

Multiband optical surface brightness profile decompositions of the Seyfert galaxies Mrk 79 and NGC 5548*

Boyko Mihov, Lyuba Slavcheva-Mihova
Institute of Astronomy, Bulgarian Academy of Sciences,
72 Tsarigradsko Chausse Blvd., Sofia 1784, Bulgaria
bmihov@astro.bas.bg
(Conference poster)

Abstract. We present preliminary results of the Johnson-Cousins (U) BVR I surface brightness profile decompositions of the Seyfert galaxies Mrk 79 and NGC 5548. The profiles were modelled as a sum of a Gaussian law for the nucleus, a Sérsic law for the bulge and an exponent law for the disk. A flat bar was added to the model profile of Mrk 79. The parameters and the total magnitudes of the structural components were derived.

Key words: Galaxies: individual: Mrk 79, NGC 5548 – Galaxies: Seyfert

Декомпозиции на многоцветни оптични профили на повърхностната яркост на Сийфърт галактиките Mrk 79 and NGC 5548

Бойко Михов и Люба Славчева-Михова

Представени са предварителни резултати от декомпозицията на Johnson-Cousins (U) BVR I профилите на повърхностната яркост на Сийфърт галактиките Mrk 79 and NGC 5548. Профилите са моделирани като сума от Гаусов закон за ядрото, закон на Серсик за бълджа и експоненциален закон за диска. Към моделния профил на Mrk 79 е добавен модел на плосък бар. Получени са параметрите и пълните звездни величини на структурните компоненти.

Introduction

We present the preliminary decomposition results for the Johnson-Cousins (U) BVR I surface brightness profiles of Seyfert galaxies. Observations and data reduction were described in Slavcheva-Mihova et al. [2005], the decomposition procedure was presented in Slavcheva-Mihova et al. [2006]. The data were obtained at the Rozhen National Astronomical Observatory of Bulgaria using the 2.0-m telescope and the Photometrics AT200 model CCD camera. Data reduction was done via ESO-MIDAS package and profiles were extracted by means of the modified version of FIT/ELL3 ellipse fitting command. Decompositions were done using unweighted non-linear least-squares method for the simultaneous fitting of the composite model profile to the observed one. The model profile library includes a Gaussian law for nuclei and rings, a Sérsic law for bulges, pure and truncated exponent laws for disks and a flat bar profile for bars (see Prieto et al. [1997]; Prieto et al. [2001]; Aguerri et al. [2005]). Spiral arms appear as bumps onto the disk-dominated part of surface brightness profiles. The data points corresponding to them were excluded from the fit through assigning zero weights. Different combinations of model profiles were used for the individual galaxies in order to get satisfactory fits to the observational profiles.

1 Results

1.1 Mrk 79

The surface brightness profiles of Mrk 79 were decomposed into a Gaussian nucleus, a Sérsic bulge, an exponent disk and a flat bar (see Fig. 1). The fitted model parameters

* Based on observations obtained at the Rozhen National Astronomical Observatory of Bulgaria operated by the Institute of Astronomy, Bulgarian Academy of Sciences.

Table 1. Fitted parameters of the bulge (effective surface brightness, μ_{eff} , effective radius, r_{eff} , and Sérsic power-law index, n) and of the disk (central surface brightness, μ_0 , and scale length, r_{scl}) components of Mrk 79 and NGC 5548.

