November, 18 2018

Dear Members the Board of Budget & Finance and ASUM Senators,

I, Kaden Harrison, along with the president of The Society of Physics Students Joe Hudelson am writing this proposal on behalf of the Society of Physics Students (SPS) and with the continued support from the Physics & Astronomy Department, Blue Mountain Observatory, and Women in Physics.

SPS would like to request funding for astrophotography equipment in order to enable students the opportunity to partake in astronomical adventures around the state of Montana. If there is one common thread among physics students it would undoubtedly be our irrational love of everything space. The night sky is simply beautiful and it is this continued sense of wonder that unites us.

After months of diligent research and planning we have put together a budget that we can confidently say will allow us to pursue our passion by capturing awe inspiring images of the deepest parts of space.

As a photographer myself I discovered astro-imaging when I began working at the Blue Mountain Observatory (BMO) over last summer. With only my camera and tripod I was able to take stunning image of the Milky Way. When others heard of what I was doing I soon received literally dozens of emails from students who were fascinated and wanted to take part. After speaking with Dr. Friend who still runs the BMO and after founding it with her late husband over thirty years ago, she recommended we looked into astrophotography and deep sky imaging.

Unlike normal photography, astrophotography consists of aligning a telescope to motion of the faintest stars, tracking celestial objects for hours at a time. These techniques used by astronomers and photographers alike are able to capture jaw-dropping images of distant galaxies, other planets, and even deep sky nebula. The result of this hard work and dedication is truly beyond words and is nothing short of existential. With the modern day advances in technology, what used to possible for only a handful of scientists in billion dollar labs can now be experienced by students with little more then a clear sky and some hard work.

Our goal with this proposal would be to do just that. After speaking with SPS and Women in Physics we have found several passionate students that are dedicated to this mission. Collectively we have committed countless hours to learning the highly technical nature of this craft and with ASUM's help can hopefully make this passion a reality.

After meeting with both groups and were taken back with the eagerness to participate students were expressing. We also spoke with several enthusiastic professors from the department who agreed to help out in any way possible. Several professors even put us in contact with astronomical organizations, experts, and professionals who do professionally. Specifically, the Western Montana Astronomical Association provided excellent guidance and expressed tremendous support for our initiative. We also Spoke with Nicholas Wethington from the SpectrUM Discovery Area who does science education outreach for UM. He very generously agreed to help with anything we need offered to help new students learn how to operate equipment and being imaging. The School of Journalism also reached out with professors informing me that students photographers have expressed interest in joining us in the field.

Getting into the budget we are very aware of the extent of what we are asking for. We were extremely cautious to not be over zealous and ask for anything we feel would be unnecessary. In creating our budget, we had four main criteria being: 1) overall cost, 2) quality of the equipment, 3) mobility, and 4) difficulty of use.

It is of crucial importance to us that this equipment lasts. Our goal with this proposal is to enable passionate students to explore the night sky for years to come, far beyond when either Joe or I graduate. For that reason, purchasing quality equipment that everyone can use was paramount.

Given my personal experience as an ASUM senator and sitting through final budgeting twice I made sure to draft a proposal that was both appropriate and realistic. Each item in our budget has been thoroughly research and is absolutely essential to the highly specific nature of our proposal. When doing astrophotography each component has to work seamlessly with the entirety of the system in order to successfully capture data. For this reason, pieces are not easily interchangeable and need to work as a whole.

For our funding proposal we are submitting five separate STIP requests in total. This was per the recommendation of ASUM's Business Manager and would prevent this process from having to go through purchasing and makes things easier to understand.

Each request is numbered and pertains to a specific component of astro-imaging. The first three funding requests represent the bulk of the costs and were the only place where we had any flexibility. For these three requests we included our standard option as recommended by the experts we talked to as well as a well bare-bones budget option that should work fine if need be. The final two requests are smaller in cost but are nonetheless essential.

