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Designing lightweight optics to detect signs of life beyond our solar system

UC Santa Barbara doctoral candidate in physics, Skyler Palatnick, PhD ’26, has been named to Heising-Simons Foundation’s Science program’s new class

of 51 Pegasi b Fellows, which he will perform at UCLA, a three-year program that provides outstanding postdoctoral scientists with the opportunity to conduct theoretical, observational and experimental research in planetary astronomy. As one of the eight new fellows for 2026, Palatnick will extend his research into ultraviolet wavelengths — a gap in current coronagraph technology.

His research will make it possible to detect more of the chemical signatures associated with biological processes. He will then combine this innovation with conventional technologies to create lightweight, compact optics, to be used in NASA’s Habitable Worlds Observatory mission.

“Ultraviolet wavelengths have a lot of signatures that might be key to detecting signs of life on exoplanets,” said Palatnick, who joins a community of 74 fellows and alumni dedicated to advancing the understanding of planet formation, exoplanets and solar system science. “For coronagraphic instruments, there’s a huge gap in ultraviolet technology.”

As an undergraduate journalism major, Palatnick was in an elective astronomy course when he decided to switch majors to astrophysics. He later pursued a master’s degree in nanotechnology engineering at UCSB.

Palatnick’s technology addresses a fundamental challenge: The extreme brightness of stars obscures their planets. To photograph planets directly, you need coronagraphs — instruments that block starlight. Typical coronagraphic masks use liquid crystal technology, which is expensive and difficult to manufacture. Metasurfaces offer an alternative that academic researchers can design, fabricate and rapidly improve without leaving campus.

Consisting of billions of minute posts, these silicon optical devices are only nanometers in size. When light passes through them, it pings around before emerging. By arranging posts of different sizes in specific patterns, Palatnick programs a metasurface to carefully manipulate starlight, directing it away from the image center to leave darkness, allowing faint planets to become visible.

“Once you have a good design and fabrication process in place, metasurfaces are cheaper and more accessible to make,” Palatnick said. “As an academic group, you can make a bunch of these things and say, ‘Okay, that didn’t work so well, but here’s what went wrong, here’s how we can do it better,’ and make improvements very quickly.”

“His work in my group has opened up a whole new research field for us, metasurface optics”, said Palatnik’s advisor, assistant professor of physics Max Millar-Blanchaer. “This technology may one day lead to the discovery of new planets around other stars. It's difficult to understate the impact he has had on the development of this technology and how far he has come during his PhD studies. With this new fellowship he'll expand upon the techniques he developed and take them into exciting new directions.”

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