RevMexAA (Serie de Conferencias), **17**, 36–36 (2003)

THE RELIABILITY OF SHAPE MEASUREMENTS

M. Kleinheinrich[1,2], T. Erben[1], K. Meisenheimer[2], H.-W. Rix[2], M. Schirmer[1,3], P. Schneider[1] and C. Wolf[4]

Galaxy Evolution: Theory and Observations (Cozumel, Quintana Roo, México, 8-12 April 2002)
Editors: Vladimir Avila-Reese, Claudio Firmani, Carlos S. Frenk & Christine Allen

We use observations of the Chandra Deep Field South taken over two years with the Wide Field Imager at the MPG/ESO 2.2-m telescope on La Silla, Chile, to investigate how reliably shapes of faint objects can be recovered. This is a crucial test for all weak lensing studies where one uses small distortions of background galaxies to infer intervening mass distributions of galaxies, clusters of galaxies or large-scale-structure.

All observations were carried out in the R-band by the COMBO-17 project, the ESO Imaging Survey (EIS) and the GOODS project. We stack subsamples of the reduced images into seven independent sum-frames and all images into one very deep sum-frame using the drizzle algorithm. The characteristics of these sum-frames are given in Table 1. Ellipticities are measured and corrected for distortions from the PSF following the KSB algorithm (Kaiser et al. 1995)

TABLE 1

Name	Origin	Date	Exp.time [s]	PSF [″]
B1	COMBO17	10/99	14230	0.81
B2	EIS	12/99	6600	0.89
B3	COMBO17	02/00	3000	0.81
B4	COMBO17	02/00	5000	0.73
B5	COMBO17	09/00	8500	0.96
B6	COMBO17	01/01	3000	1.11
B7	GOODS	11/01	17000	1.04
deep			57140	0.89

To investigate the influence of exposure time and seeing on the shape measurements we compare B1 to B3 and B3 to B6. Figure 1 shows that in the case of good seeing and different exposure times the ellipticities can be recovered fairly well, and that the noise due to the shorter exposure time in B3 only increases the measured ellipticities slightly for objects common to both frames. So, longer exposure time will mainly give more objects but hardly improve the shape measurements. However, at different seeing conditions the ellipticities are recovered only for some of the objects while for other objects systematically larger ellipticities are measured on the frame with the worse seeing due to increased noise. We find that these are preferentially small or faint objects, for which the correction from the KSB algorithm is greatest. Further, the degree of discrepancy depends on the seeing in the two frames involved. We will investigate in more detail for which objects the shape measurements can be trusted (Kleinheinrich et al.).

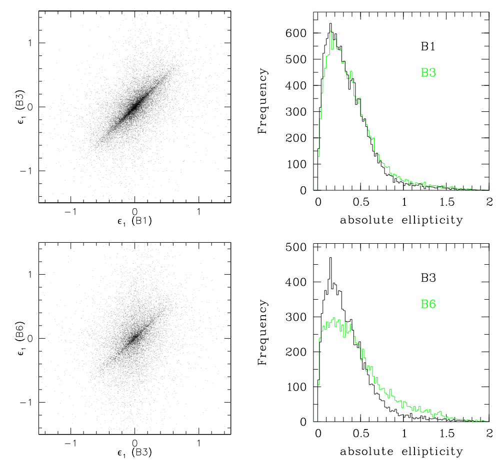

Fig. 1. Comparison of the measured ϵ_1-component (left panels) and histograms of the absolute ellipticities. Upper panels refer to B1/B3, lower panels to B3/B6.

We checked the shape measurements from the deep sum-frame against those from the sum-frames B1-B7 and found no systematic offsets. These could have been expected because the deep sum-frame is a composite of images with very different quality and PSF-patterns.

We conclude that the reliability of shape measurements is mostly dependent on the seeing conditions and that the KSB algorithm works well even for sum-frames obtained from very inhomogeneous data.

Support by the BMBF/DLR (project 50 OR 0106) is acknowledged.

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[1]IAEF, Universität Bonn, Auf dem Hügel 71, D-53121 Bonn, Germany (martina@astro.uni-bonn.de).
[2]Max-Planck-Institut für Astronomie Heidelberg, Germany
[3]Max-Planck-Institut für Astrophysik Garching, Germany
[4]University of Oxford, UK