I intend to complete a Ph.D in astronomy research in the field of extrasolar planet and brown dwarf detection, characterization, and formation. Following completion of my Ph.D, I intend to continue to work as an astronomy researcher, ideally at an observatory or research institution such as NASA. University faculty is also a position I will consider. I intend to pursue a career path that will allow me to continue to do astronomy research.

My path to astronomy is non-traditional and non-linear, but **it is precisely because of this winding path I now know for certain that a career as a researcher in exoplanetary astronomy is the ideal path for my future.** Every choice I have made as a student, every opportunity I have pursued, has been with this goal in mind.

Although I have always had an interest in astronomy, I obtained a bachelor's degree in chemistry from Purdue University as a traditional college student in 2003, and earned a commission as an **officer in the US Navy** upon completion. I served in many roles during my 5 years in the Navy, but the most impactful for me was as a nuclear power plant operator and maintenance division supervisor aboard the aircraft carrier USS John C. Stennis (CVN-74) for over 2 years in both war-time and maintenance conditions. The skills and experience I gained from that short intense time are too numerous to recount in detail here, but are an essential part of who I am and a factor in all my successes going forward. Following separation from the Navy in 2008, I taught physics in an advanced middle school magnet program, focusing my classes on teaching physics and engineering, and obtained a Master's degree in engineering education in 2014. In 2015, I decided to leave teaching to pursue a career in Astronomy.

While a second-time student at the University of Texas at Austin, I worked in the Hobby-Eberly Telescope Dark Energy Experiment instrumentation laboratory, assembling the units of the VIRUS instrument for UT's ambitious research project to measure the expansion rate of the universe. During my first summer I participated in a Research Experience for Undergraduates (REU) at Northern Arizona University (NAU) in the field of planetary science, determining if it is possible for the lakes on Titan to freeze during seasonal variations. I spent this past summer with the Berkeley SETI Research Center at the University of California Berkeley, on the Breakthrough Listen (BL) project to search for technosignatures in primarily radio wavelengths. Working with Howard Isaacson, I developed the "1 Million Star" target list for BL's upcoming observing campaign with the MeerKAT telescope in South Africa, which will be the largest Search for Extraterrestrial Intelligence (SETI) search in history.

But the most impactful research experience was my work Dr. Adam Kraus on **an orbit study of the wide planetary mass companion GSC 6214-210 b.** Dr. Kraus' program has been monitoring several of these type of companions for many years with images from the Keck Telescope, enough time to measure orbital motion. Planetary mass companions (PMCs) are large companions ($\sim$13 M_{jup}) on wide orbits ($\geq$100 AU) from their hosts that have been detected in imaging of young systems. I find PMCs exceedingly interesting because they occupy a parameter space that is difficult to explain with current brown dwarf and planetary formation mechanisms. In my work on the PMC system GSC 6214-210, I measured the astrometric relative motion of GSC 6214-210 b, fit Keplerian orbital parameters to the motion, and studied the fit for clues which could point to formation mechanism, building my own statistical algorithms. I concluded that the $\sim$14.5 M_{jup} companion was unlikely to have formed at a close radius, where the disk is thicker, and then been scattered out to its current wide orbit through a dynamical scattering interaction. **My first author paper has been submitted for publication to the Astrophysical Journal.** I also have worked with **Sarah Blunt** on the Orbitize open-source python package for astrometric orbit fitting.

Study of these systems is hampered by the exceedingly small population that is known today. **?** determined the occurrence rate of planets (5-13 M_{jup}) at separations observable in imagining (30-300 AU) to be only $0.6^{+0.7}_{-0.5}\%$. With such a low occurrence rate, direct imagining survey strategies must be optimized to select targets that maximize the likelihood of finding a giant planet or brown dwarf companion.

This led me to propose a project for the NSF Graduate Research Fellowship Program to use multi-epoch astrometry to optimize a target list to detect new directly imaged companions. As recent studies have shown (**?**, **?**, **?**), the large time baseline between *Hipparcos* and *Gaia* astrometry allows for detection of long period accelerations due to the presence of a companion of a wide orbit. Thus, by comparing the two epochs, I proposed to look for stars experiencing acceleration, and develop a target list optimized to identify substellar companions. I then proposed to follow up the target list of $\sim$50 targets, which is the upper end of the number of targets that could reasonably be surveyed during my PhD tenure, with a high-contrast imaging survey to detect the companions.

Harvard University, with its wealth of exoplanetary knowledge and access to observing resources, is an ideal institution to pursue a graduate degree in exoplanet studies. I have very much enjoyed my work with high-contrast imaging, but am open to other fields within the exoplanet community as well.

However the main reason I would like to study at Harvard is the expertise of your exoplanet community. Sean Andrews comes highly recommended to me as a mentor, and I find the work of his research group very interesting. My work on PMCs has shown me the wealth of scientific questions to be answered in star and planet formation, and his work on structure in protoplanetary disk is very exciting. I am also interested in **David Charbonneau**'s MEarth project and work on exoplanetary atmospheres. The exoplanet community at Harvard, from what I have learned about your program, sounds like just the kind of learning and research atmosphere I am looking for in a Ph.D program.

I am excited about the project I have proposed for NSF funding, however **I am open to other exciting research ideas as well.** I am committed to pursuing exoplanet research, and I am very flexible and open to adjusting the course of my Ph.D work. I do hope to be able to pursue my Ph.D at Harvard for all of the reasons I have listed above, in addition to the appeal of living in Boston. Thank you for considering my application to your prestigious research institution. My research, cv, and bio can also be found at www.loganpearcescience.com.