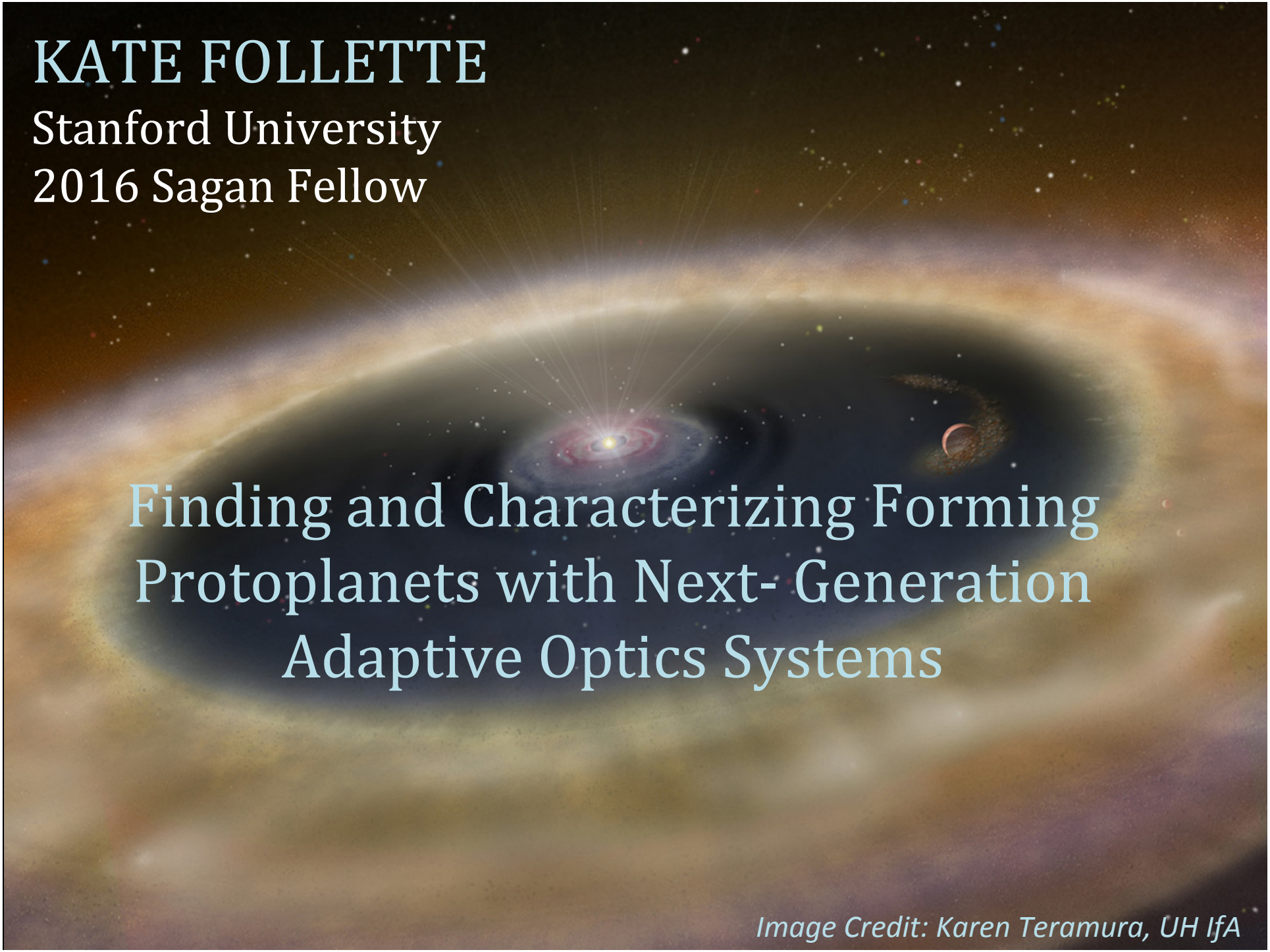


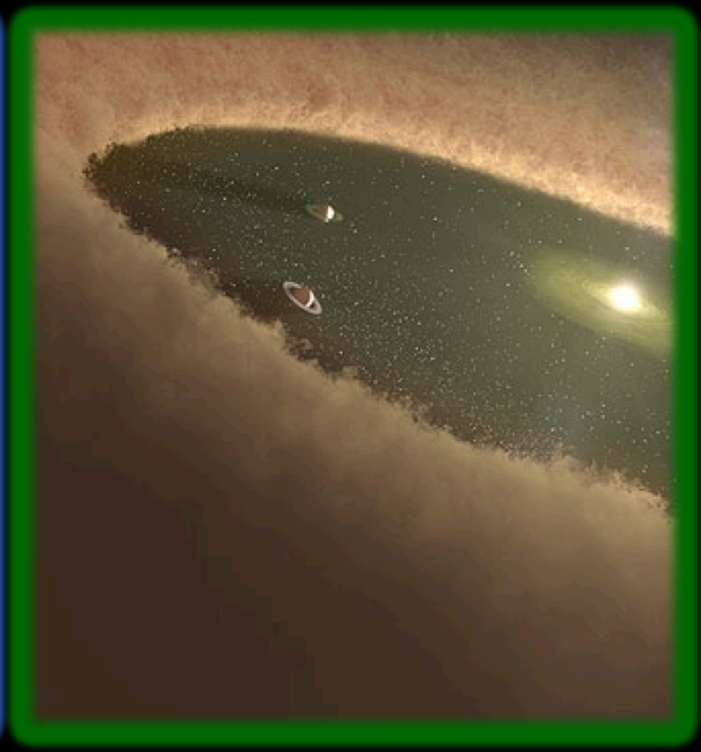
KATE FOLLETTE
Stanford University
2016 Sagan Fellow

Finding and Characterizing Forming Protoplanets with Next- Generation Adaptive Optics Systems

