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SEARCHING FOR MOVING GROUPS WITH *HIPPARCOS*

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RESUMEN

Se presenta una búsqueda de grupos en movimiento en la vecindad solar. Se utiliza la base de datos de *HIPPARCOS* y un nuevo método de búsqueda llamado el *Método del Espaghetti.* Este método esta optimizado para utilizar toda y unicamente la información astrométrica dada por *HIPPARCOS*: posición en el cielo, paralaje y movimiento propio. Hemos determinado la efectividad del método aplicándolo a realizaciones de Monte Carlo de grupos en movimiento artificiales. El método ha sido utilizado para encontrar grupos en movimiento en la vecindad solar

ABSTRACT

We present a search for moving groups in the solar neighborhood. The search is done using the *HIPPARCOS* database and a new search method: *the Spaghetti Method.* This method is optimized to search using all, and only, the astrometric information provided by *HIPPARCOS*: position in the sky, parallax and proper motion. We have gauged the efectiveness of the method applying it to several Monte Carlo experiments with synthetic moving groups. This method has been used extensively to search for moving groups in the solar neighborhood.

Key Words: **ASTROMETRY: MOVING GROUPS**

The Hipparcos astrometric mission has provided us with a database of slightly more than 10^5 bright stars in the solar neighborhood, for which positions have been determined with a median uncertainty of 0.77 mas, parallaxes with a median error of 0.97 mas, and proper motions with a median precision of 0.88 mas/yr (ESA 1997). An important aspect of this database is that the astrometry is absolute all across the sky, thus opening up the possibility of searching for stars that share kinematics, regardless of their spread in the sky.

We have devised a maximum information method to search for moving groups in the *HIPPARCOS* database (Hoogerwerf & Aguilar 1999). The astrometry from *HIPPARCOS* restricts the tip of the velocity vector of a star to a line in velocity space parallel to the line of sight and offset from the origin by the implied tangential velocity vector. Any 3–dimensional velocity vector whose tip lies on this line will project on the plane of the sky to the measured tangential velocity vector. Errors in the measurement of the astrometric quantities will thicken this line into a cylinder of elliptical cross section (spaghetti).

Stars that belong to the same moving group, will share, whithin some intrinsic group velocity dispersion, the same 3–dimensional velocity vector and thus their respective spaghetti will intersect in velocity space. Since the probability of a chance intersection among random cylinders in 3–dimensional space quickly shrinkes as the number of cylinders increases, any prominent intersection will be a candidate moving group. A series of random realizations of the null hypothesis of no moving groups is used to assess the statistical significance of the suspect intersections (Fig. 1).

The method has been compared to the traditional convergent point method (de Bruijne 1999), and with the results obtained by Perryman et al. (1998) (P98) for the Hyades. It has also been used extensively by de Zeeuw et al. (1999) in their extensive search for OB associations in the solar neighborhood. Finally, Aguilar

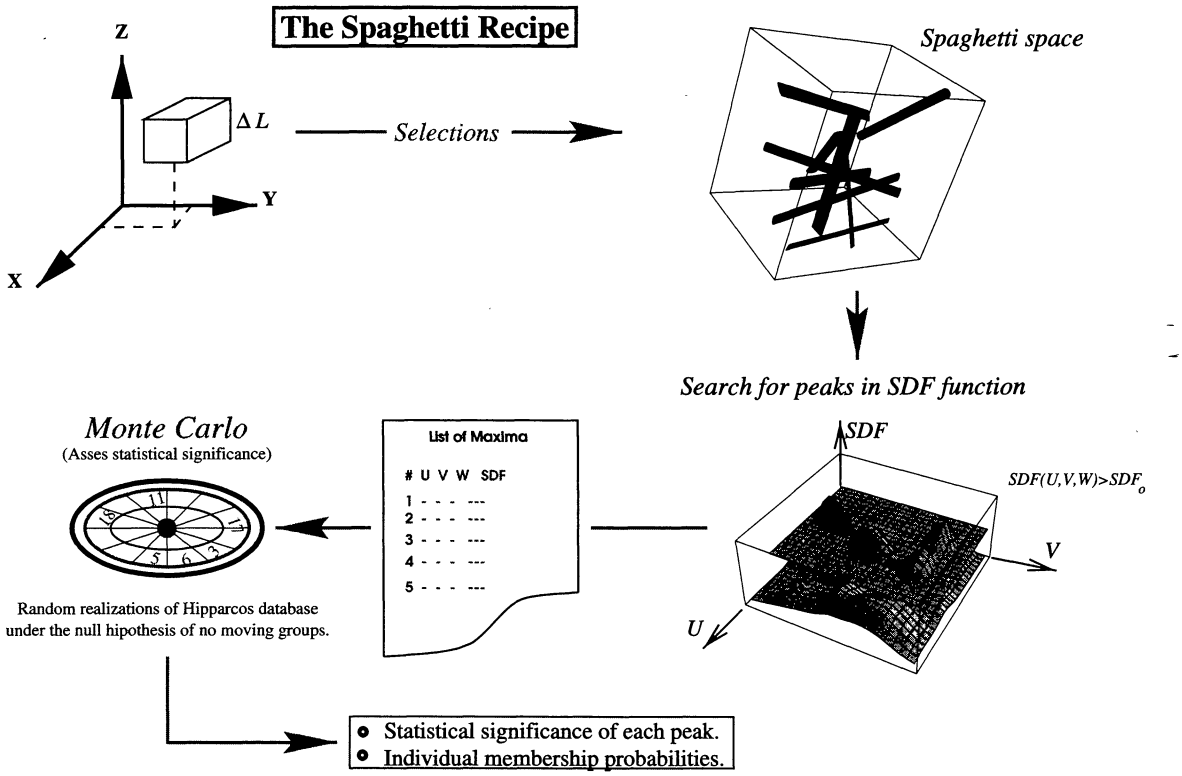

Fig. 1. The spaghetti Method: The first step is the selection of a volume in configuration space where a subsample is chosen according to user defined selection criteria. The spaghetti for each star is then computed and a Spaghetti Density Function (SDF) is defined as the sum of the probability densities contributed by each spaghetti. Peaks in the SDF above a given threshold value SDF_o are then identified as suspect moving groups. Monte Carlo experiments with synthetic surveys with no moving groups are then used to assess the statistical significance of each supect peak. Finally individual membership probabilities are computed.

& Hoogerwerf (1999) have used it to set upper limits on the velocity and number of members of putative halo moving groups passing within the solar neighborhood. In the case of the Hyades, the 3 components of the group velocity coincide within 0.3 km/s with those measured by P98, who had access to radial velocity information. Our method identifies 168 stars of which only 6 are not identified as Hyades members by P98.

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