Class Projects

AO System Design

Intro and Overview

January 30, 2020

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Project in brief

1. Choose an astronomy science question that AO can help to answer

2. Decide on an AO system that will best address your science question

We are starting this class project somewhat early in the quarter

- A trade-off

- If we wait till you know a great deal about AO, the project ends up due at the end of the quarter, the same time as all your other projects and term papers

- If we start now, you know less (so far) about AO, but as the class proceeds you will be able to connect the lectures to your project

Class project learning goals

- ## Content Goals:

  - Using AO to achieve a specific science goal

  - How to derive AO requirements from science goal

  - Relation between image quality and residual wavefront error

  - Understanding error budgets: specific contributors; AO as a system

- ## Process Goals:

  - Systems thinking

  - Requirement-driven design

  - Optimization

  - Tradeoffs

What you will actually be doing during your project

1. Choose collaborator(s) and a <u>general area of science</u> that you are interested in using AO for

2. Within your collaboration, come up with a <u>specific "science case"</u> (an investigable science question within your general topic) that benefits from AO

3. Decide upon specific "<u>science requirements</u>" needed in order for a new AO system to address your science case

4. Flow-down science requirements to performance requirements for your AO system

5. Given your performance requirements, design an AO system (on paper) that meets these requirements

6. Present your design to your peers in class ("Conceptual Design Review")

7. Synthesis discussion of what we all learned from this process

Tentative schedule for class project on AO System Design

- Intro (today)

- Starters (February 6th) in class
  - An example of how to choose key AO parameters

- Focused Investigation (Feb 11th)
  - Group work during class time

- First draft of Performance Requirements (Feb. 18th)

- Rest of February: continue working together; move from performance requirements to AO design, via error budget

- March 5th – "Conceptual Design Review"
  - Group presentations in class

- March 10th – Project Synthesis

First tasks: Choose Collaborators, Science Topic, Specific Science Case

Item	Due date	Explanation	Example
General Science Topic and Collaborator(s)	By Feb 6th (or sooner if you wish)	Choose broad science area which interests you; find collaborator(s)	Extrasolar planetary systems
Specific Science Case	In class on Feb 11th	Frame a specific question that AO can help answer	What are spectra of planets in outer parts of other solar systems (distance > 5 AU from parent star)
Science requirements for AO system design	February 18th	Develop AO system performance requirements for your science case	Angular resolution Contrast ratio between planet and parent star Wavelength range Enclosed energy Spectral resolution

Send e-mails to me
max@ucolick.org

1. Today or by Feb 6th at the very latest
   - What broad science area are you interested in?
   - Who is (are) your collaborator(s) ?
   - Put Astro289 in subject line

1. After end of class on Feb 11th (each group together)
   - What specific science question do you want to analyze?
   - How will AO help answer this question?