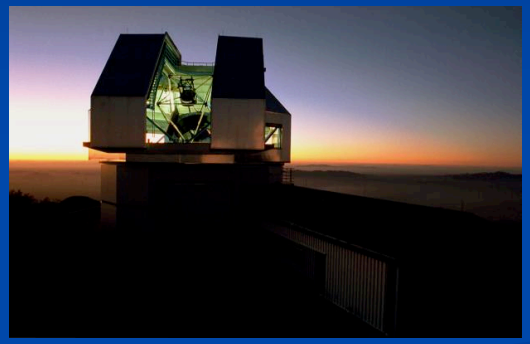
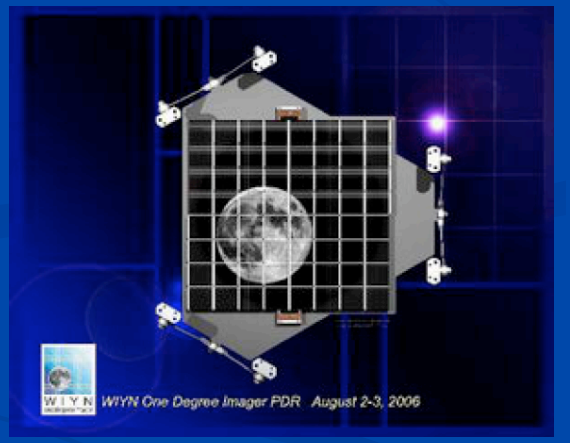
Indiana University Science with the WIYN One Degree Imager

Katherine Rhode
(Indiana University,
WIYN SAC member)



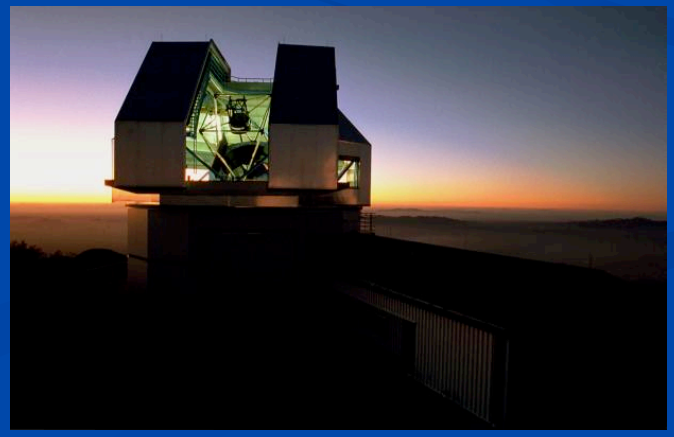


Indiana University Department of Astronomy

- Nine faculty members, plus active emeritus faculty and research scientists

- 21 PhD students, ~25 undergraduate majors, REU program

- Research areas:
  - Stellar and chemical evolution
  - Galaxies and observational cosmology
  - Stellar and Galactic dynamics
  - Astrophysical disks
  - Instrumentation



- 17% share of WIYN

Katherine Rhode - The ODI Globular Cluster System Survey

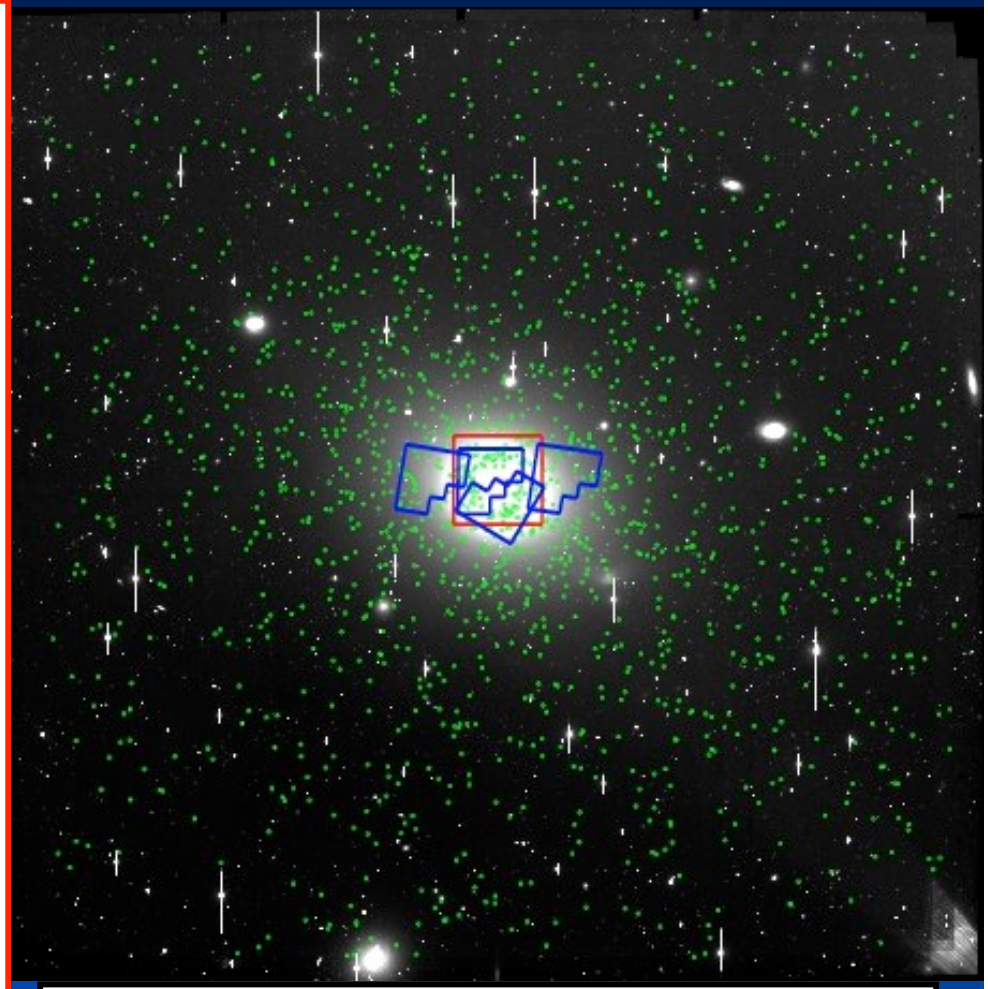
Wide-field survey of the globular cluster systems of giant galaxies in range of environments, 10-25 Mpc away

