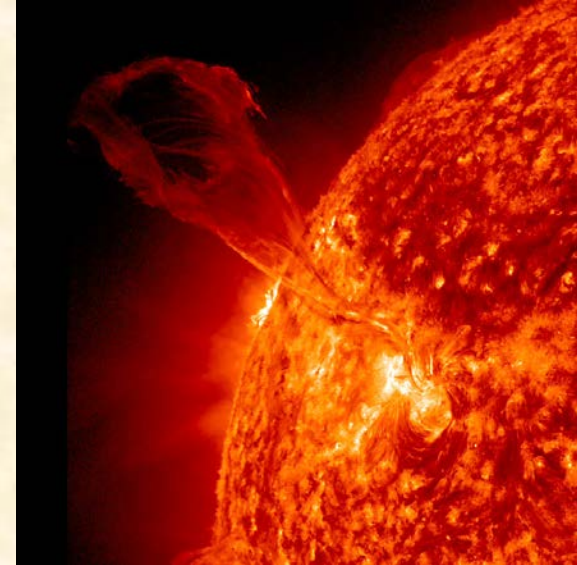
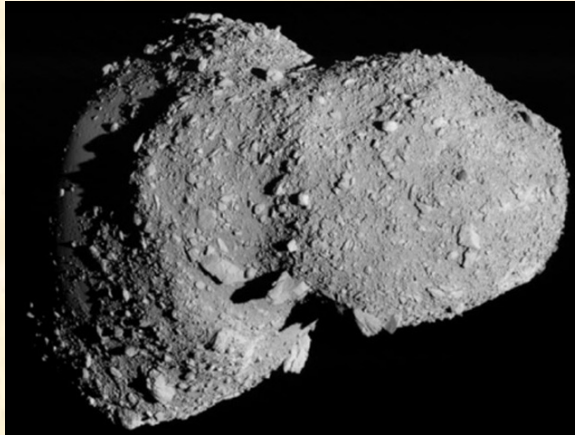


Developing astronomical research in North Dakota



Dr. Paul S. Hardersen

University of North Dakota Department of Space Studies

Associate professor

Director, UND Observatory

UND Space Studies: who are we?

- 1987 -- Founded by Buzz Aldrin and Dr. David Webb.
- Interdisciplinary M.S. program: science, engineering, life sciences, policy, history, management, law, commercial space. A rare type of academic program.
- 1996: Distance learning option begins. Enrollment skyrockets!
- 2001: Transition to a traditional academic department (teaching, research, service).
- 2004: M.S. thesis option available for campus and distance students.

UND Space Studies: who are we?

- 2012: Ph.D. in Aerospace Science begins – includes Space Studies.
- Today:
 1. Faculty of 8; student enrollment of ~25 campus students and ~125 distance students.
 2. Primary research: space suits, asteroid near-IR reflectance spectroscopy, solar physics (sunspots, filaments), double stars (**coming soon!**).
 3. Facilities: Human Spaceflight Laboratory, Life Sciences Laboratory, UND Observatory.



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News

"Outer Space in the Great Plains" Series Presentation on Feb. 9th

There will be a free talk for the public and UND campus this Saturday, February 9 as part of the... [\(more\)](#)

McGee Presents at 7th World Archaeology Congress

Space Studies graduate student Ben McGee recently coauthored a presentation given last month at... [\(more\)](#)

Colloquium Series Continues with Dr. Abbad-Madrid

The Spring 2013 Space Studies Colloquium Series will focus on the general theme "Near-Earth"... [\(more\)](#)



Space.....Not Just for Astronauts

The UND Space Studies degrees are your best choice when preparing for a career in the space industry. Our Master of Science and Ph.D. programs are multi-disciplinary and include disciplines such as planetary science, space engineering, life support systems, space policy and law, space history and space-related aspects of business and management. Unlike a typical aerospace engineering degree, the Space Studies degrees provide the student with the broader background necessary to understand the linkages between engineering, space science, and policy.

Student Research Opportunities

- Study of near-Earth and main-belt asteroids
- Solar astronomy
- Spacesuit and spacecraft simulator design, construction & testing
- Development of a Lunar/Mars base
- Remote sensing of the environment
- Aerospace payload development

[Learn more.](#)

