

**U. S. DEPARTMENT OF ENERGY
FIELD WORK PROPOSAL**

1. WORK PROPOSAL NO.: <p align="center">2414.1</p>	2. REVISION NO.:	3. DATE PREPARED: <p align="center">03-15-07</p>	3a. CONTRACTOR NO.: <p align="center">53206</p>
4. WORK PROPOSAL TITLE: Experimental Particle Astrophysics (VERITAS, DES, and Airfly)			
5. BUDGET & REPORTING CODE: KA-13-01-020	6. WORK PROPOSAL TERM: Begin: End:	7. IS THIS WORK PACKAGE INCLUDED IN THE INST. PLAN? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	7a. PRINCIPAL INVESTIGATORS: Byrum, K. Kühlmann, S.
8. HEADQUARTERS/OPERATIONS OFC PROGRAM MANAGER: Staffin, R. No. 301-903-3624	11. HEADQUARTERS ORGANIZATION: High Energy Physics		14. DOE ORG. CODE: SC
9. DOE FIELD ORGANIZATION WORK PROPOSAL REVIEWER:	12. DOE FIELD ORGANIZATION: Chicago		15. DOE ORG. CODE: CH
10. CONTRACTOR WORK PROPOSAL MANAGER: Weerts, H.J. No. 630-252-8831	13. CONTRACTOR NAME: UChicago Argonne, LLC		16. CODE: 12
17. IS THIS PROPOSAL TO DO WORK THAT INCLUDES A SECURITY INTEREST? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO			
18. WORK PROPOSAL DESCRIPTION (Approach, anticipated benefit in 200 words or less): <p style="margin-left: 40px;">This task includes the programs of experimental particle astrophysics research in the Argonne High Energy Physics Division. One major long-term effort concerns the development of readout technology for ground-based Cherenkov telescopes used for detection of cosmic ray air showers; this work is done as part of the VERITAS Collaboration. A second major long-term effort is on the Dark Energy Survey (DES) experiment in collaboration with FNAL and other groups. A third effort, the Airfly experiment, is designed to help calibrate the Auger fluorescence detectors; this is done as part of an international collaboration, including the CHM and APS Divisions at Argonne.</p>			
19. CONTRACTOR WORK PROPOSAL MANAGER: <p align="center"><i>H. Weerts</i></p>		20. OPERATIONS OFFICE REVIEW OFFICIAL: 	
<hr/> SIGNATURE	<hr/> DATE <p align="center">03-15-07</p>	<hr/> SIGNATURE	<hr/> DATE <p align="center">03-15-07</p>
21. DETAIL ATTACHMENTS: (See specific attachments.)			
<input type="checkbox"/> a. Facility requirements	<input checked="" type="checkbox"/> e. Approach	<input type="checkbox"/> i. NEPA requirements	<input type="checkbox"/> m. ES&H considerations
<input type="checkbox"/> b. Publications	<input checked="" type="checkbox"/> f. Technical progress	<input checked="" type="checkbox"/> j. Milestones	<input type="checkbox"/> n. Human/Animal Subjects
<input checked="" type="checkbox"/> c. Purpose (mandatory)	<input checked="" type="checkbox"/> g. Future accomplishments	<input type="checkbox"/> k. Deliverables	<input type="checkbox"/> o. Security requirements
<input type="checkbox"/> d. Background	<input checked="" type="checkbox"/> h. Relationships to other projects	<input type="checkbox"/> l. Performance Measures/Expectations	<input checked="" type="checkbox"/> p. Other (specify)