Technical requirements: large FOV; excellent resolution; deep, multi-color (gri ~ 24-25) imaging

Goal is ~30 galaxies in ~4 years after ODI comes online (N=50 galaxies when combined with current survey)

Primary science goal is **testing theories of galaxy formation**

Globular clusters identified in the survey are also used as spectroscopic targets (for tracing the mass distributions of the host galaxies) and matched with X-ray data to study LMXBs, black holes



KPNO-4m Mosaic R image of M49 in Virgo

FOV = 38' x 38' (Radial coverage ~120 kpc)

Green = GC candidates Blue, Red = HST coverage

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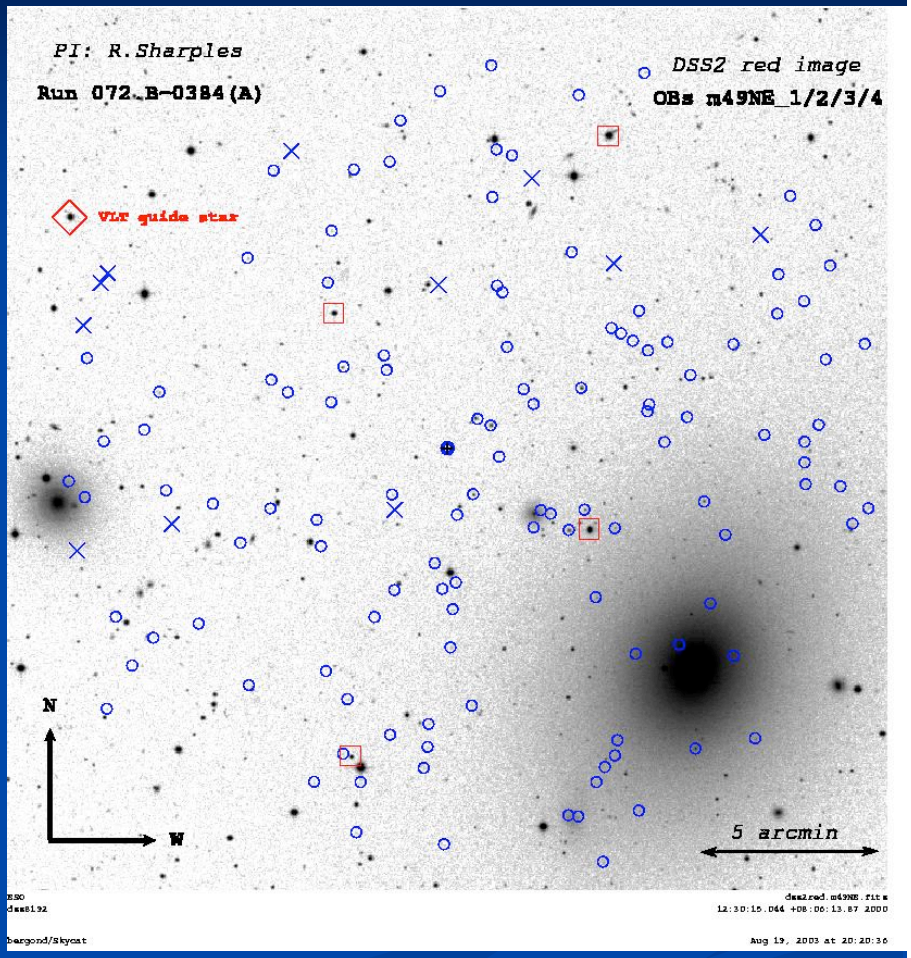


