THE TITLE OF YOUR PROJECT GOES HERE

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by

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The undersigned, appointed by the Dean of the Graduate School, have examined the Dissertion entitled:

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presented by Marat Musin,
a candidate for the degree of Doctor of Philosophy and hereby certify that, in their opinion, it is worthy of acceptance.

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ABSTRACT

This is the abstract of your dissertation project. It should not exceed one page.

Chapter 1

Data

SED fitting is now a standard technique of deriving stellar mass for a large set of galaxies. In this method multi-band photometry for a given galaxy is fitted to a series of a templates predicted by a certain population synthesis model. The best-fit template gives the parameters of the galaxy, including its redshift and mass. Historically, population synthesis models were using restframe optical photometry. One caveat is the degeneracy between the dust extinction and age of the stellar population, as both maje the color of galaxy red. Solution to this is to implement restframe near-IR where light suffers much less extinction (comparing to restframe UV and optical) and thus the degeneracy can be broken. The natural choice for us then is to use optical Sloan Digital Sky Survey (SDSS) and IR all-sky data from Wide-Field Infrared Survey Explorer (WISE).

1.1 SDSS

SDSS () was an imaging and spectroscopic survey with a dedicated 2.5 m telescope () at Apache Point Observatory. Imaging performed by 142 mega-pixel camera that

uses the drift-scan mode in five broad optical filters *ugriz* () spanning from 3000 to 10,000 Å. While the spectroscopic survey is still carried on, the imaging survey has been completed and by now their data covers 14,555 sq. degrees of unique sky area with pixel scale 0.396". Exposure time is 53.9 seconds per band. An SDSS run consists of six parallel scanlines. The skylines are 13.5' wide with the gaps between them of relatively same size. Two interleaving runs make stripe that consists of total 12 scanlines (columns).

1.1.1 Stripe 82

Single-pass images are 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.degree area on the Celestial Equator in the South Galactic Cap in the Fall (Adalman-McCarthy et al. 2007). Stripe82 is a deep survey stripe that spans $20h < RA < 4h$ and $-1.26 < Dec < 1.26$. This area was repeatedly used for calibration purposes and was scanned 70-90 times depending on RA. The advantage of these multiepoch images was quickly anticipated by various teams who stacked it and created co-added images. Annis et al () produced the first version of stacked images and it was released in SDSS DR7 (). They combined images available by December, 2005 (20-35 runs) and achieved magnitude limit 1-2 mag deeper then 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. Each of 5 bands consists of 12 columns with 463 $13.8' x 18.5'$ images (5556 images per band) with an average point-spread function FWHM of 1" in the r, i, and z bands.

1.2 WISE

WISE () was a near-IR space observatory that was launched in 2009 and mapped the entire sky with sensitivity far better than that of its predecessors, IRAS () and DIRBE (). With a 0.4 m telescope onboard always pointing at 90 degrees solar elongation, WISE made successful scans of the entire sky in four bands, namely w1 (3.4 micron), w2 (4.6 micron) , w3 (12 micron) and w4 (22 micron). Its observations have very wide range of applications from search of near-Earth asteroids and brown dwarfs to the studies of the most luminous galaxies in the Universe.

1.2.1 unWISE

WISE data are published as a set of co-added data. Atlas stacks were created by the WISE/NEOWISE team using the first 13 months of data (the AllWISE release) and are available at irsa.ipac.caltech.edu. Original images were intentionally blurred by the WISE point spread function (PSF) for better detection of deep single sources. But that leads to the blending problem in the crowded fields. Lang () has produced custom unWISE stacks analogous to the AllWISE Atlas images, but at the full spatial resolution of the instrument (2.75 arcsec).