scale as a function of right ascension and declination. The top panel shows differences in right ascension and the bottom panel shows differences in declination. The differences have been smoothed on scales of about $0''.25$. The right ascension residuals are multiplied by $\cos \delta$ so that they are in units of proper angular distance. The residuals are shown in an Aitoff projection in equatorial coordinates. The gray line shows $\delta = 41^\circ$. Black areas are outside the DR8 coverage.

scales; if we unsharp-mask by subtracting off the residual field smoothed with a Gaussian ($\text{FWHM} = 3''$), the remaining rms scatter is about 60 mas in either direction. A similar analysis south of $\delta = 41^\circ$ yields very small offsets (less than 10 mas) between DR8 and UCAC2, with closer to the expected level of scatter (40 mas), and with no large-scale coherence to the scatter. These quantities include the effects of the systematic errors described in Section 3.5 of Aihara et al. (2011).

Figure 1 shows the nature and pattern of the DR8 offsets relative to the UCAC and r14 catalogs as a function of position on the sky. The effect on the proper motions published in DR8 of the new errors described here is relatively small, because the proper motions in both DR7 and DR8 are calculated relative to USNO-B anyway (using local recalibrations). However, as noted in Section 3.5, the other errors in astrometry do have an effect on the proper motions. In the region with large astrometric errors in DR8, there is no overall shift in proper motions relative to DR7 ($< 0.1 \text{ mas yr}^{-1}$), and on $0''.25$ scales the rms scatter is $\sim 1 \text{ mas yr}^{-1}$. In the unaffected regions, there is also no overall shift in proper motions, and the rms scatter is smaller, $\sim 0.4 \text{ mas yr}^{-1}$.

We recommend users requiring correct global astrometry in the affected areas to use DR7 astrometry where available; we provide matches to DR7 in the DR8 Catalog Archive Server (in the `photoPrimaryDR7` and `photoObjDR7` tables). We are repairing the errors in the DR8 astrometry and will publish improved astrometric quantities and proper motions.

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