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Mass-imbalanced three-body systems in 2D: bound states and the one-body density

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Quantum systems composed of three particles with attractive zero-range pairwise interactions are considered for general masses and interaction strengths in two dimensions (2D). The number of bound states in a 2D three-body system increases without bound as the mass of one particle becomes much lighter than the other two. The adiabatic approximation provides an analytic form of the effective potential between the heavy particles, which explicitly shows the mass-dependence of the number of bound energy levels. An exact analytic expression for the asymptotic behavior of the spectator function in the Faddeev equation is derived, with that the large momentum form of the one-body density of the mass imbalanced system is studied. The coefficients of the leading and sub-leading order in the large- momentum expansion of the one-body density, that are called two- and three-body contact parameters, are defined and the two-body parameter is found to be independent of the quantum state in some specific 2D systems.

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