REQUEST INFO

APPLY NOW



M. Sawarynski, 2009 Space Studies Graduate Pratt & Whitney Rocketdyne

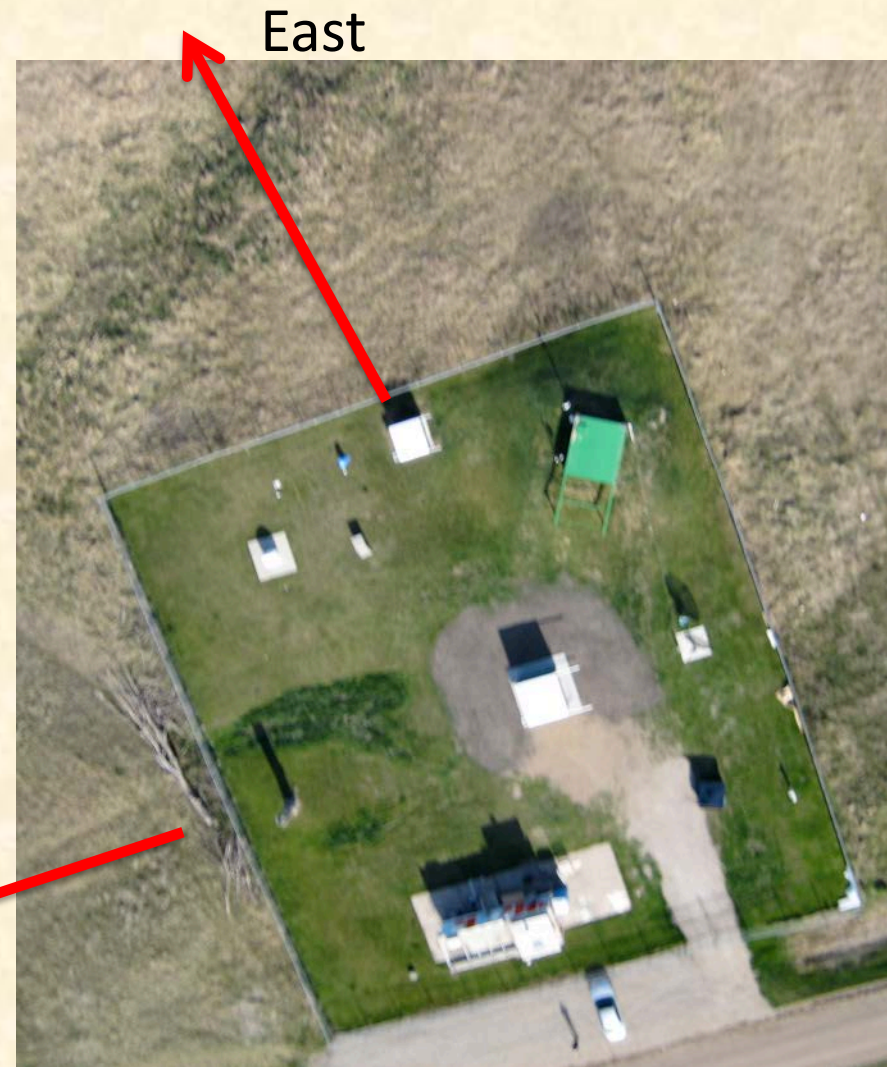
Space Studies graduates are well-prepared to lead space exploration and development of space activities in all facets of

