



# ***Stocker Astroscience Center***

## ***Observatory Director's Report***

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*by*

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### ***I. Introduction.***

The best description of the observatory is: “Wow, what a place!” I will quote statistics later, and write about events, people and things going on at the observatory, but the bottom line is it has exceeded every expectation I had for the building. For 22 years I toured observatories around the world, planned, schemed, wrote proposals, lobbied administrators, and most of all took notes. Presenting my primitive drawings of what I wanted in the observatory to the architects based on those extensive notes, I was always worried that I was forgetting something, missing something, leaving something out. This past year has proven that nothing slipped between the cracks. Every space, every feature, showed it is perfect for teaching, research, and outreach, and not just in STEM, but also in the arts!

Usually when you plan for something, and you finally get it, you find something and say, “I wish I had thought of that!” Not with the Stocker Astroscience center! With that introduction, I will outline what we have accomplished this past year.

## *Some Observatory Highlights*

Tours	2000 people of all ages	Observatory
HubbleViewspace Installation	Orbital/ATK Grant	Exhibition Hall
Concerts	Muriel Anderson, Mesut Ozgen	Teaching Lab
Special Events	Fundraisers/FIU Development	Observatory
Installation of 55" Monitor	Orbital/ATK Grant	24" Dome control Room
Messier Project	FIU Physics Majors	24" Telescope

## *II. Teaching*

Teaching begins the moment a student walks toward the domed building. From the vantage point of my office, I frequently see students walking by, staring and pointing up at the silver dome gleaming in the sunlight. They find themselves attracted to the building. Those venturing into the *exhibition hall* have a treat awaiting them. When they walk through the double doors sporting a door covering depicting an accreting black hole, and enter into the exhibition hall they first notice the impressive 6' Italian glass tile mosaic in the floor beautifully depicting the transition from the South Florida environment into the frontiers of space via the Space Shuttle. Then their gaze travels up to the domed ceiling where they see the most distant galaxies humans have ever photographed: the Hubble deep field image. To their right and left, encased in two glass display cases, they can learn about the history of telescopes and the history of American spaceflight. Straight ahead, they see a poster showing the SARA telescope locations as well as our newest display: The Hubble Viewspace exhibit. Hubble Viewspace, which is discussed below, consists of six-minute programs playing on an ultra-high definition curved TV screen. These include not only astronomy videos on the planets, stars, and galaxies, but also Earth viewing programs that demonstrate the disturbing evidence of global warming, polar cap melting, and other atmospheric and geographic processes. These are the various ways students are intrigued, inspired and educated upon entering the front door of this building.

The *Main lab room* has proven an excellent room for teaching Introductory Astronomy labs. Over 350 students routinely spend several hours a week working on new hands-on laboratories supervised by TA's and adjuncts. The laptop computers provided to students have performed well and the labs and computers were financed through Dr. Caroline Simpson's successful Tech fee grant, and Dr. Tigran Abrahamyan's development work. During off hours, the lab room can be turned into a concert hall with a 16-track professional sound system. The room has been used for several concerts (also discussed below). This room is also used for FIU Astronomy Club meetings and our public outreach star parties. These two rooms are perfect for our needs in inspiring and teaching astronomy to students and visitors.

The *Astronomy Resource room* has been an extremely important space for us. Visitors to the Center can sit there awaiting their seminars. Many physics groups also use

this room for meetings of their research groups. It provides students a quiet place to study for physics and astrophysics exams and classes. It is also an important room which is filled with star charts, astronomy magazines, and a host of other books available to astronomy students to help them plan observations with the 24" telescope. This room has served as an important gathering place in the observatory.

*The Control room* has proven to be the ultimate telescope control room. The room features four stations, one for each telescope we have access to either via SARA or our own 24" telescope in our dome. The layout of the room and the availability of wall mounted monitors makes observing with multiple telescopes easy; in fact, one person can control three of four telescopes simultaneously. The rolling chairs allow one observer to easily move between consoles without ever leaving his/her seat. The switching of monitors via the Creston pad makes it possible for everyone in the room to see the relevant monitor from their own seat. The decorations and lighting provide an inspirational lift, giving the feeling of traveling to distant galaxies while efficiently controlling these remote light collectors on three different continents. We have had up to six people observing with three telescopes, and I have operated three telescopes alone from the control room. The sound and video systems in the room allow music and videos to be played during the long observing sessions helping astronomers stay awake all night while operating the telescopes. The control room is also the primary data reduction room for our research projects. We upgraded the image reduction software during the past year. All of the images we take with our telescopes from around the world are reduced and analyzed in this room. We have a high school intern, several undergraduate students and two graduate students who work regularly in this room. It is probably the most efficiently designed control room/work room in which I have ever had the pleasure of working. The control room is a very special place for visitors as well, as I will discuss in the outreach section.

