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Gravitational stability and dynamical overheating of stellar disks of galaxies

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We use the marginal stability condition for galactic disks and the stellar velocity dispersion data published by different authors to place upper limits on the disk local surface density at two radial scalelengths $R=2hR_d$. Extrapolating these estimates, we constrain the total mass of the disks and compare these estimates to those based on the photometry and color of stellar populations. The comparison reveals that the stellar disks of most of spiral galaxies in our sample cannot be substantially overheated and are therefore unlikely to have experienced a significant merging event in their history. The same conclusion applies to some, but not all of the S0 galaxies we consider. However, a substantial part of the early type galaxies do show the stellar velocity dispersion well in excess of the gravitational stability threshold suggesting a major merger event in the past. We find dynamically overheated disks among both seemingly isolated galaxies and those forming pairs. The ratio of the marginal stability disk mass estimate to the total galaxy mass within four radial scalelengths remains within a range of 0.4--0.8. We see no evidence for a noticeable running of this ratio with either the morphological type or color index.

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