Astronomy in North Dakota

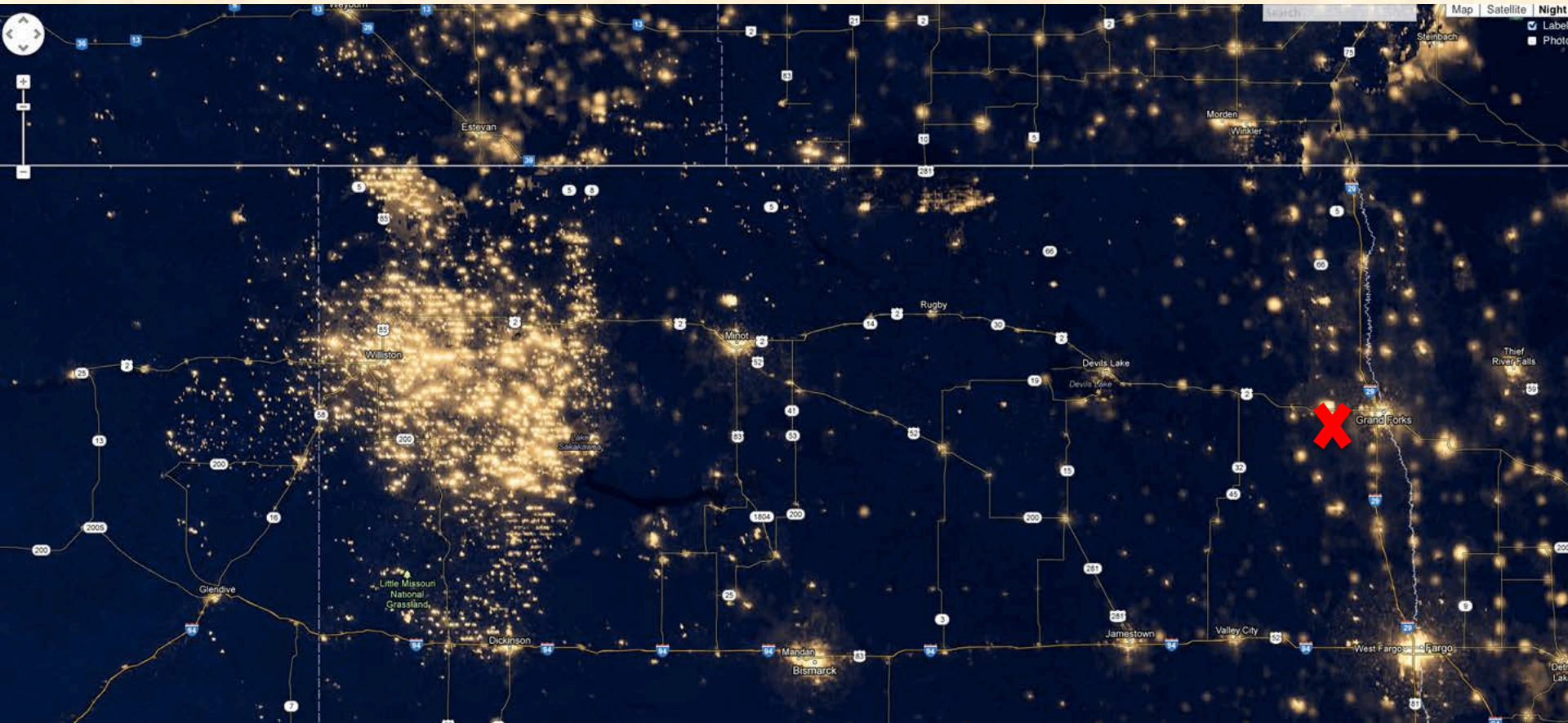
- Pre-1991: Very little astronomical research, education, or infrastructure in North Dakota.
- 1992-2004: Planetary Science Observatory (PSO). Small telescopes primarily used for public outreach.
- 2004: Proposal for 1-meter-class observatory. No funding.
- 2005: Renovations begin for Internet Observatory #1.
- 2007: Internet Observatory #2 built.
- 2008: Internet Observatory #3 built.
- 2010: New operations trailer installed. Civilization!
- 2012: Commence long-term solar and photometry programs.

UND Observatory site

- Located ~10 miles west of Grand Forks.
- Low, manageable light pollution.
- On ~1000 acres of designated prairie land that will not be developed.
- Space Studies manages assets within fenced area.
- Funded by department, college, ND EPSCoR, and private donations.

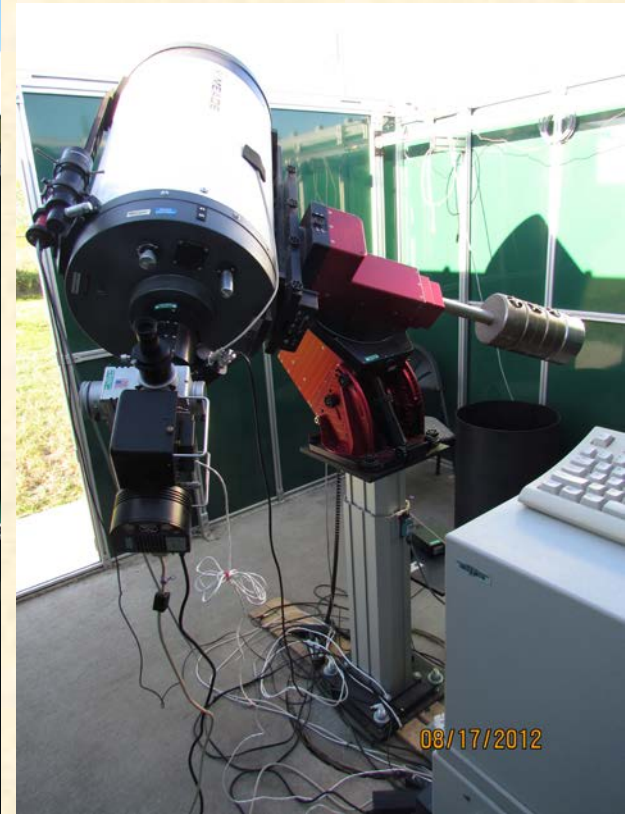


UND Observatory site



- Moonless nights – the Milky Way is visible. Light pollution east from Grand Forks, northwest from air force base, is minor.

UND Observatory telescopes



- Goal – Build Internet Observatory #4 with 24-inch telescope on-site AND/OR gain access to a 1-meter ++ observatory out-of-state.

