VELOCITY DISPERSION AND THE STABILITY OF GALACTIC DISKS

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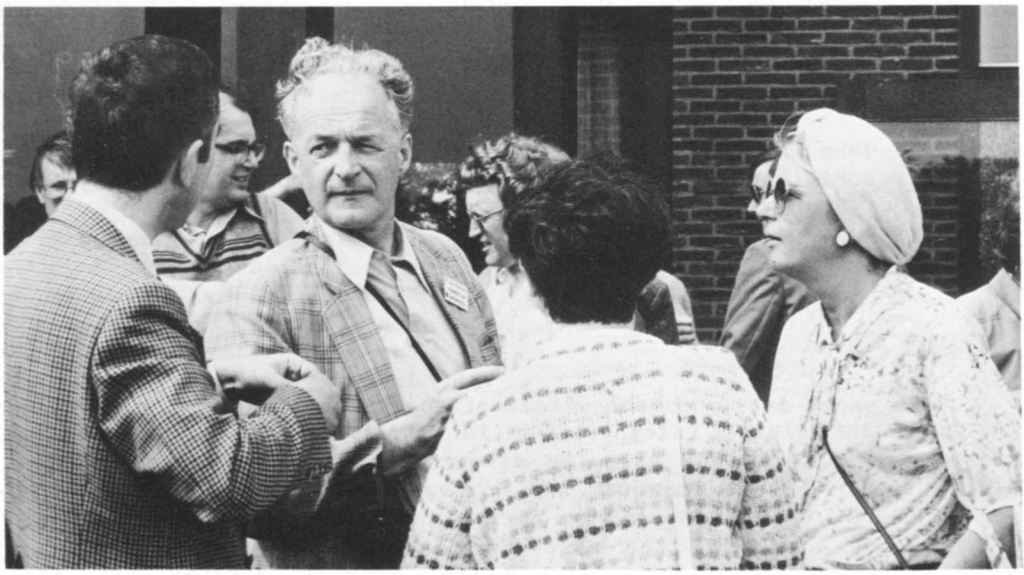
ABSTRACT

This paper estimates the effect of the stellar velocity dispersion on local and global instabilities in galaxy disks. Measurements of rotation velocities and velocity dispersions are illustrated for the disks of NGC 488 (Illingworth and Kormendy, in preparation), NGC 936 and NGC 1553. These are used to derive the Toomre stability parameter Q, i.e. the ratio of the observed dispersion to that needed for marginal stability against local modes. In both NGC 488 and 1553, Q = 2.5 - 4, depending on the assumed mass-to-light ratio. These values larger than 2 imply that the stellar disks are stable, although the gas in NGC 488 may remain unstable. This is consistent with the observation that both galaxies largely lack coherent spiral structure: NGC 1553 is an SO and NGC 488 a flocculent spiral. The SBO galaxy NGC 936 is more extreme: Q = 5 (estimated error is a factor of two). This is consistent with Sellwood's suggestion that a bar heats the disk until it is too hot to support spiral structure. In contrast to the above galaxies, Toomre has shown that our Galaxy has Q = 1.6 ± 0.5 near the Sun. It is therefore responsive enough to make spiral structure, as observed.

We also explore the stellar kinematics of the disk of NGC 1553 as a function of radius. The exceptionally strong lens component in this galaxy is very hot. At half of the radius of the lens the velocity dispersion appears to be large enough to have an effect even on global stability.

H. van Woerden et al. (eds.), The Milky Way Galaxy, 541.



Roland Wielen (left) and Hugo van Woerden discuss scientific program during excursion, with Ute Wielen and Ria van Woerden (right) listening. Background, left to right: Bruce Elmegreen, John Kormendy, Garth Illingworth, Eli Brinks. LZ

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