**Funding Pane**l

The “Foundation for Astronomy Research” has asked your group to serve as a panel to evaluate a proposals for new telescopes. Review the proposals assigned to your panel and select one to recommend for funding. For each of the proposals you review, give a scientific or technical reason why you recommend or don’t recommend funding.

Proposal Number \_\_\_\_\_ Recommendation: 🞏 Fund 🞏 Do Not Fund

Why?

Proposal Number \_\_\_\_\_ Recommendation: 🞏 Fund 🞏 Do Not Fund

Why?

Proposal Number \_\_\_\_\_ Recommendation: 🞏 Fund 🞏 Do Not Fund

Why?

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-0124\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_13 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_Gamma Ray Research Telescope in Antarctica (GRRTA)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: G. R Burst

**Institution**: Center for Humongous Explosion Research

**Science Justification**

GRRTA will detect black holes by surveying the sky for bursts of gamma ray emission from the violent explosions of massive stars at the end of their evolution. When massive stars can no longer produce energy through nuclear fusion, they first implode, and then explode violently, producing humongous explosions known as supernovae. Such explosions may emit copious numbers of gamma rays.

**Telescope Description**

The telescope will consist of eight detector modules. Each module is a sodium iodide (NaI) detector embedded in a plastic scintillator cell. The NaI emits a burst of light when it is hit by a gamma ray. These bursts of light are detected by light-sensing tubes. The plastic scintillator emits light when a cosmic ray passes through it, but not if a gamma ray passes through it, so that cosmic ray events can be rejected. The dimensions of the modules are 0.5 m x 0.5 m x 0.2 m. Gamma ray bursts are expected at rates of roughly several per day. A strong burst could result in the observation of many thousands of gamma rays within a time interval ranging from ~0.1 s up to about 100 s.

**Proposed Site**

We propose to locate the telescope in Antarctica so that we can observe year-round. The background gamma ray flux is the same day or night, so we can observe 24/7.

**Budget**

The estimated cost of constructing the telescope is $127M. Of that amount, $50M will be used to construct the detectors, and $77M will be used for construction at the South Pole. Polar operations for GRRTA will be funded by the National Science Foundation’s Office of Polar Programs.

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-0089\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_14 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_\_\_Searching for Earth-like Planets using Transit Observations (SEPTO)\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: E. T. Calhome

**Institution**: Institute for Exoplanet Discovery

**Science Justification**

Small, low-mass planets like Earth can be detected by monitoring the light of a star. If a planet orbiting the star passes in front of the star, the starlight will be dimmed slightly, as the planet blocks a fraction of the starlight. Earth transiting in front of the Sun, for example, would block 0.01% of the Sun’s light, reducing the observed brightness of the Sun by 0.01%.

**Telescope Description**

SEPTO will be a 2-meter reflecting telescope equipped with a charge-coupled-device camera to make observations in visible light. The telescope will provide a field of view equal to 2 degrees on a side, four times the diameter and sixteen times the area of the full Moon. With this field of view, we will monitor star clusters to search for transits, allowing us to observe thousands of stars simultaneously to search for transits. Because of the high elevation of our proposed site, we expect to utilize autonomous, robotic operations, with monitoring from campus on the continental US.

**Proposed Site**

The telescope will be located in the Chilean Andes on the high-elevation Atacama Plateau (5,000 m). Winds blow from the west, so air-flow over the proposed site is smooth, and we expect the stable atmospheric conditions to produce good seeing. Other facilites are already located on this site, so that we do not have to provide new infrastructure (roads, power, communications).

**Budget**

The cost of the telescope is approximately $6M. The detector will cost an additional $2M, and the telescope enclosure will cost $4M (construction costs at high elevation are significantly higher than at sea level). The northern hemisphere monitoring facility will cost an additional $1M, and operations costs at $250,000 per year for 10 years will cost an additional $2.5M. The total cost of the SEPTO project is $15.5M.