*The Computer lab* on the third floor has eight computer stations, each one with image reduction software and advanced laboratory simulator programs which allows advanced astronomy classes and a computational physics classes to be taught in the room. The room also contains the printers for the Stocker Center. An attempt to buy all new computers for the computer lab has been delayed since the tech fee grant submitted by Dr. Webb was not funded this year.

The *Student waiting room* on the third floor has also been utilized to capacity for students awaiting entry to the observing deck when the labs are crowded, and also supplies a place for the Astronomy Club to meet, astronomy students to gather and study, and has also been used for presentations.

The *Observing Deck* has been getting even more powerful with the passage of time. The permanent piers have worked brilliantly, and with the cooperation of facilities management, some of the stray light issues have been solved, making the pad an even darker place to observe from. The pad is used for astronomy labs, astronomy outreach, and in some cases, research.

The *Dome and its 24" ACE telescope* have proven to be incredible assets to FIU astronomy. The telescope is extremely reliable and efficient, allowing FIU astronomers and astronomy students to maximize the clear night available. The pointing is flawless. If you correctly type in the coordinates into the control system, the telescope goes there

and the object is centered in the CCD camera field. We routinely track for 3 minutes without any sign of trailing. The CCD has proven reliable, and the attached video camera is also very nice. The addition of the 55-inch Ultra-high definition flat screen smart monitor has been amazing. We can project the video feed to the TV screen, or down to the control room, or even down to the lab room from the telescope. We can also use it to get internet astronomy videos to play during star parties if the 24" is not open for observing. I personally purchased and installed the aluminum tarps isolating the observing computers from the dome so the monitor lights do not affect the observations. This has helped immensely in darkening the environment around the telescope while enhancing the observing experience for the observer. Although more work on lighting control needs to be done on campus, the section below describes the strides we have already made in making our campus more energy efficient, safer, and making the skies darker.

### ***III. Research***

The main purpose of the Control Room is the operation of the remote telescopes: SARA North at Kitt Peak National Observatory in Arizona, SARA South at Cerro Tololo Interamerican Observatory in Chile, and the SARA RM telescope at the Roque de los Muchachos Observatory in the Canary Islands. These three telescopes provide the bulk of the research observations for the blazar monitoring program and for Dr. Van Hamme's research programs. Typically, all three telescopes are used at the same time from the control room. In addition to three papers published last year based on observations from these telescopes, an invited talk presenting the FIU blazar monitoring data was given at the Malaga Spain meeting in May 2016.

The big surprise was that the local 24" telescope could be used for monitoring distant blazars! Although the photometry from our light polluted skies prevents the detection of micro-variability in the local data, larger amplitude variations can easily be measured in the FIU data. In fact, an outburst of BL Lacertae was discovered using the FIU 24" telescope and resulted in an international group looking at the outburst with other telescopes around the world. We also use the local telescope to do preliminary observations before our observing runs with the SARA telescopes. This capability was totally unexpected and will get even better as we begin to control the scattered light on campus and purchase better cameras for the telescope.

The FIU Blazar group has devised a new theory of blazar micro-variability which is being tested with the SARA telescopes and hopefully with telescope time on larger instruments at national observing sites.

### ***IV. Outreach***

Since the last report we have hosted fourteen formal star parties (listed in Appendix I) and over thirty-three tours. Tour groups ranged from grade school classes (Metropolitan International School 7<sup>th</sup> graders) to Howard Lipman's FIU development board. I have a spreadsheet listing nearly every visitor to the observatory which I will not reproduce here, but it's fair to say people from every walk of life, every age level, every position inside the university, and people from all over the community has asked for and received personal tours of the Astroscience center. The "take your kids to school Day"

merits mention in this report. I listed hours I could be available, thinking a few hours would be used for this. However, every hour I listed was filled to capacity! I even had people and their children who couldn't get tickets stop in for a tour anyway. By Friday evening, I had given at least six hour-long tours, hosting over 120 parents and children in the observatory. I was exhausted by the end of the day, but I received numerous e-mails of thanks for taking the time to show the observatory. According to my records, I have devoted over 109 hours to tours and public events since last July, most of these hours during evenings and on weekends and nearly 2000 people have visited the observatory in the last academic year. The control room is a highlight of any tour, and frequently it is difficult to get people to leave the room! It is indeed a special space on campus and in the building.

