VELOCITY STRUCTURES IN THE VERTICAL EXTENSIONS OF SPIRAL ARMS

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Yuan and Wallace (1973) explained the "Rolling motion" in galactic spiral arms by geometrical means as apparent, but not actual motions. Strauss and Poeppel (1976), however, could demonstrate, that these geometrical effects are not sufficiently large to produce the rolling motions. The aim of this investigation is to explain the remaining part of the rolling motion effect with the galactic fountain model (Bregman 198o).

Data
We use two 21-cm line surveys in the form of $(v,b)_l$ contour maps of brightness temperature; the Maryland Green Bank survey and the Berkeley survey. A two armed spiral (Simonson 1976) was assumed and the three-component galactic mass model of Rohlfs and Kreitschmann (1981) adopted for the calculation of the radial velocity field. We investigated the Perseus arm and measured the slope dv/db on the contour maps as well as the location of (v,b_o) of the spiral arm center and the extension Δb of the arm.

Discussion
After correcting for the geometrical effects (displacement, warp), we find $dv/db \neq o$ for $7o^o < l < 16o^o$ ($dv/dz > 2o$ km/sec/kpc); there are also large regions with $dv/db \sim o$ (Fig. 1). From these residuals a net velocity $v_z = (dv/dz)\,dz$ (velocity difference between the velocity at the height z and z = o) was calculated as a measure of the rising and falling motions. The net velocities (Fig. 2) could be compared with the velocity of a mass falling free from some height z to the galactic plane (Feitzinger, Kreitschmann 1982). They group reasonably well around the free fall velocities for different z heights. The distribution of star-forming sites reavels concentrations of young objects in regions with great v_z velocities, so that a model with rising and falling gas (Bregman 198o) seems to be adequate. The remaining part of the apparent rolling motion can be attributed to such phenomena.
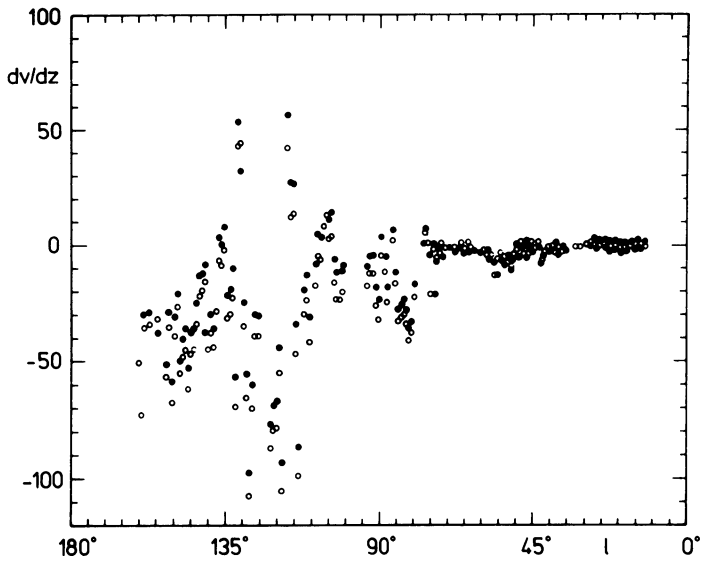
Fig. 1 Observed velocity gradients dv/dz in the Perseus arm with (dots)
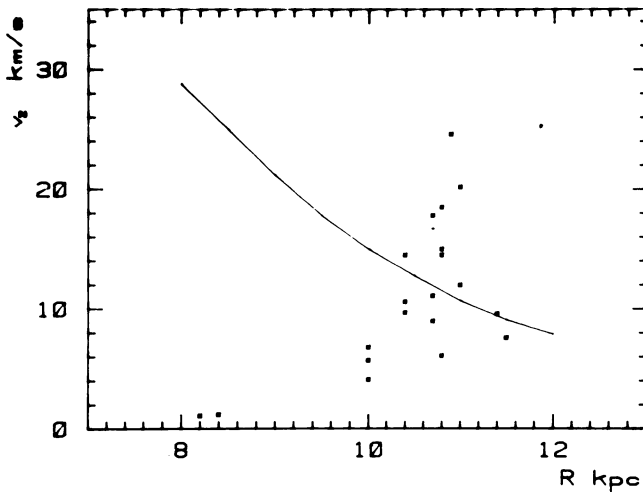   and without (circles) geometrical corrections.

Fig. 2 Velocity distribution $v_z(R)$ for z = o.3 kpc; the solid line is
       the free fall velocity

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