Galaxy/Band/Epoch	μ_{eff} [mag arcsec ⁻²]	r_{eff} [arcsec]	n ...	μ_0 [mag arcsec ⁻²]	r_{scl} [arcsec]
Mrk 79/ <i>U</i> /Apr.'99	...	...	...	21.781 0.064	12.318 0.240
Mrk 79/ <i>B</i> /Feb.'99	...	...	...	21.604 0.025	13.194 0.077
Mrk 79/ <i>B</i> /Apr.'99	21.987 1.204	3.363 1.509	1.150 1.158	22.369 0.012	18.160 0.071
Mrk 79/ <i>V</i> /Feb.'99	18.530 0.578	1.326 0.226	1.994 0.193	21.143 0.013	14.582 0.051
Mrk 79/ <i>V</i> /Apr.'99	19.522 0.491	1.981 0.359	3.107 0.329	21.504 0.012	18.087 0.075
Mrk 79/ <i>R</i> /Feb.'99	19.528 1.564	2.463 1.445	1.659 1.553	20.911 0.021	16.380 0.093
Mrk 79/ <i>R</i> /Apr.'99	21.243 0.242	5.777 0.967	1.377 0.552	21.086 0.051	17.998 0.267
Mrk 79/ <i>I</i> /Feb.'99	22.420 0.684	14.666 5.144	7.637 2.333	20.262 0.027	15.990 0.334
Mrk 79/ <i>I</i> /Apr.'99	20.403 0.057	5.100 0.235	0.747 0.154	20.578 0.021	18.527 0.143
NGC 5548/ <i>U</i> /Apr.'99	...	...	...	...	...
NGC 5548/ <i>B</i> /Apr.'99	20.908 0.174	6.276 0.531	5.437 1.314	22.836 0.083	22.827 0.492
NGC 5548/ <i>V</i> /Apr.'99	21.008 0.551	9.161 2.672	4.564 1.273	22.138 0.254	19.580 1.026
NGC 5548/ <i>R</i> /Apr.'99	19.743 0.071	6.149 0.284	1.663 0.188	20.895 0.127	18.149 0.633
NGC 5548/ <i>I</i> /Apr.'99	19.753 0.307	8.573 1.452	3.701 0.558	20.721 0.169	20.537 0.260

Table 2. Fitted parameters of the bar (central surface brightness, μ_0 , bar length, r_{bar} , and scale length, r_{scl}) component of Mrk 79.

Galaxy/Band/Epoch	μ_0 [mag arcsec ⁻²]	r_{bar} [arcsec]	r_{scl} [arcsec]
Mrk 79/ <i>U</i> /Apr.'99	23.374 0.072	22.227 0.191	1.388 0.313
Mrk 79/ <i>B</i> /Feb.'99	23.239 0.041	21.884 0.114	1.376 0.138
Mrk 79/ <i>B</i> /Apr.'99	22.667 0.028	21.285 0.103	2.248 0.048
Mrk 79/ <i>V</i> /Feb.'99	22.095 0.016	20.287 0.069	2.034 0.045
Mrk 79/ <i>V</i> /Apr.'99	21.903 0.018	20.305 0.070	2.221 0.046
Mrk 79/ <i>R</i> /Feb.'99	21.263 0.044	19.738 0.167	2.495 0.086
Mrk 79/ <i>R</i> /Apr.'99	21.340 0.061	20.519 0.112	2.258 0.081
Mrk 79/ <i>I</i> /Feb.'99	21.016 0.026	19.768 0.064	2.114 0.046
Mrk 79/ <i>I</i> /Apr.'99	20.532 0.053	19.489 0.222	2.934 0.083

and their errors are listed in Table 1 and in Table 2; in all tables the errors of the parameters are listed next to their values. The total magnitudes of the structural components and their errors are listed in Table 3 (the total bar magnitude is not listed). Two regions of the profiles were excluded from the fit – these regions reflect the galaxy two-arm spiral structure. The spiral arms start from the bar end and for half a revolution pass close to the bar producing the first bump of the surface brightness profiles around $a = 30$ arcsec next to the bar end and then open through the disk producing the second bump around $a = 40 - 45$ arcsec.

1.2 NGC 5548

The surface brightness profiles of NGC 5548 were decomposed into a Gaussian nucleus, a Sérsic bulge and an exponent disk (see Fig. 2). The region of the surface brightness profiles around $a = 35$ arcsec is influenced by the galaxy spiral arms and was excluded from the fit. The fitted model parameters and their errors are listed in Table 1. The total magnitudes of the structural components and their errors are listed in Table 3.

Table 3. Total magnitudes of the nucleus, bulge and disk components of Mrk 79 and NGC 5548. The mean FWHM of the frame PSF, $\langle \mathcal{FW}_{\text{PSF}} \rangle$, and the standard deviation of the fit, σ_{fit} , are also listed.