Globular Cluster candidates in M49 targeted for VLT spectroscopy

Con Deliyannis - Open Cluster Studies with WIYN ODI

- Wide-field, deep broadband (ugriz) imaging of open star clusters
- Overall goal: to better understand star and cluster evolution over a range of stellar masses and evolutionary time scales
- Specific objectives:
  - Empirical definition of lower main sequences and brown dwarf sequences
  - Binary fractions (implications for cluster formation and evolution)
  - Rotation period monitoring (stellar angular momentum history)
  - Cluster ages, e.g., from bottoms of white dwarf sequences

(Tyagan Miller, IU)

(N. Sharp, NOAO/AURA/NSF)

John Salzer - ODI Survey for Emission-Line Objects

- Wide-field narrow-band imaging survey for emission-line objects at a range of redshifts.
- Cover tens of square degrees to good depth.
- Utilizes strengths of ODI: good areal coverage, superior image quality, 4-m class telescope aperture.
- Select filters to fall within OH windows to reduce sky background (e.g., 8120-8260 A). In this case, detect Hα at z ~ 0.25, [O III]λ5007 at z ~ 0.64, [O II]λ3727 at z ~ 1.20, and Lyα at z ~ 5.7.
- Detect star-forming systems and AGN at a variety of redshifts using different lines. Repeat observations with ~3-4 filters to probe SFRs and activity at a range of redshifts *for a given line*.
- Requires special narrow-band filters.

Liese van Zee - ODI Survey for Low-Mass Galaxies

Project to probe the faint end of the luminosity function and exploring role of environment in evolution of low-mass galaxies.

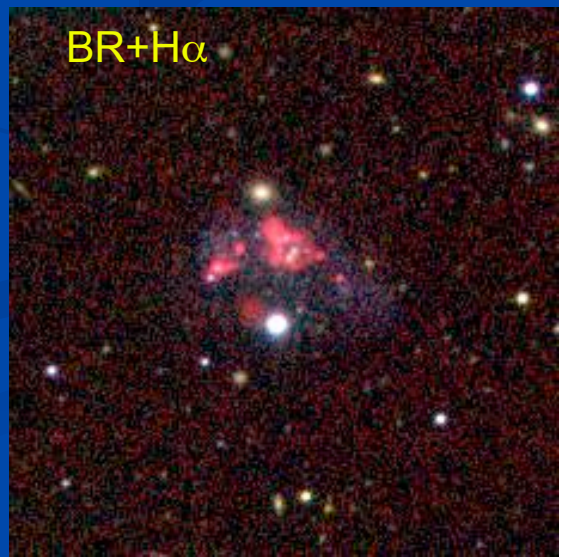

(Tyagan Miller, IU)

- Broadband (ugriz) + narrowband (Hα) imaging of ~100 square degrees sampling a range of local environments (field, group, cluster).
- ODI's advantage is spatial resolution, which is key for morphological identification (and removal) of luminous background galaxies.

Key Goals:

• calculating the LF

• investigating SF triggering and regulating mechanisms in different environments



Kent Honeycutt - Monitoring M-dwarf Flaring in Open Clusters with ODI

M dwarfs can exhibit outbursts/flares that dramatically increase brightness over very short time scales (few hours or shorter)

- Measure flare amplitudes and shapes as function of stellar mass and rotation (rotation from photometric star spot rotational modulation—same data).
- Combine with spectroscopy (WIYN Hydra) to study correlation with H-alpha emission. Is H-alpha a reliable proxy for flaring?
- Studying M dwarfs in clusters provides an estimate of age and chemical composition.
- RELEVANCE:
  - Life on planets surrounding M dwarfs
  - Understanding the mechanisms and evolution of cataclysmic variables

(J. Schachter, IU)

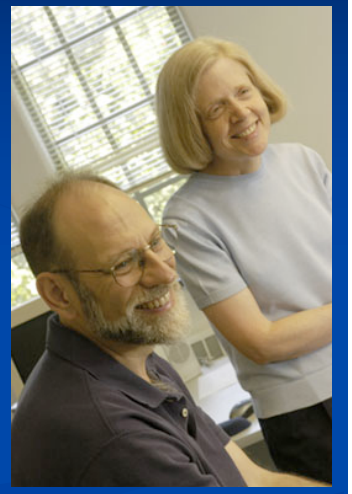
Caty Pilachowski, Haldan Cohn, and Phyllis Lugger - Observations of Outer Regions of Globular Clusters