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-0162\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_14 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_\_\_\_\_\_Canadian Solar Instrument (CSI)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: D. Brown-Howt

**Institution**: Laboratory for Solar Investigations

**Science Justification**

Solar flares emit x-rays as well as charged, high-speed particles, but the x-rays travel at the speed of light, while the charged particles have lower velocities (though still a pretty fast!) and arrive at Earth minutes to hours later than do the x-rays. Observations of solar x-rays can provide at least several minutes warning in advance of solar particle storms, allowing power and communications utilities and satellites to reduce the risk of damage. We propose two new telescopes, CSI-N and CSI-S, to monitor the solar x-ray flux to provide a warning of impending solar storms.

**Telescope Description**

CSI will focus X-rays from the Sun onto the detector using a series of concentric, cylindrical mirrors similar to those used in the Chandra X-Ray Telescope launched and operated by NASA. A special charge-coupled-device detector designed to detect x-rays, similar to those used in dental offices, will be used to detect the x-rays.

**Proposed Site**

We propose to build CSI-N in northern Canada above the Arctic Circle, where the Sun is up 24 hours a day during the boreal summer, and a second telescope, CSI-S, in Antarctica, at Palmer Station, to operate during the austral summer. With two telescopes, one at each of the Earth’s poles, we will be able to monitor the Sun continuously.

**Budget**

The budget for CSI-N will be $30M, including construction of a road and power lines to our site on the Canadian Shield. Infrastructure is already available at Palmer station, so the budget for CSH-S is slightly lower, $25M. Our ground control station will be located in Toledo, Ohio, where our principal laboratory is located, and space and equipment are already available. Annual operations costs are estimated at $5.6M per year for 20 years, for a total project cost of $167M.

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-0157\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_15 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_\_\_\_\_\_Gravity Wave Observatory (GWO)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: I. M. Heavyset

**Institution**: Center for the Study of Gravitation

**Science Justification**

Gravity waves are predicted to be produced when mass accelerates. Gravity waves are changes in the gravitational field that result from the acceleration of mass. Gravity waves are normally very weak, but gravity waves of detectable strength may be produced when objects of large mass orbit closely together, such as a binary neutron star. As the neutron stars orbit, they lose energy by emitting gravity waves, and spiral together, eventually merging in a burst of strong gravity waves. It is expected that these events are sufficiently common that we should detect a few events per month from anywhere in the Universe with a sufficiently sensitive gravity wave detector.

**Telescope Description**

The technique we propose for GWO is to measure the distortion in a large block of aluminum when a gravity wave passes through the material. The distortions are expected to be less than the size of an individual atom, but we have developed a laser technique that detect distortions this small. It has been tested in the laboratory and achieved the necessary precision, and we are confident that the technology can be scaled up to a full-size version that will be capable of detecting gravity waves from merging neutron stars.

**Proposed Site**

To have a chance of detecting gravity waves, we need a site that is geologically very stable, so there are no ground tremors, and a site that is located away from major sources of noise such as traffic or construction. A site away from population centers is needed. The GWO will be built underground and will require several kilometers of tunnels to house the laser beams in long vacuum chambers. We plan to build GWO in rural Louisiana.

**Budget**

The construction cost for GWO is estimated at $300M, with an annual operating cost of $30M. The total cost, including 10 years of operation, is $600M.

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-0235\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_15 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_\_\_\_Cosmic Microwave Balloon Experiment\_ (CMBE)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: H. T. Ayr

**Institution**: Enormous State University

**Science Justification**

The Big Bang theory postulates that the Universe has evolved from an original hot, dense state to its current density and structure. If that is the case, then light radiation from the hot gas early in the Universe would be visible today as microwave radiation coming from all directions nearly isotropically. The Cosmic Microwave Background radiation (CMB) was detected by radio astronomers in the 1950s, and we are still learning about its properties. We propose a long-duration balloon experiment in Antarctica to study the properties of the CMB.