Galaxy/Band/Epoch	Nucleus [mag]	Bulge [mag]	Disk [mag]	$\langle \mathcal{FW}_{\text{PSF}} \rangle$ [arcsec]	σ_{fit} [mag arcsec ⁻²]
Mrk 79/U/Apr.'99	14.139 0.013	...	14.333 0.077	4.185	0.063
Mrk 79/B/Feb.'99	14.747 0.012	...	14.007 0.028	3.224	0.050
Mrk 79/B/Apr.'99	15.368 0.194	16.594 1.549	14.078 0.015	3.975	0.017
Mrk 79/V/Feb.'99	15.322 0.320	14.888 0.686	13.328 0.015	3.119	0.021
Mrk 79/V/Apr.'99	15.853 0.319	14.781 0.629	13.222 0.015	3.687	0.016
Mrk 79/R/Feb.'99	14.311 0.467	14.633 2.017	12.844 0.024	3.234	0.030
Mrk 79/R/Apr.'99	14.340 0.045	14.589 0.437	12.814 0.060	3.205	0.017
Mrk 79/I/Feb.'99	14.336 0.115	12.858 1.024	12.247 0.053	3.138	0.012
Mrk 79/I/Apr.'99	14.085 0.026	14.304 0.115	12.244 0.027	3.494	0.015
NGC 5548/U/Apr.'99	...	...	...	3.495	...
NGC 5548/B/Apr.'99	14.170 0.106	13.370 0.253	14.048 0.095	2.906	0.042
NGC 5548/V/Apr.'99	14.321 0.085	12.741 0.839	13.683 0.278	2.679	0.044
NGC 5548/R/Apr.'99	13.397 0.032	12.860 0.123	12.605 0.148	2.470	0.036
NGC 5548/I/Apr.'99	14.025 0.070	11.740 0.479	12.163 0.171	2.535	0.034

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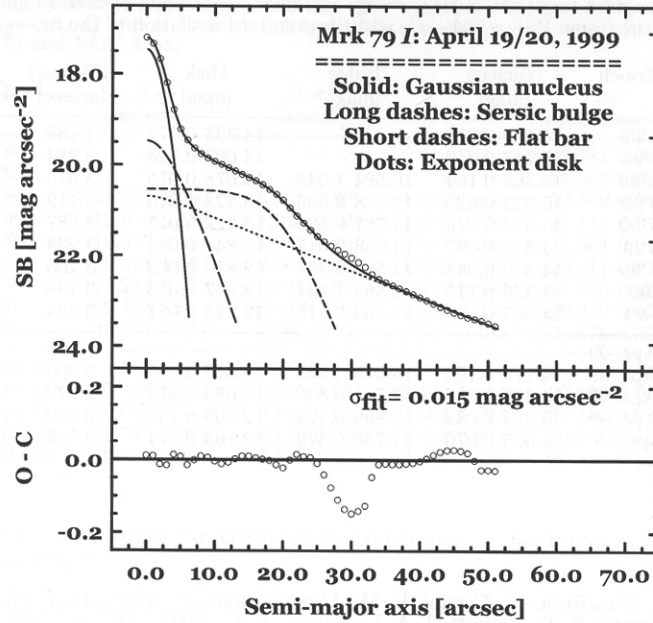


Fig. 1. *I* band surface brightness profile decomposition for Mrk 79. The open circle line is the observed profile and the solid line is the model one. Observed minus calculated profile, $O - C$, is also shown.

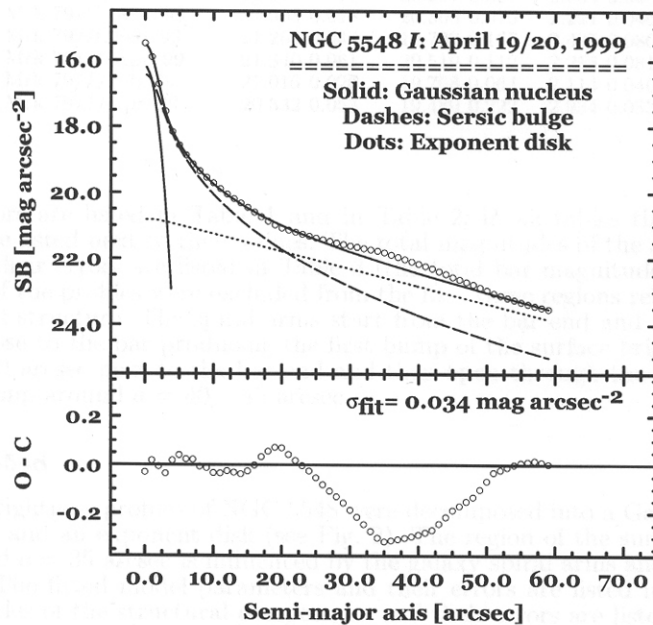


Fig. 2. The same as in Fig. 1, but for NGC 5548.