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Gravitational lenses could allow a galaxy-wide internet

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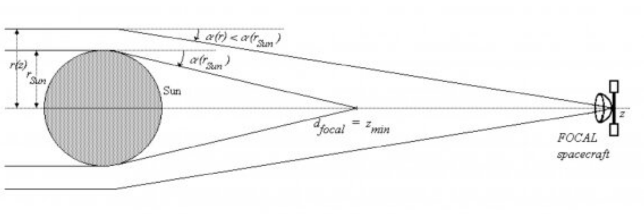

Magnifying a radio signal with gravitational lensing. Credit: Claudio Maccone

As Carl Sagan once said, "The sky calls to us. If we do not destroy ourselves, we will one day venture to the stars." And our first emissaries to the stars will be robotic probes. These interstellar probes will be largely autonomous, but we will want to communicate with them. At the very least, we will want them to phone home and tell us what they've discovered. The stars are distant, so the probes will need to make a very long-distance call.

Currently, we communicate with space probes throughout the solar system via the Deep Space Network (DSN). This is a collection of antenna stations located around the world. Each station has one large 70-meter dish and several smaller dishes. Such large radio dishes are necessary because the signals from a space probe are rather faint, and they grow fainter with increasing distance.

When we start sending probes to other stars, we're going to need an interstellar communication network. Perhaps a galaxy-wide internet. But we still don't know how to make one. Although we can transmit powerful radio signals into space, the strength of these signals grows faint over stellar distances. Most of what we transmit couldn't be detected beyond a few light years given our current technology. Several solutions have been proposed, such as using focused laser light, but a new study looks at using gravitational lensing to get the job done.

Radio signals are a good choice for interstellar distances because they can transmit a good amount of data at relatively low power. This is why we use radio for interplanetary communication. The downside is that because radio waves have a long wavelength, they are difficult to focus in a single direction. We can point a narrow beam of laser light at a particular star, but we can't easily focus a narrow beam of radio light. And our radio signals will need to be focused to carry across light-years.

This new study looks at how radio signals could be focused by the sun or nearby stars. Since stars gravitationally warp the space around them, light passing near a star can be gravitationally lensed. This effect can be used to focus radio light similar to the way a glass lens focuses optical light. In this new paper, Claudio Maccone did some basic calculations of the kind of bandwidth one could get between the sun and nearby stars such as Alpha Centauri and Barnard's Star. The data rate could be on the order of kilobits/second, which is on the order of the old dial-up days of the internet. Not great by modern standards, but certainly enough to transmit useful images and data from another star.

More information: Galactic internet made possible by star gravitational lensing. arXiv:2103.11483v1 [astro-ph.GA] arxiv.org/abs/2103.11483

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