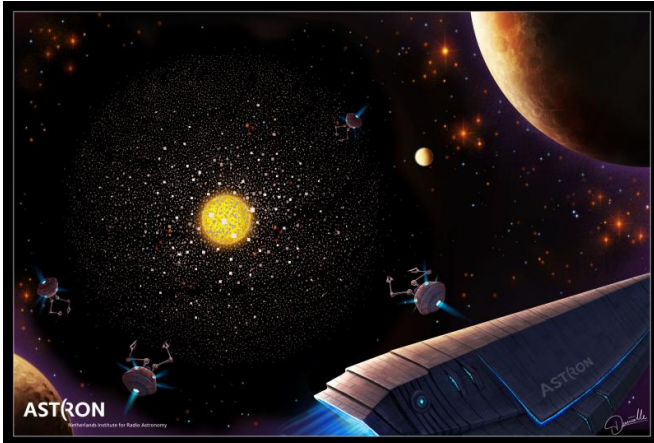


Advanced alien civilizations rare or absent in the local universe

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The figure shows what the activities of a Kardashev Type III civilization might look like — encapsulating the energy of stars by so-called Dyson spheres or swarms is one way to harness enormous energies on truly galactic scales. The resulting waste heat products such a galactic scale enterprise would produce, should be detectable by today's telescopes. Credit: Danielle Futselaar/ASTRON

Sensitive new telescopes now permit astronomers to detect the waste heat that is expected to be a signature of advanced alien civilizations that can harness enormous energies on the scale of the stellar output of their own galaxy. Professor Michael Garrett (ASTRON General & Scientific Director) has used radio observations of candidate galaxies to show that such advanced civilizations are very rare or entirely absent from the local universe.

Advanced civilizations harnessing energies on galactic scales (so-called Kardashev Type III civilizations) are expected to be detectable in the mid-Infrared part of the spectrum via the emission of significant waste heat products. A team of [astronomers](#) led by Dr. Jason Wright (Penn State University, USA) has already drawn up a list of

several hundred candidate galaxies (culled from a total population of 100,000 objects) where unusually extreme mid-IR emission is observed. One problem is that although rare, this kind of emission can also be generated by natural astrophysical processes related to thermal emission from warm dust.

Professor Michael Garrett (ASTRON & University of Leiden) has used radio measurements of the very best candidate galaxies and discovered that the vast majority of these systems present emission that is best explained by natural astrophysical processes. In particular, the galaxies as a sample, follow a well-known global relation that holds for almost all galaxies—the so-called "mid-infrared radio correlation." The presence of radio emission at the levels expected from the correlation, suggests that the mid-IR emission is not heat from alien factories but more likely emission from dust—for example, dust generated and heated by regions of massive star formation.

As Professor Garrett explains: "The original research at Penn State has already told us that such systems are very rare, but the new analysis suggests that this is probably an understatement, and that advanced Kardashev Type III civilizations basically don't exist in the local universe. In my view, it means we can all sleep safely in our beds tonight—an alien invasion doesn't seem at all likely!"

Joking aside, Professor Garrett is still looking at a few candidate [galaxies](#) that lie off of the astrophysical correlation: "Some of these systems definitely demand further investigation, but those already studied in detail turn out to have a natural astrophysical explanation too. It's very likely that the remaining systems also fall into this category, but of course it's worth checking just in case!"

The technique applied by Professor Garrett can also be used to help identify less advanced (Kardashev Type II) [alien civilizations](#) that

command more limited resources on sub-galactic scales. Such civilizations are still considerably more advanced than our own (Earth is not yet on the Kardashev Type I scale) but they might be more common as a result.

Professor Garrett has plans to look for these less advanced civilizations: "It's a bit worrying that Type III civilizations don't seem to exist. It's not what we would predict from the physical laws that explain so well the rest of the physical universe. We're missing an important part of the jigsaw puzzle here. Perhaps advanced civilizations are so energy efficient that they produce very low [waste heat emission](#) products—our current understanding of physics makes that a difficult thing to do. What's important is to keep on searching for the signatures of extraterrestrial intelligence until we fully understand just what is going on."

The main results are presented this week as a letter in the European journal *Astronomy & Astrophysics*.

More information: *Astronomy and Astrophysics* 2015, A&A, 581, L5 "Application of the Mid-IR/Radio correlation to the ? sample and the search of advanced civilisations" - M.A. Garrett [DOI: 10.1051/0004-6361/201526687](#) and <http://arxiv.org/pdf/1508.02624v1.pdf>

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