

# **An interplanetary mission to Neptune System I: Analysis of trajectories to Neptune using gravity assists**

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At the present time the search for the knowledge of our Solar System continues effective. So, in July 1st, 2004, the international Cassini-Huygens Mission spacecraft entered into orbit around the planet Saturn and in January, 2005, send data from the Huygens probe which is studying Saturn's largest moon, Titan. On January 19, 2006, occurred the launch of the New Horizons spacecraft to Pluto and Charon. NASA's Solar System Exploration theme listed a Neptune mission as one of its top priorities for the mid-term (2008-2013). The gravity assist is a proven technique in interplanetary exploration, as exemplified by the missions Voyager, Galileo, Cassini etc. Here, a mission to Neptune for the mid-term (2008-2020) is proposed, with the goal of studying several schemes for the mission. A direct transfer to Neptune is considered and also Venus, Earth, Jupiter, and Saturn gravity assists are used for the transfer to Neptune, which represent new contributions for a possible real mission. We show several schemes with and without braking near Neptune, in order to find a good compromise between the  $\Delta V$  and time of flight to Neptune. Besides taking advantage of asteroid flyby opportunities, when the spacecraft passes through the asteroid belt. To incorporate an asteroid flyby, we first need to optimize a trajectory to Neptune with planetary flybys and then search for asteroids that pass close to this trajectory, to finally reoptimize the trajectory including one or more asteroid flybys