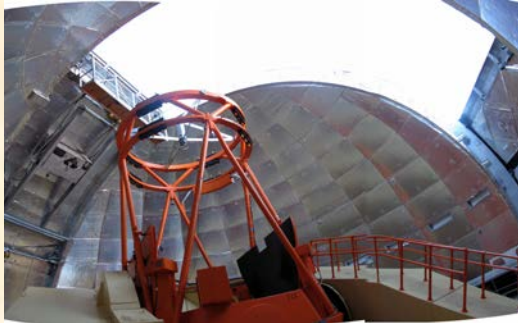
UND Observatory/astronomy research

1. Intrinsic sunspot rotation and associations with solar flares – using ISOON data. NSF proposal pending.
2. Identifying new Vestoids in the main asteroid belt derived from WISE data. Submit to NASA, June 2013.
3. Asteroid photometry program to derive rotation rates. Broadband *VR* photometry.
4. Long-term solar H α chromospheric observations (full disk/high resolution) to monitor filament formation and solar flares.

UND Observatory in 2013

- Research and education projects for 2013 will include:
 1. Broadband *VR* photometry for ~6 asteroids to determine rotation rates. Differential and absolute photometry.
 2. Rebuild Internet Observatory #2 for day and night operations. Solar H α observations on all clear days.
 3. Double star astrometry (Russ Genet/Jo Johnson).
 4. Support student thesis/non-thesis research projects.
 5. Potential project: combined photometry/spectroscopic study of T Tauri stars.
 6. Teaching support for SpSt 425: Observational Astronomy.

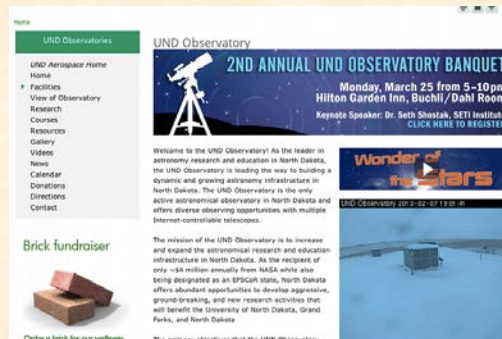
UND Observatory/astronomy research



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Collaborations will be essential to our success!



Seeking partnerships with other observatories.

UND Aerospace Sciences Ph.D.

- Mission: To provide interdisciplinary teaching and research at the highest academic levels. To provide highly educated scholars and leaders with the skills necessary to mix technology and science with an understanding of the politics and economics of the aerospace fields.
- Requirements:
 1. An M.S. degree from an accredited institution. GPA = 3.25+.
 2. Statement of personal goals.
 3. Professional resume'/CV.
 4. GRE General Examination (no specific score required).
 5. Industry experience preferred (but not required).

UND Aerospace Sciences Ph.D.

- Degree requirements include:
 1. Completion of 60 credits beyond M.S. degree.
 2. 12-18 dissertation credits.
 3. Pass qualifying examination to advance to candidacy.
 4. Core courses: Avit 501, SpSt 501, Avit 521, and SpSt 590.
 5. 6-12 credits of Scholarly Tools (i.e., research methods).
 6. Residency requirement – on campus one week per year.
 7. Remaining coursework – Space Studies or applicable UND courses from other departments, ~20-32 credits.

Molding a coherent astronomy Ph.D.

- The key: Choosing the best courses for the particular research project for each student.
- Graduate astronomy/planetary science courses currently available:
 - SpSt 520 – Asteroids, Meteorites, and Comets.
 - SpSt 521 – The Planet Mars.
 - SpSt 527 – Extraterrestrial Resources.
 - SpSt 524 – Current Topics in Astrobiology.
 - SpSt 526: Astronomical and Spacecraft Instrumentation.
 - SpSt 528: Space Environment and the Sun.

Molding a coherent astronomy Ph.D.

- The real key – using the SpSt 570 option, i.e., ‘new’ or ‘experimental’ courses. This allows students to receive instruction in topics appropriate to the research project.
- For example, for a double star/stellar physics Ph.D., courses could include:
 1. Stellar structure and evolution.
 2. Orbital dynamics for binary stars.
 3. Stellar spectroscopy and photometry.
 4. Astrometric theory and applications.
 5. Others.....

Things to remember....

- Admissions: Ph.D. students only begin each fall semester.
- Admissions deadline: February 1, annually.
- Funding: The biggest challenge – GRA/stipends currently only available for students conducting asteroid research.
- Faculty are beginning to make a stronger effort at obtaining research grants.
- **Distance students who do not require GRA/stipend funding have a better chance of admission.**

Departmental goals

1. Develop an in-house capability to design and build instruments for both ground-based observatories and spacecraft.
2. **Design and operate a space mission design laboratory.**
3. Partner with other universities/non-profits to operate large observatories that may be closing, i.e., NSO/Sac Peak, NSO/Kitt Peak, UKIRT, etc.
4. **Increase astronomy research grant funding in Space Studies.**
5. Increase the post-doc population in Space Studies.
6. Find money. Lots of money.....

Questions?

