A STUDY OF THE HIGH-INCLINATION POPULATION IN THE KUIPER BELT. I. THE PLUTINOS

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Introduction: The dynamical stability and evolution of the Plutinos with high inclinations ($10^\circ \leq i \leq 90^\circ$) are systematically explored. We first analyze the basic features of the 2:3 Neptune mean motion resonance(NMMR), to measure the variations of the stable libration centers and the minima of resonant amplitudes for different *i*. The contours of the resonant amplitudes on the plane of the semimajor axis and *i* are mapped out numerically. We then investigate the stable region in the 2:3 NMMR using the N-body simulation. We find that, for all prograde orbits, the survival Plutinos over the age of the Solar system are always present. Such new finding has been coupled to the resonant capture process of highly inclined objects within the planet migration model. Our results show that: (1) the 2:3 NMMR trapping is allowed for all *i*. The capture probability decreases first with the increase of *i*, but then raises instead when *i* exceeds ~50°; (2) Plutinos should have obtained their large *i* prior to the resonance capture; (3) the 7:11 inclination-type resonance rather than the Kozai resonance could be responsible for the nearly-circular Plutinos with $15^\circ < i < 50^\circ$; (4) Objects with $i > 50^\circ$ can hardly sustain in the Kozai resonance during the outward tranport. Lastly, we discuss the implications for Plutinos with extreme inclinations in the future surveys.