One important aspect of this proposal is that unlike other funding requests, our goal will not be realized if we receive partial funding. Given the nature of what we are doing we would need every aspect of the proposal to get funded for us to be operational. We have been painfully aware of this reality and for what ever reason if we are not able to get funded in full, we would humbly ask that we to not get funded at all.

Passions like this can be very expensive so we made it our goal to find the cheapest solutions possible. This is student money and we want to respect this process by not asking for more then what is needed. We would also be happy to answer any questions regarding how all this stuff works or why we chose any particular piece of equipment. For more information, we included an excel spreadsheet with descriptions and links of each item in our proposal.

To keep things simple our budget consists of these five components:

1. A Primary Imaging Telescope ($1,030 - $3,698)
2. An Equatorial Mount ($1,345 - $2,910)
3. A Primary Imaging Camera ($2,475 - $4,690)
4. An Auto-Guidance System ($525)
5. And Power Supply ($550)

To keep things concise, astrophotography works by hooking up a camera and telescope to an equatorial mount. We then calibrate the mount and telescope for its terrestrial position and align that with the relative motion of the night sky. The power supply is what keeps the equipment

running all night and the guidance system ensures that the telescope maintains its course throughout the imaging session.

In preparation for this proposal Joe and I made sure to secure other forms of funding. As a result, SPS has agreed use all of its remaining funds to support this project. Joe and I have also coordinated with several students for all other equipment needs not detailed in the proposal. Several other passionate students have also agreed to provide their personal computer, vehicles, and gas money to make this a reality once up and running and have expressed their impassioned support for this request.

We are also aware of how much we are asking for and are appreciative for the opportunity for our dream come to light. When I first joined ASUM Senate the organization was going through a budget crisis where going bankrupt and shutting down childcare were both serious possibilities. I am so happy to see how far ASUM had come since and am honored that even then we could enable students to do cool and amazing things. For this reason, I must stress that we would not be making this request if we did not believe it was within the realm of possibility; or if we felt we would be taking away from other student groups.

Finally, in preparation for this request we reached out to several members of the board to anticipate any concerns or questions you might have. We found this feedback extremely useful and took concrete steps to alleviate these concerns as a result.

The two most common concerns were issues of storage and of sponsoring equipment that would be utilized by the department itself. Both concerns are completely valid were handled appropriately.

To solve these two potential issues, we spoke with the Academic Advisor for the Physics and Astronomy Department Mark Reiser. He assured us that this equipment could be safely stored in the Clap Building year round with select student leaders given access to the space. He also assured us along with Dr. Friend that this equipment would remain the property of the student group and will not overlap with departmental use.

We greatly appreciate your consideration for this proposal and would be happy to speak to any questions or concerns you many have.

Thank you for your consideration.

Sincerely,

Kaden Harrison & Joe Hudelson

Reccommended Set-Up:

Description:	Name:	Link:	Price:
Equatorial Mount	iOptron CEMI	http://www.	2,910
Primary Imaging Telescope	Fluorostar 13	https://willia	3,698
Field Flattener/Reducer	StarField 0.8>	http://www.(	165
Primary Imaging Camera	Astro 5D Mar	http://www.(	4,690
Auto-guiding System	Orion Magnif	https://www.	350
Power Supply 1	Celestron Po\	https://www.	200
Power Supply 2	Celestron Po	https://www.	150
Dew Heater System	Dew Controll	https://astro:	105
Dew Heater Strip (Imaging Scope)	Dew Heater -	https://astro:	55
Dew Heater Strip (Guide Scope)	Dew Heater -	https://astro:	40
T-Ring Adapter 42mm	Sky-Watcher	https://www.	25
		Total:	$12,388

Budget Set-Up:

