Title: Shell galaxies
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Abstract: Stellar shells observed in many giant elliptical and lenticular as well as a few spiral and dwarf galaxies presumably result from radial minor mergers of galaxies. We show that the line-of-sight velocity distribution of the shells has a quadruple-peaked shape. We found simple analytical expressions that connect the positions of the four peaks of the line profile with the mass distribution of the galaxy, namely, the circular velocity at the given shell radius and the propagation velocity of the shell. The analytical expressions were applied to a test-particle simulation of a radial minor merger, and the potential of the simulated host galaxy was successfully recovered. Shell kinematics can thus become an independent tool to determine the content and distribution of dark matter in shell galaxies up to ~100 kpc from the center of the host galaxy. Moreover we investigate the dynamical friction and gradual disruption of the cannibalized galaxy during the shell formation in the framework of a simulation with test particles. The coupling of both effects can considerably redistribute positions and luminosities of shells. Neglecting them can lead to significant errors in attempts to date the merger in observed shell galaxies.

Keywords: galaxies: kinematics and dynamics, galaxies: interactions, galaxies: evolution, methods: analytical and numerical