Abstract

All four giant planets have satellites with large inclined eccentric orbits that are known as irregular moons. This thesis contains the results of searches for irregular moons around two of the giant planets, Jupiter and Saturn. Both searches consisted of stacking multiple images to detected moons smaller than have been discovered before. From a square degree field 52 jovian moon candidates were found, of which seven were linked to known moons. From two 1 square degree fields 120 saturnian candidates were found, with 40 of them linking to previous discoveries.

Extrapolating the detections to the entire irregular moon populations of both gas giants, there are (to within a factor of 2) 600 jovian moons down to a diameter of 0.8 km, and 150 ± 30 saturnian moons down to a diameter of 2.8 km. Both sets of detections were used to create luminosity functions of the two irregular moon populations. At the faintest magnitudes of both luminosity functions, exponential indexes α were measured to be 0.29 ± 0.15 and $0.78^{+0.14}_{-0.12}$, corresponding to a differential diameter power law of indexes $q \simeq 2.5$ and $\simeq 5$ respectively. These slopes imply that the jovian irregular moon population is in collisional equilibrium and the saturnian population had a recent (0.1-2.8 Gyr) large collision.