

## 2. Data

In this section I describe optical and IR data that constitute a basis to this thesis.

### 2.1 SDSS and Stripe82

SDSS (York et al. 2000) is an imaging and spectroscopic survey of the Northern hemisphere with a dedicated 2.5 m telescope (Gunn et al. 2006) at Apache Point Observatory. Imaging is performed by 142 mega-pixel camera that uses the drift-scan mode in five broad optical filters – *ugriz* (Fukugita et al. 1996) spanning from 3000 to 10,000 angstroms. Integration of light goes in all 5 bands simultaneously and each scanline in each filter is later divided into individual 13.5' \* 13.5' images with effective exposure time 54.1 s. ~~Images are photometrically (Ivezic et al. 2004) and astrometrically (Pier et al. 2003) calibrated.~~

Single-pass images are ~~relatively~~ shallow (magnitude limit in r band is 22.2 AB) and thus is not suitable for our purposes. For that reason we shall use Stripe82, a ~300 sq.deg are on the Celestial Equator in the South Galactic Cap in the Fall (Adelman-McCarthy et al. 2007). Stripe82 is a deep survey stripe that spans  $20^{\text{h}} < \text{RA} < 4^{\text{h}}$  and  $-1.26 < \text{Dec} < 1.26$ . This area was repeatedly used for calibration purposes and was scanned 70-90 times depending on RA. The advantage of these multi-epoch images was quickly anticipated by various teams who stacked it and created co-added images. The first version of stacked images was done by Annis et al. 2011 and released in SDSS DR7. They combined images available by December, 2005 (20-35 runs) and achieved magnitude limit 1-2 mag deeper than single-epoch SDSS products. Several teams produced their own co-adds using different strategy for the selection and post-processing of images (e.g. Huff et al. 2011, Jiang et al. 2009). It is important to outline that images were taken under different photometric conditions (e.g. significant moonlight and poor seeing in several runs performed in 2005-2007). Jiang et al. 2014 (J14) released a new version of co-adds in which only images that had been taken under perfect photometric conditions were used. These co-adds that we shall use in our work are in general 0.2 mag deeper than in Annis et al. 2011 and 2 mag deeper than single-epoch SDSS images (see fig 7 in J14) and reach 25.1 Ab magnitudes in g-band at 5 sigma.

### 2.2 WISE

Wise (Wright et al. 2010) is ...

### 2.3 unWISE