The Clarke exobelt, a method to search for possible extraterrestrial civilizations

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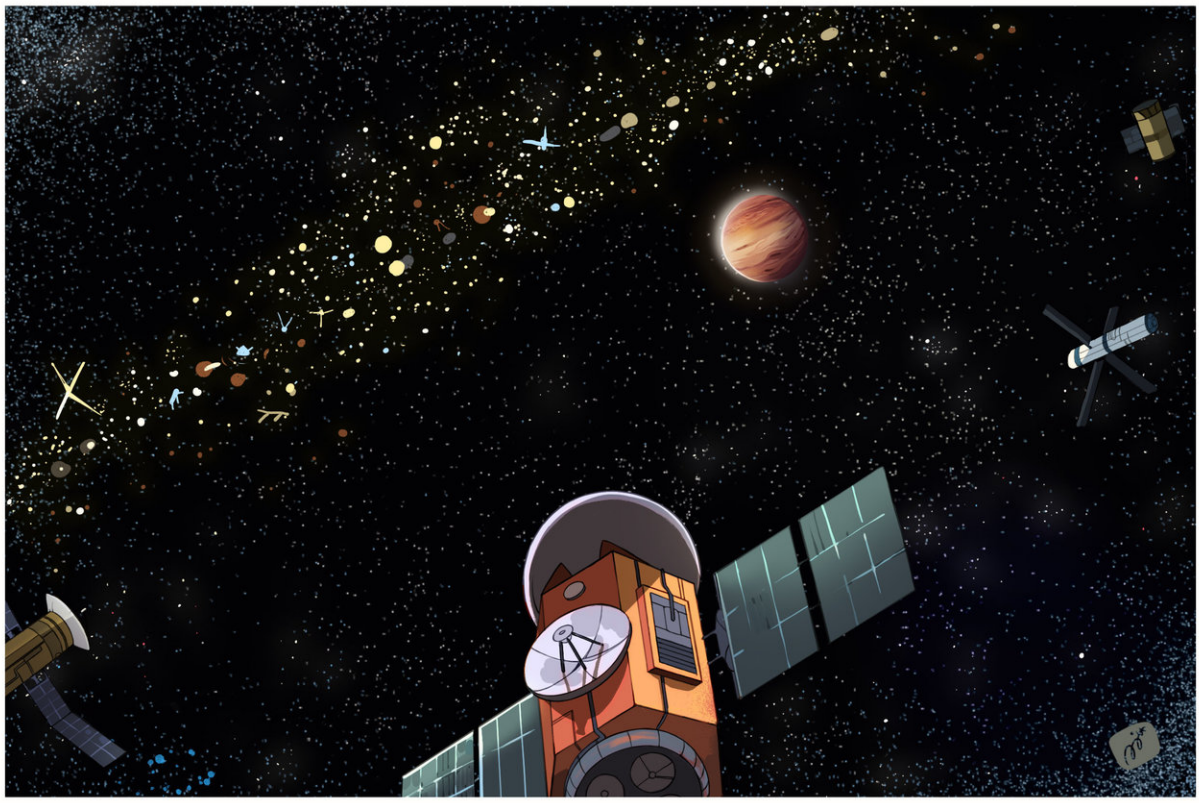

Clarke exobelt. Credit: Credit: Caro Waro

A new study published in the *Astrophysical Journal* by Hector Socas-Navarro, a researcher at the IAC, examines the possibility of detecting hypothetical artificial satellites orbiting around other worlds.

Finding life in other parts of the universe is one of humanity's enduring dreams. For the first time in history, the scientific community has hopes that this dream will become a reality in the not too distant future. This is, in part, due to the new generation of giant telescopes, presently in the planning phase, with which astronomers hope to make detailed analyses of the atmospheres of planets beyond the solar system. For this reason, researchers are making efforts to investigate biomarker evidence of life on these planets.

However, finding intelligent civilizations, or technological capacity, seems much less likely. To start with, researchers lack "technomarkers," the analogues of biomarkers, revealing the presence of technology. Since the 1980s, there have been searches for radio signals from other civilizations, so far unsuccessful. This is hardly surprising since the radio emissions from a society like ours would not be detectable at interstellar distances unless they were deliberately focused in the direction of the receiver. In the scientific literature, there have been proposals to look for technomarkers, for instance, so-called "Dyson Spheres," hypothetical artificial megastructures constructed around a star to collect its light and thereby supply the energy of a civilization much more advanced than ours.

In an article published today by the IAC researcher Hector Socas proposed a new technomarker, which is characterized by the fact that it could be produced by present-day technology on Earth. There is a region in space around planets called the "Clarke Belt," in honour of Arthur C. Clarke, who in 1945, published an article about the use of geostationary orbits for telecommunications. In this belt are geostationary satellites used for a large number of practical applications.

The publication presents a variety of simulations of "Clarke exobelts" to investigate the possible imprint they would leave on the light of the parent star as the planet transits across its disk. The optimum conditions

for observing them are found for planets in orbit around red dwarf stars, which are also the best places to look for exoplanets in general. The article published in the *Astrophysical Journal* describes how these artificial belts can be distinguished from natural rings. Using this technique, current projects and space missions designed to detect exoplanets and their moons and rings could also be used to detect this marker. "We have to keep our eyes open, just in case we detect such traces in the data," says Hector Socas

Earth's Clarke Belt, consisting of geostationary and geosynchronous satellites, is not dense enough to be detected at interstellar distances, at least with our present observing capabilities. Around two-thirds of existing satellites are in the region termed "low orbit," which means the first few hundred kilometres above the Earth, where space debris is already a significant problem. The Clarke Belt orbit is it 36,000 km above the Earth, and it is presently much less populated, but the article shows that in recent decades, the density of satellites in these orbits has been growing exponentially. If this rate continues, our Clarke Belt would be detectable from other stars by the year 2200.

The rate could even be sped up if access to these orbits was reduced in cost, for example, by the new reusable rockets, or by the construction of a future space lift. Or it could be slowed down if technological advances lead to other priorities. In any case, there is an active debate about whether humanity should send messages into space or whether we ought to listen discreetly without revealing our presence. "In this context, the exponential increase in our population of satellites could become a signal that gives us away, whether we like it or not. This is a point that should be taken into account in this debate," says Socas.

Faced with the question of whether we will one day discover a Clarke Exobelt and thereby find an extraterrestrial civilization, the researcher says, "It seems unlikely, but it costs nothing to take a look. It is as if

someone gave you a lottery ticket. You know that it is very unlikely that you will win, but since you have it, you check up on the result, just in case."

More information: Hector Socas-Navarro. Possible Photometric Signatures of Moderately Advanced Civilizations: The Clarke Exobelt, *The Astrophysical Journal* (2018). DOI: 10.3847/1538-4357/aaae66

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