

N-body Simulations of Double-barred (S2B) Galaxies From Cold Inner Disks

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N-body simulations are good approaches to further our understanding of the formation and evolution of double-barred galaxies. Previous simulations normally need dissipative components or rotating pseudo-bulges to generate S2B structures. Here we report our pure-disk N-body simulations of S2Bs. Based on sets of simulations, a dynamical cold inner disk seems to be one of the essential conditions to form S2Bs. The long-lived S2B galaxies, in our simulations, show comparable dynamical properties with previous observations and analyses. The most interesting kinematic feature, presented in our double-barred models, is the $\sigma - humps$ beside inner bars. $\sigma - humps$ are always tightly coupled with inner bars, which might offer a possible mechanism of $\sigma - hollows$ and $\sigma - drops$ by secular evolution for the first time. These initial conditions also shed some light on the formation mechanism of S2B galaxies.