THE SPHERICAL HARMONICS AS AN ALTERNATIVE TOOL FOR DETERMINING THE KINEMATICAL PARAMETERS OF THE LOCAL MILKY WAY

M. HERNANDEZ-PAJARES[1], J. NUÑEZ[2]
1 Dp. Matemàtica Aplicada i Telemàtica, U.P.C.
Ap. 30002 Barcelona, Spain
2 Departament d'Astronomia i Meteorologia, U.B.
Av. Diagonal 647,08028 Barcelona, Spain

1. Introduction

The main objective of this work has been the connection between the Ogorodnikov-Milne model (OM) and the Spherical Harmonic development (SH) for different kinematic observables. This new approach allow us to benefit from the high orthogonality, easy extension to high orders and no appearance of the distance in the SH expansions; and also to benefit from the intrinsic meaning of the OM parameters. This work (a complete description will appear in Hernández-Pajares & Núñez, 1991, Astron. J., submitted) completes the theoretical studies started in Hernández-Pajares & Núñez (1990a, Astrophys. Space Science **170**, 187 and 1990b, *Error, bias and uncertainties in Astronomy*, ed. Jaschek and Murtagh, Cambridge Univ. Press, 339).

2. Developments and results

When the velocity components are analyzed without taking into account the distance we are studying their projection on the celestial sphere. We have demonstrated that the angular part of those can be expressed as a SH finite series. Also to maintain that dependence after the projection is necessary and sufficient that the density of number of stars be a product of a radial and an angular function: i.e. the Separability hypothesis. Under this hypothesis we have established the analytical relationships between the SH coefficients and the OM parameters for six kinematic observables.

In order to know if a given stellar sample is separable we have designed a Test based on the Inertia Matrix. We have applied it to the Bright Star Catalogue (Hoffleit, 1982, 4th ed., New Haven, Yale University Observatory) with $m_V \leq 6$ and $B\text{-}V \geq 0$, using the Bahcall and Soneira two-component model of the Galaxy (1980, Astrophys. J. Suppl. Ser. **44**, 73 and 1984, Astrophys. J. Suppl. Ser. **55**, 67). The result obtained clearly indicates that the complete sample fulfills the separability hypothesis. So it is feasible from an astronomical point of view.

Finally we have applied the new emergent strategy to a sample of more than 6000 stars with a residual velocity lower than 65 Km/s belonging the the kinematic catalogue compiled by Figueras (1986, Ph. Thesis, U. Barcelona). The results obtained are in agreement in several cases with others recent results of the literature and give additional estimations of galactic kinematic parameters. In the next future we will apply this procedure to small samples segregated in function of statistical and dynamic considerations (see for instance Hernández-Pajares and Monte, 1991, *Artificial Neural Networks*, ed. Prieto, *Lecture Notes in Computer Science*, Springer-Verlag, **540**, 422 and Cubarsí, 1990, Astron. J. 99, 1558.).