**Telescope Description**

Our balloon payload consists of a 1.2-m radio telescope that focuses microwaves onto an array of radio receivers, each detecting a different wavelength or frequency of microwave light. The receivers are kept very cold, at a temperature of 0.27 degrees above absolute zero, to minimize background radiation. Incoming microwave radiation warms the detectors slightly, and the slight rise in temperature is measured to determine the intensity of the microwave radiation. Since only a tiny fraction of the sky can be seen concurrently, the telescope is rotated to scan the sky.

The radio telescope is carried up to an altitude of 42,000 m, above most of the atmosphere, by a long-duration balloon, and will be carried around the south pole by high altitude winds for several months as it scans the sky.

**Proposed Site**

Our experiment will be carried out at the South Pole because the air is very dry, we can fly at high altitude to get above the atmosphere, and the local atmospheric conditions will permit long-duration flights.

**Budget**

The CMBE project will cost approximately $30M to build and deploy the telescope and instrument.

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-0777\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_15 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_\_\_\_\_The Binary Star Telescope (BST)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: V. B. Starr

**Institution**: South Coast School of Mining and Technology

**Science Justification**

Astronomers like to say that three of every two stars is a binary star. Binary stars are very common in the Universe, and they can be detected as visual doubles (both stars seen separately), as eclipsing binaries (brightness variations caused when one star passes in front of or behind the other), or from shifts in the stars’ velocities as they orbit each other. Even so, we don’t have a clear picture of the distribution of orbital separations of binaries – how many binaries orbit close together compared to how many orbit with wide separations. We propose the BS Telescope to identify new binary stars and study their orbital properties.

**Telescope Description**

The BS Telescope is proposed as a new space telescope in orbit around the Earth. Although it will observe at optical wavelengths it will take advantage of being above the atmosphere to achieve sharper images than can be obtained on the ground. This will permit detection of even closer binaries than can be detected from the ground.

The telescope itself will have a diameter of 1 meter. It will be equipped with a charge-coupled device camera to obtain images of stars, and will observe stars throughout the galaxy. We expect to resolve stars as close together as 0.01 arc seconds with our 1-meter telescope.

**Proposed Site**

The BS Telescope will be launched from the International Space Station (ISS) into near-Earth orbit, trailing behind the ISS by 50 kilometers. It will be operated for 3 years, and sample approximately 100,000 stars.

**Budget**

The estimated budget of the BS Telescope project is $100M. Space hardware is expensive, since it must be tested to meet specifications for operation in space.

**Foundation for Astronomy Research**

**Proposal Number** \_\_\_\_S13-1144\_\_\_\_\_\_\_\_\_\_ **Submission Date** \_\_\_15 Dec 2012\_\_\_\_\_\_\_\_

**Title** \_\_\_\_\_\_Star Formation Observatory (SFO)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Principal Investigator**: O. S. Kool

**Institution**: West State Institute of Engineering and Technology

**Science Justification**

Regions of cool gas and dust emit electromagnetic radiation in the radio region of the spectrum, rather than in the optical part of the spectrum as hot stars do. Radio photons are low energy, and require large radio telescopes to detect them. We propose to build the new SFO radio telescope with a diameter of 100 meters to detect and study the radio spectrum of cool gas and dust in star forming regions.

**Telescope Description**

The SFO will be 100-m in diameter and fully steerable, so that we can point it anywhere in the sky. We will optimize the telescope to detect radiation from molecular hydrogen with a wavelength of 21 centimeters, so our telescope “mirror” will formed of wire mesh rather than a solid surface. With a diameter of 100-m, we expect to achieve a resolving power of 0.5 arc minutes, or 30 arc seconds.

**Proposed Site**

Since the Earth’s atmosphere is very transparent at a wavelength of 21-cm we do not have to locate our telescope on the top of a mountain to get above the atmosphere. Instead, we will locate the telescope on a small hill behind campus. The infrastructure (road, power, communication) for the site is already developed, since the campus radio station and electrical power sub-station are located as the base of the hill.

**Budget**

The construction budget for the telescope is $100M and the annual operations cost is estimated to be $10M. The campus will cover the cost of several staff positions to maintain and operate the facility, so we are requesting $160M for construction and 10 years of operation of SFO.