BIASES IN MASS ESTIMATES OF GROUPS OF GALAXIES

Gary A. Mamon
New York University

The knowledge of the masses of small groups of galaxies is important, because the timescales for collapse and virialization of groups depend on their mass-density. While the large inefficiency of the virial mass statistic is well known (Bahcall and Tremaine 1981, hereafter BT, and references therein), biases in the virial mass may produce wrong evolution timescales for small groups. These biases originate from group contamination by interlopers, and from the different galaxy and dark matter distributions inside the groups (caused by mass segregation). This second bias was first studied by Smith (1980, 1984) although already implicit in the work of Limber (1959). It formally arises because the ratio $2T/C$ where $C = \sum \mathbf{F}_\alpha \cdot \mathbf{R}_\alpha$ (the Clausius virial) is not the same for the luminous and global matter distributions. We illustrate here some quantitative aspects of this Limber bias from the output of N-body simulations of groups of 8 galaxies described elsewhere (Mamon 1986).

Table 1 below shows for the projected groups the median ratios of virial (luminosity weighted) and projected (BT) mass to total mass interior to the smallest sphere containing the centers of the galaxies.

Table 1

Initial Conditions	Group Density	Galaxy Type	Time (Gyr)	# in sample	M_{vir}/M	M_{pro}/M
Virialized	Dense	Halo	0.5	216	0.99	1.12
Virialized	Dense	Hubble	2	111	0.94	1.10
Virialized	Loose	Halo	20	267	0.89	1.01
Virialized	Loose	Hubble	20	264	0.81	0.91
Collapsing	Loose	Halo	20	195	0.98	0.87
Collapsing	Loose	Hubble	20	231	0.95	1.00

The numbers in Table 1 indicate that the median virial mass is a fair mass estimator, although it is generally too low by 10%. The projected mass also produces consistent values with a constant of $32/(\pi GN)$ in front of the sum of BT's equation (20). A similar result is reached by Heisler *et al.* (1986). The softening of the potential energy into a Clausius virial for dense groups of often overlapping galaxies has a negligible effect on the median mass estimate. Restricting the analysis to groups or subgroups of 4 galaxies produces similar results.

Bahcall, J. N. and Tremaine, S. 1981, *Ap. J.*, **244**, 805.
Heisler, J., Tremaine, S., and Bahcall, J. N. 1986, preprint, and in this volume.
Limber, 1959, *Ap. J.*, **130**, 414.
Mamon, G. A. 1986, to be submitted to *Ap. J.*.
Smith, H. 1980, *Ap. J.*, **241**, 63; 1984, in *Clusters and Groups of Galaxies*, p. 523.

J. Kormendy and G. R. Knapp (eds.), Dark Matter in the Universe, 114.