The revision of the MASS/DIMM star catalogue

N. Shatsky, V. Kornilov

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Abstract

The compilation of the (updated) version of the MASS (MASS/DIMM) device target catalogue is described. The new catalogue of 119 stars is presented together with criteria of star selection discussed in details. The comparison with previous version of the target catalogue is given.

With the expansion of the MASS-DIMM turbulence characterization technology, the need to revise the star catalogue of the device has become evident. Application to the measurements of atmospheric extinction, misidentification problems due to imperfect pointing of the feeding telescope, occasional lack of targets, red stars too faint for the measurements, etc have forced the MASS group to recompile the list of stars to be used with the device (especially in robotic mode).

The original list was compiled in early 2000-s given more or less the same ideas as follow here except that the fact of the MASS band being significantly bluer than Johnson's V was not taken into account. Meanwhile, a small effort has been made to clean the resulting list as a few experimental devices existing that time were used in manual mode only. With the advent of the numerous and automatic astroclimate monitors, the need for the thoughroughly refined catalogue become evident, but the observers put almost no attention to the potential problems coming from "bad stars". The experience with the e.g. Tololo data processing and installation of the own astroclimatic facility of the MASS group home institution at Caucasus has revealed the drawbacks of the list and gave birth to the new catalogue described here.

As input catalogue, the Bright Stars (5th Revised Ed., Hoffleit et al, 1991) is again taken, from which all stars down to Vmag=3.4 were extracted (260 objects). Then the list was cleaned according to following criteria:

I. Remove stars too faint for a MASS device. The device has the spectral band in between the Johnson's B and V bands). Here the color equation of the Sternberg device was taken: $MASSmag = Vmag + 0.45 * (B - V)$; stars with $MASSmag > 3.2$ were removed. This relation is somewhere in the middle of the range of the color equation slopes of other MASS devices (0.35 for MASS/DIMMs with filters to 0.6−0.8 in ESO MASS/DIMMs) so this filtering has not removed their potential targets.

II. The double stars with component V-magnitude difference less than 4 and separation between 0.3 arcsec and 4 arcmin were rejected. (Fainter stars does not introduce much light; closer

pairs scintillate synchronously; wider pair companions cannot drop into the MASS aperture simultaneously). The information on duplicity is collected from the BS catalogue itself and its notes.

III. Composite spectrum objects and 2 M-giants were removed since their spectral energy distributions cannot be represented by any of the "normal" ones used in MASS data processing.

IV. Stars revealing the large (> 0.2) formal color excess due to imperfectly determined spectrum class or strong interstellar absorption were also removed as those with warped spectral energy distribution.

V. Strongly ($V_{max} - V_{min} > 0.3$) variable stars were removed as making the extinction control violated and since their spectra and colors are also varying with time. Low-amplitude variables are left in the list with the notes (see below). This was made based on the GCVS4.2 catalogue data.

VI. A few targets were dropped which have close (< 1 degree) and brighter neighbour which can cause misidentification and pointing errors. In majority of such cases, the neighbouring stars are better MASS targets. The search for close (BS) objects was made using VizieR service of CDS; its results on relatively bright neighbours are presented in the notes to the star list (see below).

As a result of filtering presented above, the cleaned list contains 119 stars. We have to note that DIMM measurements demand only the criterion I) and partly II) to be fulfilled for successful seeing measurements. So, the list for the standalone DIMM measurements is more reach and may be compiled separately, given its own field of view and color sensitivity constraints.

Compared to the initial MASS star catalogue, 34 stars were removed and 22 added. Among removed, 21 star are faint (> 2.7V) red stars which have too low count in MASS apertures. Among 13 others, Zet UMa and Gam Cen are close doubles; Ups Sco removed being too close to Lam Sco; Bet Per, Eps Per are bright strong variables; 6 other removed variables are faint (> 2.8V); Zet Per and Zet Oph removed due to strong color excess.

Among stars added to the initial catalogues, there are 3 bright (Bet Ori, Bet Tau and Eps CMa) and 3 moderately bright (Alp And, Zet Pup and Alp UMi) stars. Half (11) of news are added blue stars with MASS mag 3.1−3.2. They can be measured with enough precision on clear skies when no other bright target available.

The spectral treatment might seem too complicated for such a "robust" technique as scintillations analysis. Meanwhile, special effort was made to study the role of the spectral band and uncertainties in its knowledge in the turbulence profile restoration (see `http://dragon.sai.msu.ru/mass/download/doc/mass_spectral_band_eng.pdf`). So, the observes are warned once again to maintain the correct color response curve of their device in the processing of the MASS data.

