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Author: Prof. Gregory Matloff
New York City College of Technology, United States, GMatloff@citytech.cuny.edu

SOLAR SAILING TO THE SUN'S INNER GRAVITY FOCUS: A DESIGN STUDY

Abstract

Solar Sailing to the Sun's Inner Gravity Focus: A Design Study

Dr. Gregory L. Matloff, GMatloff@citytech.cuny.edu

Associate Professor Emeritus Adjunct Associate Professor, Physics Dept. New York City College of Technology, CUNY, 300 Jay St., Bklyn, NY 11201, USA

The next extrasolar destination after the heliopause at 200 AU is likely to be the Sun's inner gravity focus at 550 AU. At solar distances beyond this point, electromagnetic radiation from celestial objects occulted by the Sun will be concentrated in a highly amplified narrow beam. This effect of general relativity will be of interest to SETI researchers, astronomers seeking to image nearby extrasolar planets, explorers of the near fringe of the Oort Comet Belt and designers of interstellar relays. In this paper, an algorithm is developed allowing one to calculate interstellar cruise duration to this destination for solar sail craft launched from initially parabolic solar orbits and always oriented normal to the Sun as a function of perihelion distance, payload mass, sail area, reflectivity and areal mass thickness. It is assumed that a significant fraction of payload mass is devoted to a xenon-fueled radioisotope electric rocket to allow cross-range capability ≥ 550 AU from the Sun. It is shown that travel times to 600 AU approximate 5-7 decades for reasonable values of the parameters considered.