Description:	Name:	Link:	Price:
Equatorial Mount	Sky-Watcher EQ6-R Pro	http://www.s	$1,345
Primary Imaging Telescope	The Explore Scientific ED	https://explo	1,030
Field Flattener/Reducer	StarField 0.8X reducer-fl	http://www.(	165
Primary Imaging Camera	Canon EOS 6D Mark II - E	http://www.s	2,475
Auto-guiding System	Orion Magnificent Mini A	https://www.	350
Power Supply 1	Celestron PowerTank Litl	https://www.	200
Power Supply 2	Celestron PowerTank Litl	https://www.	150
Dew Heater System	Dew Controller	https://astro:	105
Dew Heater Strip (Imaging Scope)	Dew Heater - 12 Inch Tel	https://astro:	55
Dew Heater Strip (Guide Scope)	Dew Heater - 5 Inch Tele	https://astro:	40
T-Ring Adapter 42mm	Sky-Watcher 48mm T-rin	https://www.	25
Bahtinov Mask	AstroZap - Bahtinov Foc	https://explo	25
		Total:	$5,965

The Associated Students of The University of Montana **Date of Request:** 12/2/18

STIP Request Form

Group Name: Society of Physics Students

Person(s) Preparing the Request: Kaden Harrison & Joe Hudelson

Contact Phone Number: 661.714.9449 E-mail: kadenharrison27@gmail.com

ASUM Index Code: 577

Item Being Requested: German Equatorial Mount

Please attach a cover letter explaining how the item(s) will be used, how it will benefit your group and/or the University, and any other details that may help ASUM when considering your request.

	Item Description	Vendor	Price
Quote #1	iOptron CEM60	Ontario Telescopes	$2,910
Quote #2	Sky-Watcher EQ6-R Pro	Sky-Watcher USA	$1,345
Quote #3			

Other Sources of Funding: FY19 Final Budgeting for Society of Physics Students

Total Amount Being Requested: $ ($1,345 - $2,910) Total Cost of the Item/Project: $ ($1,345 - $2,910)

Group Member Signature: Kaden Harrison Date: 11/26/18

For ASUM Use:

Board on Budget And Finance:

Total Amount Approved: 2,910.00 Date: 12/2/18

X: Alexandria Schafer Print Name: ALEXANDRIA SCHAFER

ASUM Senate:

Total Amount Approved: _____ Date: _____

X: _____ Print Name: _____

The Associated Students of The University of Montana **Date of Request:** 12/2/18

STIP Request Form

Group Name: Society of Physics Students

Person(s) Preparing the Request: Kaden Harrison & Joe Hudelson

Contact Phone Number: 661.714.9449 E-mail: kadenharrison27@gmail.com

ASUM Index Code: 577

Item Being Requested: Primary Imaging Telescope

Please attach a cover letter explaining how the item(s) will be used, how it will benefit your group and/or the University, and any other details that may help ASUM when considering your request.

	Item Description	Vendor	Price
Quote #1	Fluorostar 132	William Optics	$3,698
Quote #2	The Explore Scientific ED102 Triplet CF	Explore Scientific USA	$1,030
Quote #3			

Other Sources of Funding: FY19 Final Budgeting for Society of Physics Students

Total Amount Being Requested: $ ($1,030 - $3,698) Total Cost of the Item/Project: $ ($1,030 - $3,698)

Group Member Signature: Kaden Harrison Date: 11/26/18

For ASUM Use:

Board on Budget And Finance:

Total Amount Approved: 3,698.00 Date: 12/2/18

X: Alexandria Schafer Print Name: ALEXANDRIA SCHAFER

ASUM Senate:

Total Amount Approved: _____ Date: _____

X: _____ Print Name: _____

The Associated Students of The University of Montana **Date of Request:** 12/2/18

STIP Request Form

Group Name: Society of Physics Students

Person(s) Preparing the Request: Kaden Harrison & Joe Hudelson

Contact Phone Number: 661.714.9449 E-mail: kadenharrison27@gmail.com

ASUM Index Code: 577

Item Being Requested: Primary Imaging Camera

Please attach a cover letter explaining how the item(s) will be used, how it will benefit your group and/or the University, and any other details that may help ASUM when considering your request.

