

PLANS FOR A 1-METER-CLASS PROFESSIONAL ASTRONOMICAL OBSERVATORY FOR THE STATE OF NORTH DAKOTA. P.S. Hardersen¹ and S. de Silva², ¹Department of Space Studies, Room 526, Box 9008, University of North Dakota, Grand Forks, ND 58202. Hardersen@volcano.space.edu. ²Department of Space Studies, Room 528, Box 9008, University of North Dakota, Grand Forks, ND 58202. desilva@space.edu.

Introduction: The Department of Space Studies at the University of North Dakota (UND) is proposing to build and operate a 1-meter-class professional astronomical observatory in the State of North Dakota. Currently, no professional observatories exist within the state. The proposed facility, which will be operated and maintained by the Department of Space Studies, will serve state-wide research, education, and public outreach goals through collaborative outreach efforts with North Dakota's colleges, universities, and public and private schools. Educators, students, and researchers will have access to the observatory either on-site or via the Internet. Research efforts will primarily focus on different types of photometry due to the low-altitude location of the observatory.

Facilities Overview: The observatory will be located on UND land ~13 miles west of Grand Forks, near Emerado, ND. The plot of land for the observatory is already maintained by the Department of Space Studies and includes ACIT, a 16-inch Meade Schmidt-Cassegrain Internet-controlled telescope that is used for undergraduate-level classes. Additionally, an 18-inch Newtonian telescope is housed in a 24-foot-diameter dome. Three permanent telescope piers will be installed during summer 2004 for the Department's small 8-inch and 10-inch telescopes.

Construction of the new observatory will involve removal of the 24-foot-diameter dome and a trailer that has been used for equipment storage.

The new observatory will consist of a ~1-meter telescope housed in a traditional dome. The dome will be connected to a large, 70' x 30' multipurpose building via a walkway. The attached building will serve a variety of purposes such as telescope control, maintenance and repair, and as a meeting place for classes, community groups, and public events. The first floor of the building includes a large open area that will facilitate group events.

Site: The observatory site is located in the Red River Valley of eastern North Dakota and sits at an elevation of ~200 meters. As is typical of low-altitude observatories, the number of clear nights is variable. In the past ~3 years, the number of clear nights has averaged ~50%. Light pollution is moderate. Sky glow from Grand Forks is visible ~20° above the eastern horizon; similar sky glow from Grand Forks Air Force Base is visible ~10° above the northwestern horizon. Although the sky conditions are not ideal, they are acceptable and will allow substantive astronomical research and educational activities to take place.

The site includes access to power and water infrastructure that will not require significant upgrading in anticipation of the new observatory.

Research: Due to its low-altitude location, most of the research activities will involve different types of photometry. Examples of research activities include variable star photometry; asteroid light-curve photometry; extrasolar planet transit photometry; and search programs for near-Earth asteroids, supernovae, gamma ray bursts, and lunar flashes.

Establishment of an asteroid light-curve photometry project will complement the work of UND's researchers who conduct near-IR reflectance spectroscopy of asteroids [1,2]. Although light-curves exist for ~2000 asteroids [3], more than ~150,000 are present in the main asteroid belt. Deriving asteroid rotation rates from light-curve data will complement spectroscopic measurements of asteroid surfaces and studies of their mineralogical compositions.

Extrasolar planetary transits have been detected by small telescopes [4]. Since the first extrasolar planet detection in 1992 [5], more than 120 extrasolar planets have thus far been detected. Photometric transits offer an independent detection technique that can verify detections by other methods, such as Doppler shifts from stars orbiting the system's center-of-mass [6].

Many types of variable stars exist that vary their photometric output in a systematic manner [7]. Long-term observation programs, such as those conducted by the American Association of Variable Star Observers (AAVSO) [8], offer researchers and students the ability to study particular stars, their modes of variability, and the underlying physical mechanisms.

Education: Efforts are underway to inform the North Dakota educational community about the capabilities of the proposed observatory. State-wide mailings have been conducted to introduce educators to this project. Thus far, positive responses have been received from colleges, school districts, individual schools, and teachers from across North Dakota. Letters of support have been received from Minot State University, Bottineau Campus, Minot; Turtle Mountain Community College, Belcourt; Lake Region State College, Devils Lake; Jamestown Public Schools, Jamestown; Grand Forks Public Schools, Grand Forks; Sawyer School District #16, Sawyer; Lakota Public School District #66, Lakota; Beulah Public School District #27, Beulah; Edinburg Public School District #106, Edinburg; St. Mary's Central High School, Bismarck; Woodrow Wilson Community High School, Fargo; Hope-Page High School, Hope; Century High School, Bismarck; Des Lacs Burlington High School, Des

Lacs; Midway Public Schools, Inkster; and Northwood Public Schools, Northwood. In addition, a letter of support has been received from the City of Grand Forks.

Internet-control of the observatory, with staff overseeing telescope operations on-site, will allow educators and students from across the state to utilize a high-quality telescope without the necessity of traveling to the Grand Forks area. Due to winter weather hazards and long distances, travel to the observatory during the winter months would not usually be feasible. Internet-control, however, will provide access for educators and students from across the state and will truly make the observatory a state-wide resource.

Collaborations are planned with interested schools and colleges that will allow researchers, educators, and students access to the telescope. Educators, as well as researchers, must submit proposals that will be competitively reviewed by a telescope allocation committee (TAC). Successful proposals will then be allocated observing time.

Public Outreach: Due to the lack of any large astronomical facilities within North Dakota and the planned observatory design presented here, significant efforts will be made to develop and implement public outreach programs in the Grand Forks area as well as throughout the state.

Events such as Astronomy Day, Space Week, Space Day, and regularly-scheduled star parties will serve as ways to promote astronomy and science education in the Grand Forks area and throughout the state. Unique astronomical events will also be used to inform and educate the general populace about astronomy, the night sky, and the scientific method.

Current Status: The architectural firm of Widseth-Smith-Nolting (WSN) completed a feasibility study of the observatory for UND in September 2003 [9]. Estimated capital costs for the telescope, multipurpose building, and all associated furnishings is ~\$1.9 million in 2006 dollars.

Efforts are currently underway to raise funds from public and private sources. A proposal for the observatory telescope will be submitted to the NSF Major Research Instrumentation (MRI) program in January 2005. Other efforts will be made to obtain funds from private foundations, the North Dakota state legislature, and the federal government.

References: [1] Hardersen P. S. et al. (2004) *Icarus*, 167, 170. [2] Hardersen P.S. et al. (2002). *LPSC XXXIII*, Abstract #1148. [3] Lagerkvist C.-I. et al. (1989) *Asteroids II*, 1162. [4] www.transitsearch.org. [5] Wolszczan A. and Frail D.A. (1992) *Nature*, 355, 145. [6] Marcy G.W. and Butler R.P. (1998) *Annu. Rev. Astron. Astrophys.*, 36, 57. [7] Good G.A. (2003) *Observing Variable Stars*, Springer-Verlag, London. [8] www.aavso.org. [9] Holje P.A. (2003). Feasibility Study for Observatory Facility, Emerado, North Dakota. Project #780G153. Widseth-Smith-Nolting.