A few of the outreach projects we have in place deserve special mention. The Hubble Viewspace project was funded by Orbital/ATK and resulted in an amazing display in the Exhibition hall. Since the hall is accessible to students on weekdays between 9:00 am and 6:00 pm, anyone can go in and sit for 10 minutes and watch an updated program on the UHD 55" color TV about astronomy, space flight, or the Earth. The programs are created by the Hubble Space Telescope Institute are uploaded to the dedicated FIU computer in the Stocker Control room every night and looped throughout the day for any interested viewer. The programs are awesome, containing music, incredible graphics, and the most up-to-date information available from a reputable source. The programs are spectacular and I think they are a huge addition to our educational mission.

We also initiated, with the help of one of our physics majors, Daniel Puentes, the Messier Project. Charles Messier was an astronomer who in the late 1700s was a comet hunter. In an attempt to find comets he ran across many non-stellar objects which he confused for comets, so he kept a list of these non-cometary objects to avoid in the future. It turns out that the objects in this list are some of the most interesting non-stellar objects in the sky. Supernova remnants, star formation regions, globular clusters, open clusters and external galaxies are all represented in the list of 110 sources. Amateur astronomers strive to see every messier object during a "Messier Marathon". Mr. Puentes proposed we photograph all of the Messier objects using the FIU 24" telescope and filters and create a catalogue of color images of every Messier object in the list. So far in our first year, we have photographed 56 out of the 110 objects. High school interns and summer visiting undergraduate interns are contributing to the image reduction and color combinations of the images. We just purchased Photoshop Elements for the control room which will help us produce high quality professional images of these objects observed from the FIU campus. This on-going project produces many of the images we use for the Stocker Picture of the Week feature on our web site.

Thanks to Susanna Rose and Walter Van Hamme, the college set aside a small amount of money to pay qualified students to open up the observatory every clear Saturday night so students can come and look through our smaller telescopes and see what the 24" telescope is looking at via the cameras attached. This has been a really rewarding program. Four undergraduate students who qualified as operators have embraced this and we have been open every clear Saturday night. Since we started this

program in the spring, we had visitors on ten different Saturday nights, including students and visitors from the community.

We have also hosted three fundraisers for the GuitART festival directed by Mesut Ozgen of the music department. On July 24, 2015, November 7, 2015, and July 29, 2016, we transformed the bottom lab room into a concert hall and hosted several guitarists performing to raise money for the GuiART festival which takes place yearly in February. These events were very successful contributing not only to science education, but the arts as well. Following the concerts, we opened up the roof for observing adding a special treat for concert goers. The web site continues to be updated with news, public event dates, and of course our SPOW (Stocker Picture of the Week). We post a new picture from our telescopes every week (similar to NASA's Astronomy picture of the day). Our undergraduate and graduate student interns do most of the image processing and writing up the explanation of the image. This has resulted in a large number of exceptional images from our telescopes.

## ***V. Light Pollution***

I wrote a proposal to Dr. Ken Jessell (FIU CFO) and John Cal of facilities management entitled: *Bring the Stars back to FIU*. I studied the lighting around the observatory and on near-by buildings and identified a number of ways we can significantly reduce up-scattered light without affecting down-illuminating light and safety. This consisted of simply turning lights such as upward-pointing architectural accent lights off, removing dangerous ground lights that point upward South of the CP building, and outward pointing lights illuminating the Graham Center's north and west face. Note: the termination of these lights did not affect in any way the walkway illumination, or doorway, window, or ground lighting. Additional lights pointing toward the observatory from the rooftops of surrounding buildings were also turned off. This undoubtedly caused a large reduction of the lighting bill since several of these lights were 400 Watt fixtures that remained on all night long illuminating only concrete and airplane underbellies. Finally, there was a light leak on the walkway lights in the quad between CP, HLSI, HLSII and the student center. The upward scattered light did nothing to aid ground illumination, but did affect vision from the observing pad on the roof of the Astroscience Center. I proposed painting the offending conic reflectors in each fixture a flat camouflage black to effectively plug the light leak. The electric department carried out the modifications using paint I purchased from Home Depot and the situation was successfully resolved. There are still outstanding lighting issues, and improvements, but with the help and cooperation of facilities and the university administration, we can have a better lighted, safer, and sky-friendly campus and save money at the same time!