	Item Description	Vendor	Price
Quote #1	Astro 5D Mark IV(Cooled 5D Mark IV)	Centra IDS	$4,690
Quote #2	Modded Canon EOS 6D Mark II	Spencer's Camera	$2,475
Quote #3			

Other Sources of Funding: FY19 Final Budgeting for Society of Physics Students

Total Amount Being Requested: $ ($2,475 - $4,690) Total Cost of the Item/Project: $ ($2,475 - $4,690)

Group Member Signature: Kaden Harrison Date: 11/26/18

For ASUM Use:

Board on Budget And Finance:

Total Amount Approved: 4,690.00 Date: 12/2/18

X: Alexandria Schafer Print Name: ALEXANDRIA SCHAFER

ASUM Senate:

Total Amount Approved: _____ Date: _____

X: _____ Print Name: _____

The Associated Students of The University of Montana **Date of Request:** 12/2/18

STIP Request Form

Group Name: Society of Physics Students

Person(s) Preparing the Request: Kaden Harrison & Joe Hudelson

Contact Phone Number: 661.714.9449 E-mail: kadenharrison27@gmail.com

ASUM Index Code: 577

Item Being Requested: Power Supply + Dew Heater

Please attach a cover letter explaining how the item(s) will be used, how it will benefit your group and/or the University, and any other details that may help ASUM when considering your request.

	Item Description	Vendor	Price
Quote #1	Celestron PowerTank Lithium Pro	Celestron	$200
	Celestron PowerTank Lithium	Celestron	$150
	Dew Controller	Astro Zap	$105
	Dew Heater Strap - 12 Inch Telescopes	Astro Zap	$55
	Dew Heater Strap - 5 Inch Telescopes	Astro Zap	$40
Quote #2			
Quote #3			

Other Sources of Funding: FY19 Final Budgeting for Society of Physics Students

Total Amount Being Requested: $ ($550 Total Cost of the Item/Project: $ $550

Group Member Signature: Kaden Harrison Date: 11/28/18

For ASUM Use:

Board on Budget And Finance:

Total Amount Approved: 550.00 Date: 12/2/18

X: Alexandria Schafer Print Name: ALEXANDRIA SCHAFER

ASUM Senate:

Total Amount Approved: _____ Date: _____

X: _____ Print Name: _____

The Associated Students of The University of Montana **Date of Request:** 12/2/18

STIP Request Form

Group Name: Society of Physics Students

Person(s) Preparing the Request: Kaden Harrison & Joe Hudelson

Contact Phone Number: 661.714.9449 E-mail: kadenharrison27@gmail.com

ASUM Index Code: 577

Item Being Requested: Auto-Guiding System

Please attach a cover letter explaining how the item(s) will be used, how it will benefit your group and/or the University, and any other details that may help ASUM when considering your request.

	Item Description	Vendor	Price
Quote #1	Orion Magnificent Mini AutoGuider Package	Orion Telescopes	$350
	Bahtinov Mask	Astro Zap	$25
	StarField 0.8X Reducer-Flattener/Reducer	Ontario Telescopes	$165
	T-Ring Adapter 42mm	Astronomics	$25
Quote #2			
Quote #3			

Other Sources of Funding: FY19 Final Budgeting for Society of Physics Students

Total Amount Being Requested: $ ($525 Total Cost of the Item/Project: $ $525

Group Member Signature: Kaden Harrison Date: 11/26/18

For ASUM Use:

Board on Budget And Finance:

Total Amount Approved: 525.00 Date: 12/2/18

X: Alexandria Schafer Print Name: ALEXANDRIA SCHAFER

ASUM Senate:

Total Amount Approved: _____ Date: _____

X: _____ Print Name: _____