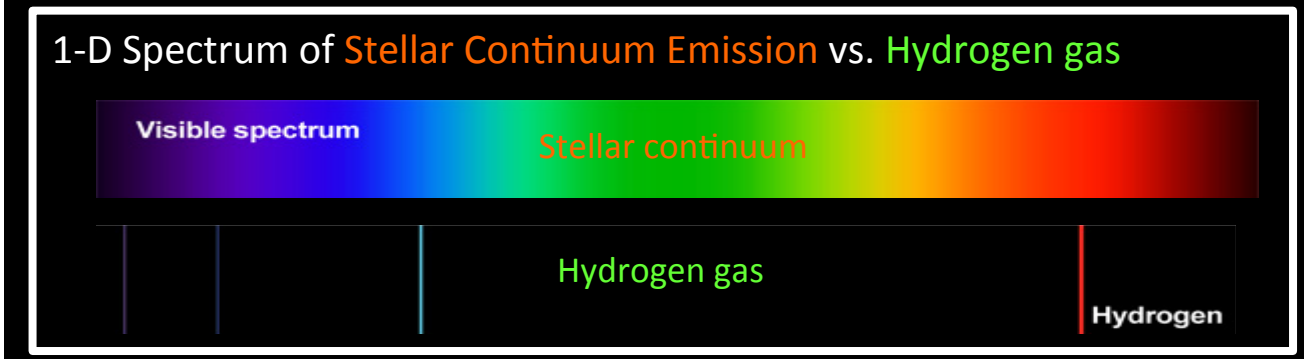
Image Credit: Karen Teramura, UH IfA

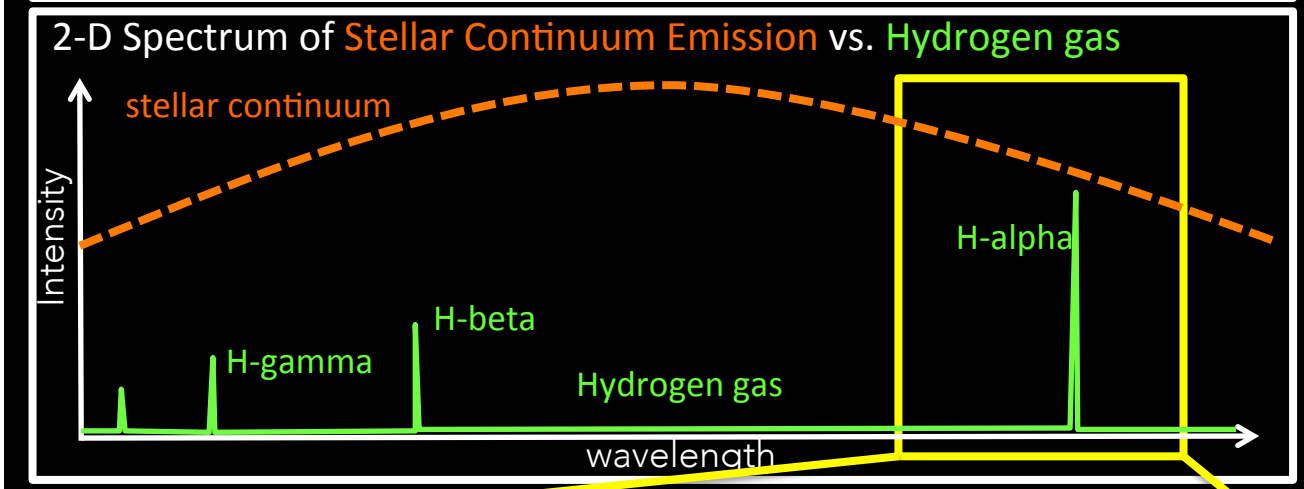
MY SAGAN PROJECT

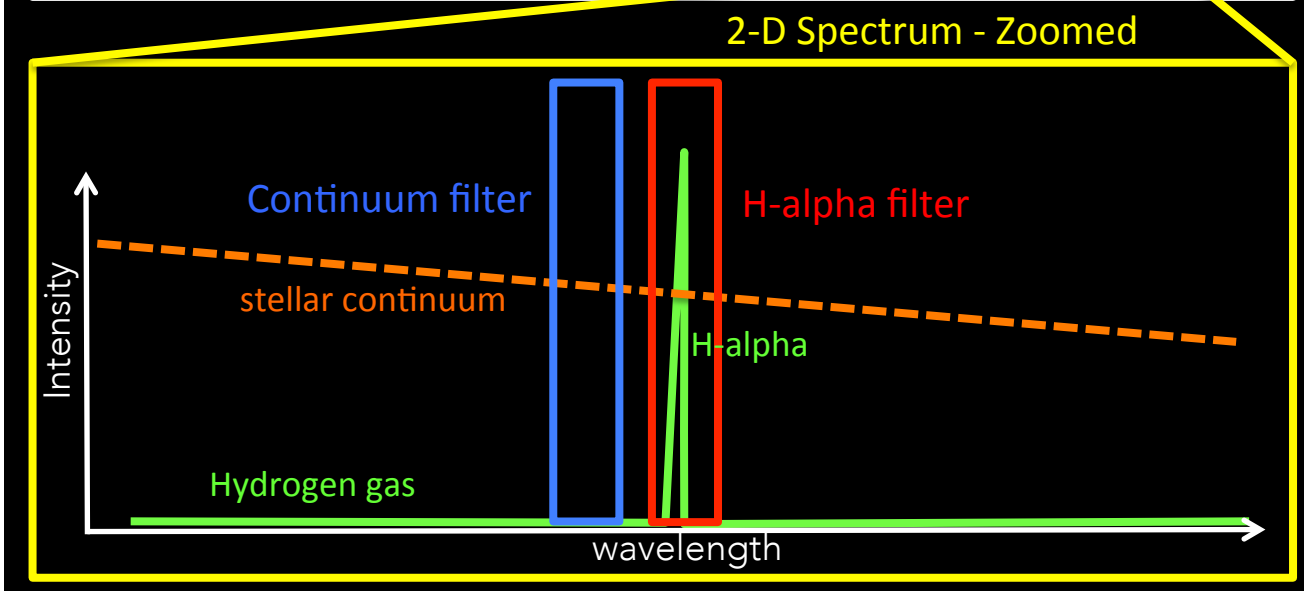
Survey twenty transitional disks in search of accreting proto-planets (planets still in the process of growing) with the Magellan Adaptive Optics (MagAO) system, and characterize their environments with the Gemini Planet Imager.



Transitional disks are a sub-class of the ubiquitous circumstellar disks that surround young stars. Generically, circumstellar disks are the remnants (gas and dust) of the star formation process. Transition disks have giant (solar-system sized) cleared central cavities that we believe are carved by the gravitational influence of planets and/or protoplanets