## ***VI. Funding***

The observatory has no budget of its own. All improvements/enhancements must come from donations. We set up an IGNITE account and so far have successfully raised several hundred dollars via IGNITE since the observatory opened its doors. Private donations from the MIT alumni association and from a planetarium in California to whom I gave a SKYPE talk to amounted to a few hundred dollars.

We did receive several tech fee grants over the years. The latest grant was for the telescope installation costs that were not covered by the previous tech fee. Our current proposal for updated computers and software in the third floor image processing lab was not funded.

We did receive a generous grant from Orbital ATK Corporation. This mega corporation builds rocket parts and motors from ULA. One of our supporters has a brother on the Orbital/ATK board of directors. He asked us to write a proposal which we did. The proposal contained projects that ranged from several thousand dollars to two million dollars for a planetarium to finish out the science center. Orbital/ATK came up with a \$5,000 grant. With that \$5000, we installed the Hubble Viewspace in the exhibition hall, upgraded our image processing software in the control room, and installed the 55" TV in the 3th floor dome room for the 24" telescope video feed. We hope to continue our relationship with Orbital/ATK in the future. We are working with Joe Hornstein in the development office to continue looking for funds for improvements at the observatory and perhaps even the addition of a planetarium.

## ***VII. Future***

I expect a busy future for the observatory in its missions of teaching, research, and outreach. In addition to our planned programs, several film classes have asked to shoot videos in the control room, as well as FIU university film crews. High school, grade school, and even private companies have all asked for tours of the observatory. No one will be turned away. I hope to continue to make the campus a darker, safer place albeit with proper lighting, and at the same time improve the capabilities of the observatory. Continual upgrades to the exhibition hall are in the plans, including a second curved UHD screen which will feature our own images and programs scrolling across the TV screen so visitors can see not only what HST is doing, but the research we are performing. We will continue to make the lab room available for campus groups and concerts if they do not conflict with the primary mission of teaching.

We would like to continue our relationship with Orbital/ATK and perhaps find other similar sources for external funding. Joe Hornstein of the development office is working with me on finding further sources and revisiting Orbital/ATK. I have also not given up on the planetarium. To propel the Astroscience center into the elite category we are still missing the huge piece: The state of the art planetarium. I would just take one big donor, so we are still working on it! Can't wait to get started!

Sincerely,  
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***Appendix 1. Formal Star parties***

Date	Time	Event
Friday, Apr 24, 2015	8:00 - 11:00 pm	End-of-semester Star Party
Tuesday, July 14, 2015	7:00 - 11:00 am	New Horizons Flyby
Friday, July 17, 2015	8:00 - 11:30 pm	FIU Key West Style Star Party
Friday, Sept. 18, 2015	8:00 - 11:30 pm	SCAS Star Party
Friday, Oct. 2, 2015	8:00 - 9:30 pm	Public Lecture
Monday, Oct 19, 2015	8:00 - 11:30 pm	White House Star Party
Friday, Nov. 6, 2015	8:00 - 9:30 pm	Jam with the Cosmos
Friday, Dec. 4, 2015	8:00 - 10:00 pm	FIU Winter Star Party
Friday, Jan 22, 2015	8:00 - 11:30 pm	Welcome Back Star Party
Friday, Jan. 29, 2016	8:00 - 10:00 pm	Design for Exploration
Friday, Feb 19, 2016	8:00 - 9:30 pm	SCAS Star Party
Friday, Mar. 25, 2016	8:00 - 9:30 pm	Gravitational Waves
Friday, April, 8, 2016	8:00-9:30 pm	End-of-semester Star Party
Friday, Jul. 15, 2016	8:00 11:30 pm	Key West Style Star Party

***Appendix II. Pictures***



***Hubble Viewspace display***



*The Moon on the 55" TV screen located in the observatory dome as seen by the 24" telescope.*



*Local high school group tour of the observatory with Dr. Webb..*