The Origin of Saturn's Rings Revisited

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A set of key observations over the Cassini spacecraft's tenure has constrained Saturn's rings' age to be less than a few 100 Myr effectively ruling out currently accepted ring origin scenarios, all of which require that the rings are ancient or primordial. We propose a new scenario motivated from evidence of a comparably recent dynamical instability ~100 Myr ago which would have led to collisions between Saturn's pre-existing mid-size icy moons, opening the door to possible ring formation during that epoch. Successfully testing this scenario requires better understanding of collisional outcomes. Toward that end, we introduce a new suite of simulations modeling impacts between Saturn's icy moons using the next generation smoothed hydrodynamical and gravity code \textit{SWIFT}. The unprecedented spatial resolution achieved in these simulations ($10^{8.5}$ particles within the simulation box) allows us to depict the myriad of gravitationally bound objects formed during icy moon collisions which may afterwards evolve both thermally and dynamically to re-accrete or collide with other bodies. Our unprecedented high resolution further allows us to determine a size distribution of fragments which can be used to inform crater impact distributions on newly accreted or remaining moons.