A Survey of Local Group Galaxies Currently Forming Stars. I. UBVRI Photometry of Stars in M31 and M33

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We present UBVRI photometry obtained from Mosaic images of M31 and M33 using the KPNO 4-m telescope. We describe our data reduction and automated photometry techniques in some detail, as we will shortly perform a similar analysis of other Local Group galaxies. The present study covered 2.2 square degrees along the major axis of M31, and 0.8 square degrees on M33, chosen so as to include all of the regions currently active in forming massive stars. We calibrated our data using data obtained on the Lowell 1.1-m telescope, and this external method resulted in millimag differences in the photometry of overlapping fields, providing some assurance that our photometry is reliable. The final catalog contains 371,781 and 146,622 stars in M31 and M33, respectively, where every star has a counterpart in (at least) the B, V and R passbands. Our survey goes deep enough to achieve 1-2% photometry at 21st magnitude (corresponding to stars more massive than 20Mo) and achieves <10% errors at U~B~V~R~I~23rd mag. Although our typical seeing was only modest (0.8-1.4", median 1.0") by some standards, we find excellent correspondence between our catalog sources and those we see in our HST ACS data for OB48, a crowded region in M31. We compare our final photometry with those of others, and find good agreement with the CCD catalog of M31 stars by Magnier et al., although our study covers twice the area and goes about 2 mags deeper. The photographic studies of others fare less well, particularly at the faint end in V, where accurate background subtraction is needed for good photometry. We provide cross references to the stars confirmed as members by spectroscopy, and compare the location of these to the complete set in color-magnitude diagrams. While follow up spectroscopy is needed for many projects, we demonstrate the success of our photometry in being able to distinguish M31/M33 members from foreground Galactic stars. Finally, we present the results of a single night of spectroscopy on the WIYN 3.5-m telescope examining the brightest likely members of M31. The spectra identify 34 newly confirmed members, including B-A supergiants, the earliest O star known in M31, and two new Luminous Blue Variable candidates whose spectra are similar to that of P Cygni.

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Comments:

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