Deep imaging in multiple filters (griz) around Milky Way globular clusters, out to distances of ~2 - 3 degrees (or further if appropriate)

Select high-latitude clusters to minimize contamination from disk stars

Use these types of observations to investigate:

- Dynamical mass loss
- Tidal tails
- Characterizing low mass stellar populations in globular clusters
- Search for CVs in outer regions (Cohn & Lugger)



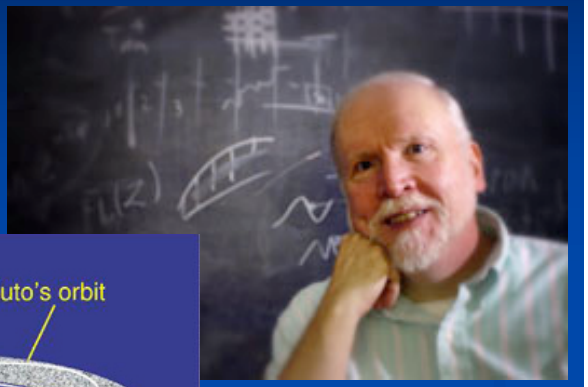
(Tyagan Miller, IU)

(Kafka & Honeycutt, IU/WIYN/NOAO/NSF)

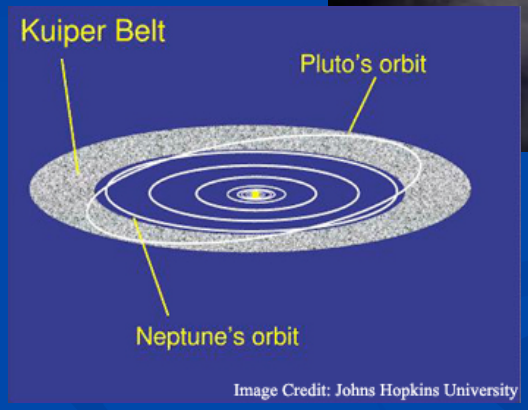
Dick Durisen - ODI Studies of Small Bodies in the Solar System

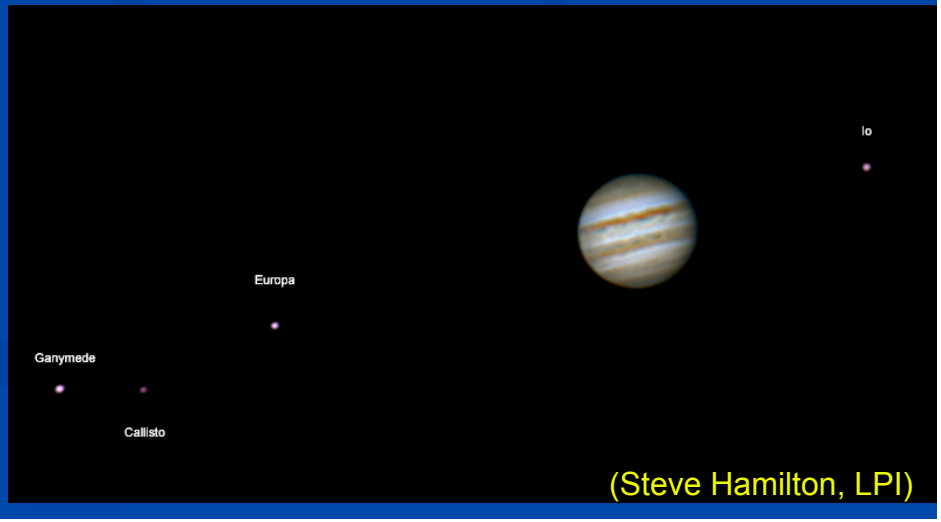
For example:

- Searching the entire Hill sphere of Jupiter to look for satellites (the outskirts have not been entirely surveyed)
- Studies of Kuiper belt objects with ODI
- Looking for ideas from others in the WIYN consortium, and/or planetary scientists in the community…



(Tyagan Miller, IU)





(Steve Hamilton, LPI)

ODI Data Reduction, Analysis, & Archiving

IU astronomers and information technology staff have been working with WIYN to determine how IU's high-performance computing and storage facilities can help with ODI data processing and archiving

IU has powerful supercomputers, the Data Capacitor (a unique 1-Petabyte rapid-access data storage facility), and a 4-Petabyte robotic tape archive that can be used for WIYN ODI data

Details are TBD, but one possibility is that ODI data will be automatically copied to IU, pipeline-processed (with some user input), archived, and made available to WIYN users via a web interface

Some analysis and visualization could be done remotely by users accessing their data via IU supercomputer connected to Data Capacitor (performs faster than local disk)