

The Search for Planet 9

Extrasolar planet expert **Prof. Nick Cowan** joined the McGill Space Institute as a faculty member in Fall 2015. His office was down the hall from cosmologist **Prof. Gil Holder**. The two collaborated on a project to develop a method to search for Planet 9 — a hypothetical large planet in outer Solar System, announced to some fanfare in January 2016.

What question were you trying to answer?

We wanted to know whether the thermal glow of planet nine was detectable with millimeter telescopes.

Why did you find this question interesting?

Cosmologists (e.g., Holder) look at the cosmic microwave background and aren't used to thinking about moving foreground objects. Planetologists (e.g., Cowan) use optical and IR telescopes and don't think about radio and millimeter telescopes. So it was a fun outside-of-the-box collaboration.

What does doing your research look like?

This project mostly involved pen and paper math, and noodling around on the blackboard. We used simple Python scripts to double check the math and make a figure. Our usual research usually involves using data from telescopes (on the ground and in space) and writing/running computer code to analyse it.

Neither of us could have done this project on our own. Fortunately, our offices are right next to each other, which made it easy to talk to each other as we worked through the problems.

What did you find?

We found that planet nine is readily detectable with many current and near-term millimeter-te-

scopes. Even if it ends up being discovered via reflected light, millimeter-telescopes would tell us the planet's temperature.

Did anything unexpected happen during this project?

Cowan: The entire project was surprising. Neither of us expected to collaborate on such a paper!

Holder: I would add that I was pleasantly surprised by the enthusiastic embrace of solar system science by my cosmologist colleagues; there is clearly a strong appetite for this sort of research, it just needs a way to happen.

Why this is important

The search distant Solar System objects, including Planet Nine, has focused on reflected sunlight. Our study was the first to show that searches for *thermal* flux, in particular mm radiation, was a viable method to search for Planet Nine or any other planets lurking beyond the Kuiper belt.

Cosmologists build mm telescopes to study the cosmic microwave background, so it was surprising to us (and indeed most cosmologists) that their experiments might also do compelling planetary science. We also showed that thermal radiation would constrain Planet Nine's temperature and radius (and hence its formation history and subsequent evolution). This might help us understand why Uranus and Neptune, our two familiar ice giants, have vastly different internal heat sources.

Cowan, N B, G. Holder,
and N. A. Kaib (2016),
*Cosmologists in Search
of Planet Nine: The Case
for CMB Experiments,*
ApJ. Lett. 822, L2.

