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Skyler C Simmons* (xinkaisen@gmail.com), 275 TMCB, Brigham Young University, Provo, UT 84602. *A new family of linearly stable periodic simultaneous binary collision orbits in the two-dimensional four-body problem.*

Recently, periodic orbits involving collisions between pairs of bodies have been receiving more and more attention. Beginning with a periodic three-body equal-mass collinear orbit established numerically by Schubart (1956), there have been many papers establishing results of unequal-mass variations of this orbit, including linear stability (Hietarinta & Mikkola 1993, Saito & Tanikawa 2007, 2009, 2010) and analytic existence (Venturelli 2008, Moeckel 2008, Shibayama 2011). A four-body collinear variation of this orbit was discovered numerically (Sweatman 2002, Sekiguchi & Tanikawa 2004). Numerical linear stability for this orbit has also been established (Sweatman 2006) as well as analytic existence (Ouyang & Yan, 2011).

In this presentation, we will show a class of two-dimensional periodic orbits of four bodies with simultaneous binary collisions between the masses. We will begin by showing the four-body orbit with equal masses and provide an outline of the analytic proof of its existence. We will then show the symmetric mass case, wherein the masses are symmetric with respect to a 180-degree rotation about the origin. Lastly, we will introduce the stability technique of Roberts and show its application to our problem, demonstrating stability for an interval of mass ratios. (Received August 22, 2011)