The new version of the MASS (MASS/DIMM) star catalogue is presented with the following table structure (we give the field name and the FORTRAN-like format; the fields are separated with a single space:

Field	TYPE	DESCRIPTION
HR	I4	Bright Stars catalogue number
Name	C7	Star name (from BS field, spaces replaced with underscore)
RAH2000	I2	Right ascension hour, J2000
RAM2000	I2	Right ascension minute, J2000
RAS2000	I2	Right ascension second, J2000
DECD2000	C3	Declination degree with sign symbol, J2000
DECM2000	I2	Declination arcminute, J2000
DECS2000	I2	Declination arcsecond, J2000
VMAG	F5.2	Johnson V-band magnitude
BV	F5.2	Johnson B-V color
SED	C3	Spectrum Energy Distribution code (see Turbina description)
SPTYPE	C13	Spectral type from BS
FL	C2	Flags: 'N' - close (<10') neighbour, '1' - variable ampl 0.04-0.09V, '2' - var. 0.1-0.19V, '3' - var. 0.2-0.27V
NOTES	C35	Close duplicity, variablity, neighbours distance, direction and V-magnitudes (found in 3x3 degree square)

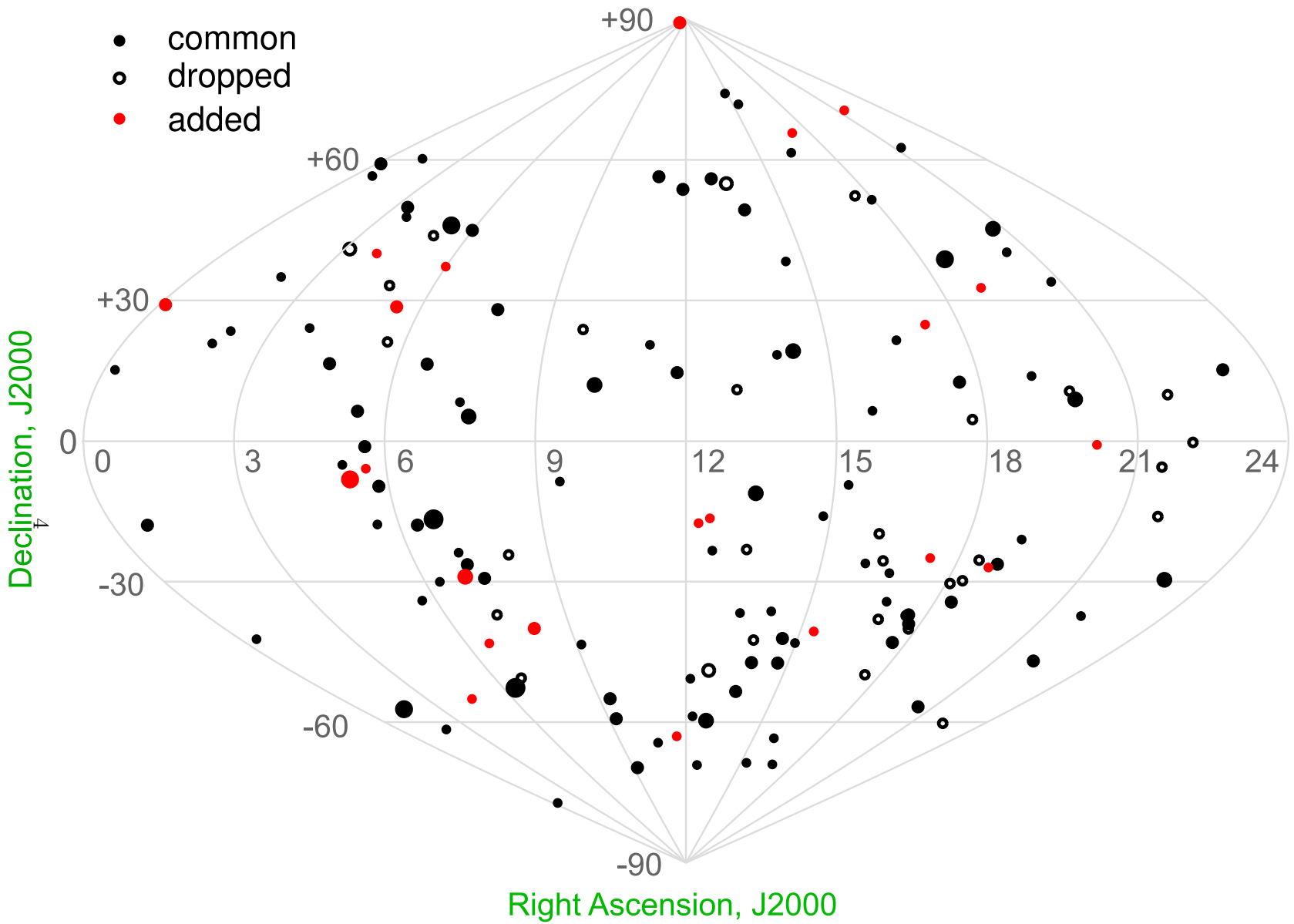

Figure 1: Distribution of MASS star catalogue stars on the sky. The stars added to the list are shown in red, removed targets are open circles. The size of the symbol denotes the MASS magnitude.