Title:	A modified WKB formulation for linear eigenmodes of a collisionless self-gravitating disc in the epicyclic approximation
Authors:	Gulati, M. (/jspui/browse?type=author&value=Gulati%2C+M.) Saini, T.D. (/jspui/browse?type=author&value=Saini%2C+T.D.)
Keywords:	Waves Galaxies: kinematics and dynamics Methods: analytical
Issue Date:	2016
Citation:	Monthly Notices of the Royal Astronomical Society,460(1),pp.1019-1032.
Abstract:	The short-wave asymptotics (WKB) of spiral density waves in self-gravitating stellar discs is well suited for the study of the dynamics of tightly-wound wavepackets. But the textbook WKB theory is not well adapted to the study of the linear eigenmodes in a collisionless self-gravitating disc because of the transcendental nature of the dispersion relation. We present a modified WKB theory of spiral density waves, for collisionless discs in the epicyclic limit, in which the perturbed gravitational potential is related to the perturbed surface density by the Poisson integral in Kalnaj's logarithmic spiral form. An integral equation is obtained for the surface density perturbation, which is seen to also reduce to the standard WKB dispersion relation. Although our formulation is general and applies to all discs, we present our analysis only for nearly Keplerian, low-mass, self-gravitating discs revolving around massive central objects, and derive an integral equation governing the slow precessional modes of such discs. For a prograde disc, the integral kernel turns out be real and symmetric, implying that all slow modes are stable. We apply the slow mode integral equation to two unperturbed disc profiles, the Jalali–Tremaine annular discs, and the Kuzmin disc. We determine eigenvalues and eigenfunctions for both m = 1 and m = 2 slow modes for these profiles and discuss their properties. Our results compare well with those of Jalali–Tremaine.
URI:	https://academic.oup.com/mnras/article/460/1/1019/2608995 (https://academic.oup.com/mnras/article/460/1/1019/2608995) http://hdl.handle.net/123456789/2521 (http://hdl.handle.net/123456789/2521)
Appears in Collections:	Research Articles (/jspui/handle/123456789/9)

Files in This Item:

File	Description	Size	Format	
Need to add pdf.odt (/jspui/bitstream/123456789/2521/1/Need%20to%20add%20pdf.odt)		8.63 kB	OpenDocument Text	View/Open (/jspui/bitstream/12345

Show full item record (/jspui/handle/123456789/2521?mode=full)
(/jspui/handle/123456789/2521/statistics)