Galaxy Evolution: Theory and Observations (Cozumel, Quintana Roo, México, 8-12 April 2002)
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DUST ATTENUATION IN BULGE+DISK SYSTEMS

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We present new Monte-Carlo radiative transfer calculations aimed at quantifying the dust effects (absorption and scattering) on the total UV/optical/near-IR continuum emission from the stellar populations of an Sbc galaxy like the Milky Way (MW) and of its individual bulge and disk components, as a function of dust content and galaxy inclination.

The stellar bulge (disk) is modelled as a doubly-exponential spheroidal (disk). The scale-height of the stellar disk is assumed to increase with wavelength (λ), according to observational results available in the literature, twenty-five λ's (from 1000 Å to 3 μm) being considered. The mass model of the "typical" Sbc galaxy is taken from Dehnen & Binney (1998). The intrinsic (i.e., unattenuated by dust) spectral energy distribution of the stellar populations of bulge and disk is determined through PÉGASE (Fioc & Rocca-Volmerange 1997) in each case, consistently with reasonable constraints available in the literature for a galaxy like ours. The model galaxy is projected onto the sky-plane from ten different inclinations (from 0° to 90°). MW-type dust is assumed to be distributed within a doubly-exponential disk, either in a homogeneous medium or in a two-phase clumpy one (with clumps of fixed filling factor and density contrast). Six different values of the central V-band optical depth τ_V (i.e., dust mass) are considered (see Witt & Gordon 2000).

For the bulge, the disk and the galaxy as a whole, each simulation gives the attenuation function

$$\mathcal{A}_\lambda = -2.5\ log[f_\lambda(esc)], \tag{1}$$

$f_\lambda(esc)$ being the fraction of light at a given λ escaping from the system, either directly or after scattering by dust, in the direction to the outside observer.

For the same values of τ_V and i, $\mathcal{A}_\lambda$ is *different* for each structural component and the whole galaxy.

In Fig. 1, we reproduce the face-on correction for the observed B-band magnitude ($\Lambda_B^{i,0}$) of a typical Sbc galaxy of inclination i predicted by our models (solid lines) with a two-phase clumpy distribution of dust ($\tau_V = 0.25$, 0.5, 1, 2, 4, 8 from the b.r.c. to the u.l.c., respectively). The model results are systematically different from analogous standard *empirical* corrections, e.g. from Gavazzi & Boselli (1996) (dotted line) and Tully et al. (1998) (dashed line), which were determined statistically under the *simplistic* assumption that the dust is distributed homogeneously within the mid-plane cross-section of the disk.

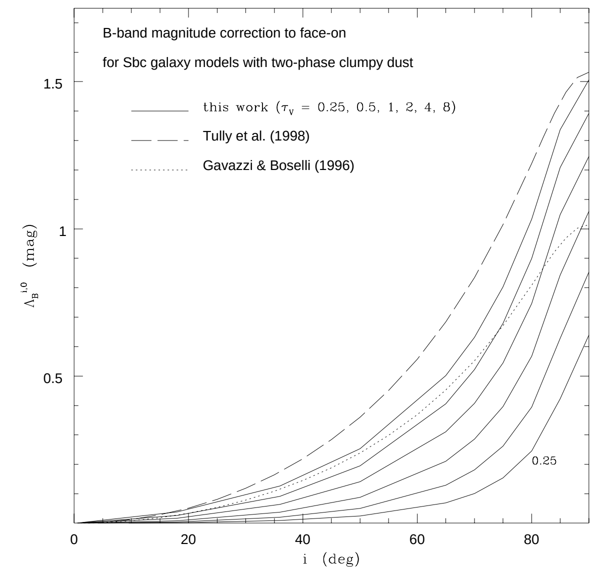

Fig. 1. Comparison of model and empirical corrections to face-on for the observed B-band magnitude of a typical Sbc galaxy with inclination i.

This result highlights the importance of a correct modelling of the dust effects on the determination of the intrinsic luminosity of a galaxy and e.g. the calibration of the Tully-Fisher (1977) relation, when different Hubble types are considered.

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