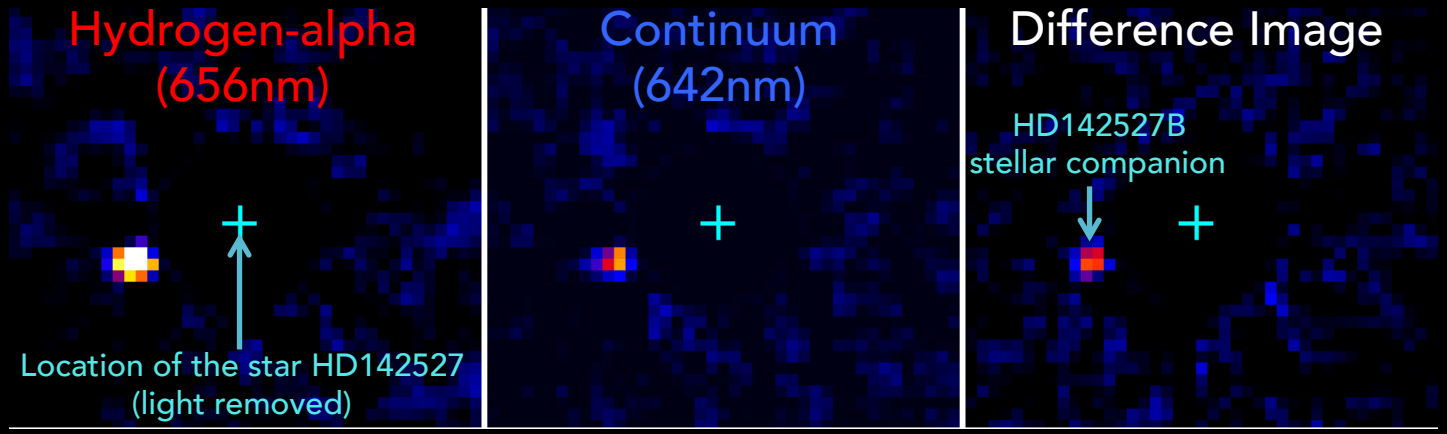




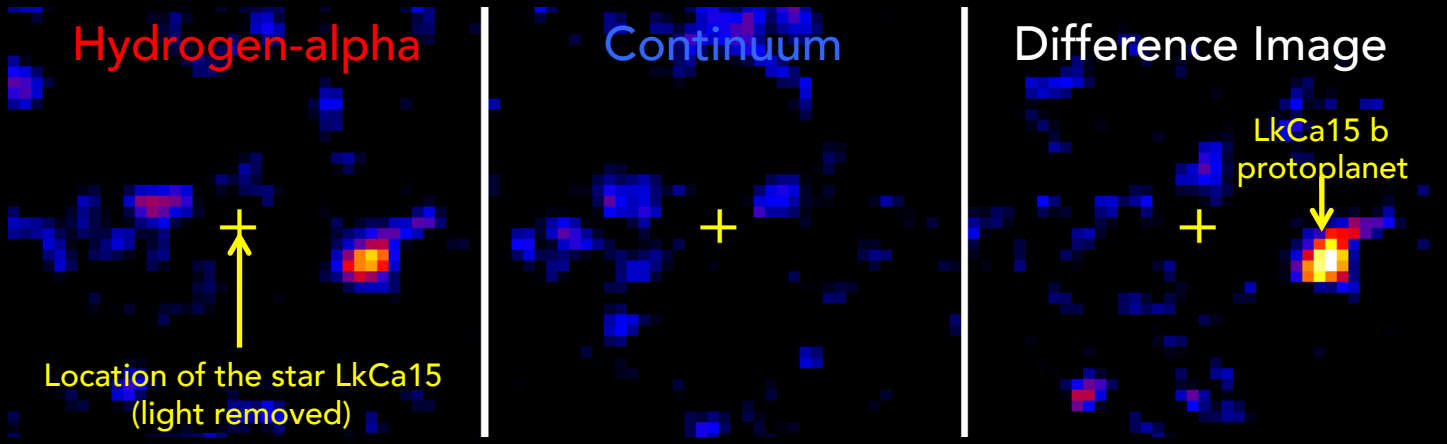
Stellar photospheres emit light of all wavelengths (a small proportion of which are absorbed in its outer layers, not pictured here). Pure hydrogen gas, on the other hand, has a unique spectral fingerprint consisting of concentrated emission at just a few specific wavelengths, including hydrogen-alpha.

MagAO's Simultaneous Differential Imaging (SDI) mode images in two filters simultaneously. Stellar continuum emission is nearly equal in both filters, while emission from hydrogen gas appears preferentially in one filter (H-alpha) and not the other (continuum). The difference of images in the two filters (with the continuum scaled to correct for the slight difference in brightness), allows us to isolate the contribution of glowing hydrogen gas.

HD142527B– An Accreting Stellar Companion



LkCa15 b – An Accreting Protoplanet



Planets and stars grow by attracting hydrogen gas, which heats up as it falls onto them in a process called accretion. We might expect that the objects carving gaps in transition disks will have a range of masses, so it's important to be able to distinguish between stellar binaries and true planetary mass companions. Accreting protoplanets, like LkCa15b, are too low in mass to have a detectable level of continuum emission, so they appear **only** in the H-alpha image, and not in the continuum, whereas stellar companions like HD142527B appear in both.