Studying the local stability parameter of the two-component galactic disc

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Gravitational stability plays a crucial role in galaxy structure and evolution. While early studies relied on one-fluid models to estimate the stability parameter Q, real galaxies require a two-fluid approach as the low dispersion of interstellar gas can significantly reduce stability despite its low mass fraction (Jog & Solomon 1984). Different formulations have been followed by various groups for finding stability parameter, Q_{sg}, for a two-fluid model. Among these different models, most followed one is Wang-Silk approximation. However, Jog (1996) pointed out that this approximation results from an incorrect analysis and can lead to an error of 40% in determining Qsg. Also, most of previous studies only show radial variation of Qsg. Here, through these studies, we provide a more accurate description of stability parameter Q_{sg} following method of Jog (1996) and produce spatially resolved maps of Q_{sg} to explore different science cases, e.g., effect of gas mass fraction on stability of galactic disk as anticipated by Jog (1996); a comparison of two-fluid vs one-fluid model with observed galaxies; impact of stability parameter on star formation in a resolved way; and study of typical size-scale of star-forming regions.