

INTERSTELLAR RADIO LINKS ENABLED BY GRAVITATIONAL LENSES OF THE SUN AND STARS.

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Abstract: The gravitational lens of the Sun is an astrophysical phenomenon predicted by Einstein's general theory of relativity. It implies that, if we can send a probe along any radial direction away from the Sun up to the minimal distance of 550 AU and beyond, the Sun's mass will act as a huge magnifying lens, letting us "see" detailed radio maps of whatever may lie on the other side of the Sun even at very large distances. The recent book by this author (ref. [1]) studies such future FOCAL space missions to 550 AU and beyond.

In this paper, however, we want to study another possibility yet: how to INCREASE the future interstellar radio links between the solar system and any future interstellar probe by utilizing the gravitational lens of the Sun as a huge antenna.

In particular, we study the Bit Error Rate (BER) across interstellar distances with and without using the gravitational lens effect of the Sun.

The conclusion is that only when we will exploit the Sun as a gravitational lens we will be able to communicate with our own probes (or with nearby Aliens) across the distances of even the nearest stars to us in the Galaxy, and that at a reasonable Bit Error Rate.

Furthermore, we study the RADIO BRIDGE between the Sun and any other Star that is made up by the two gravitational lenses of both the Sun and that Star. The alignment for this radio bridge to work is very strict, but the power-saving is enormous, due to the huge contributions of the two stars' lenses to the overall antenna gain of the system. For instance, we study in detail (see also ref. [2]):

- 1) The Sun – Alpha Cen A radio bridge.
- 2) The Sun – Barnard's Star radio bridge.
- 3) The Sun – Sirius A radio bridge.
- 4) The radio bridge between the Sun and any Sun-like star located in the Galactic Bulge.
- 5) The radio bridge between the Sun and any Sun-like star located inside the Andromeda galaxy (M 31).

The conclusion is that a radio interstellar telecommunication network can indeed be built if the gravitational lenses of all stars involved are exploited. Then the new question arises: has any advanced civilization already built such a radio telecommunication network? If so, our current and future SETI searches should be tuned-up to match with this newly-realized possibility.

Keywords: Sun gravitational lens, space probe, special relativity, propulsion, telecommunications.

References:

[1] Maccone C. (2009) *Deep Space Flight and Communications, a 400-pages technical book published by Praxis-Springer, ISBN 978-3-540-72942-6.*

[2] Maccone C. (2009) *Interstellar Radio Links Enhanced by Exploiting the Sun as a Gravitational*

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