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LESSONS LEARNED ABOUT THE SOLAR GRAVITY LENS AT THE KISS-ISM 2014-2015 WORKSHOPS

Abstract

The Keck Institute for Space Sciences (KISS) at Caltech run two seminars on September 8-11, 2014, and January 13-15, 2015, about designing a new probe to explore the InterStellar Medium (ISM). The primary goals of this new robotic space mission are intended to be:

1) Travel as far as possible away from the Sun at a speed about ten times higher than the Voyager I and II speed. The direction of exit out of the solar system still was to be decided.

2) Explore the physics of the heliosphere up to the heliopause and beyond into the interstellar medium, both of which are expected to be located at distances smaller than 500 AU (half a light week).

3) Possibly, have the spacecraft surviving up to 550 AU (sphere of the Sun Gravity Lens) and even beyond that to 1000 AU to measure in situ for the first time ever the Sun Gravity Lens focusing predicted by General Relativity.

In this paper we describe some lessons learned at those two Workshops regarding the Sun Gravity Lens:

a) First of all its use for keeping the telecommunication link between the Earth and any future truly Interstellar Mission by exploiting the Sun as a huge radio antenna, the ONLY antenna capable of assuring robust radio telecommunications across interstellar distances up to 10 light years away or more.

b) Another use of the Sun Gravity Lens in the optical frequencies is to visualize hugely magnified picture of extrasolar planets lying on the other side of the Sun with respect to the spacecraft position. This is a rather new and recent field of mathematical modelling since the approximation of geometric optics for the Sun Gravity Lens is no longer sufficient and one must resort to physical optics instead, in particular by solving the eikonal equation.

In this paper we review these recent developments to pave the way to future Interstellar Flights (see Ref. [1]).

REFERENCE

[1] Maccone, C., "Mathematical SETI", a 724-pages book published by Praxis-Springer in the fall of 2012. ISBN, ISBN-10: 3642274366 — ISBN-13: 978-3642274367 — Edition: 2012. See, in particular, Chapters 12 through 16.