**WORK PROPOSAL REQUIREMENTS FOR OPERATING/EQUIPMENT
OBLIGATIONS AND COST**

CONTRACTOR NAME UChicago Argonne, LLC		WORK PROPOSAL NO. 2414.3		REVISION NO.		CONTRACTOR NO. 53206		DATE PREPARED 01/30/2007	
21. STAFFING (in staff years)		PRIOR YEARS	FY2007	FY2008	FY2009		FY2010	FY2011	TOTAL TO COMPLETE
				ESTIMATE	REQUEST	AUTHORIZED			
a. Scientific			0.6	2.9	4.6		0.0	0.0	
b. Other Direct			0.0	0.0	0.0		0.0	0.0	
c. Technical Services*			0.0	0.0	0.0		0.0	0.0	
d. Total Direct			0.6	2.9	4.6		0.0	0.0	
23. OBLIGATIONS AND COSTS (in thousands)									
a. Total Obligations			159	737	1129		0	0	
b. Total Costs			151	706	1107		0	0	
24. EQUIPMENT (in thousands)									
a. Equipment Obligations			0	0	0		0	0	
b. Equipment Costs			0	0	0		0	0	
25. MILESTONE SCHEDULE (Tasks)		FY2009 DOLLARS				PROPOSED SCHEDULE	AUTHORIZED SCHEDULE		
		PROPOSED		AUTHORIZED					
26. REPORTING REQUIREMENTS									

* Technical services staffing includes ANL support divisions' scientific effort.

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WORK PACKAGE NUMBER	WORK PROPOSAL NUMBER 2414.1	DATE PREPARED 03-15-07	REVISION NUMBER

21. DETAIL ATTACHMENTS: (See specific attachments.)

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|--|---|---|---|
| <input type="checkbox"/> a. Facility requirements | <input type="checkbox"/> e. Approach | <input type="checkbox"/> i. NEPA requirements | <input type="checkbox"/> m. ES&H considerations |
| <input type="checkbox"/> b. Publications | <input type="checkbox"/> f. Technical progress | <input type="checkbox"/> j. Milestones | <input type="checkbox"/> n. Human/Animal Subjects |
| <input checked="" type="checkbox"/> c. Purpose (mandatory) | <input type="checkbox"/> g. Future accomplishments | <input type="checkbox"/> k. Deliverables | <input type="checkbox"/> o. Security requirements |
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A. VERITAS and R&D for Cherenkov Telescope Readout & Electronics

Collaborative efforts between Argonne National Laboratory, the University of Chicago Laboratory of Astrophysics and Space Research, and the University of Utah have focused on R&D work for improving technology in cosmic ray air Cherenkov telescopes, for use in a possible upgrade of the VERITAS imaging Cherenkov detector. Collaborative efforts between Argonne and the University of Iowa have continued on R&D work for developing a topological 500MHz upper level trigger, for possible use in a VERITAS upgrade. Argonne scientists continue to contribute to the current dark matter VERITAS science program. We consider this work as both an opportunity to probe fundamental particle physics with VERITAS and also as a technological challenge. Resources for this effort come from DOE base funds, Univ. of Chicago funds and LDRD funds.

a) FY 2006-2007 Accomplishments: The TRICE telescope and telescope infrastructure are complete, and regular observation shifts are underway. First data with a partial camera was observed in spring 2006. Data analysis is underway. Argonne physicists have presented TrICE physics concepts and hardware design at international conferences. By fall 2007, TrICE will be complete and a journal paper is expected.

Argonne physicists perform regular shifts on VERITAS, lead the science dark matter working group, and are active in other science groups. Deirdre Horan is working on N-body dark matter simulations in collaboration with UCLA, and the ANL VERITAS group is analyzing dark matter targets. Argonne physicists hold positions of leadership within the VERITAS experiment. A demonstration topological trigger board has been built and tested, and a system design for the prototype is underway. A demonstration photon counting ASIC has been built and tested. Structural engineering on new optical designs for a possible VERITAS upgrade have begun. We request funds for a continued joint postdoc with the University of Chicago. Our current postdoc (who has been supported by laboratory discretionary funds) will be moving at the end of the summer to work with NASA on GLAST. The VERITAS collaboration is planning to submit a technology proposal for an upgrade in fall 2007.

b) FY 2008 Plans: We will continue R&D work for improving the technology of cosmic ray air Cherenkov telescopes and future gamma-ray telescopes. We plan to use our R&D efforts as a basis to be part of the VERITAS technology proposal. We plan to build a prototype fast topological trigger board and test this in parasitic mode on the VERITAS-4 array (using tech. upgrade funds). We plan to construct a prototype of a telescope with a new optical design. The prototype ASIC electronics will be completed and ready to

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implement and test on a full 15 degree camera. We request continued support of a postdoc.

c) FY 2009 Plans: Based on work done in previous years Argonne will play lead roles in the design and engineering of high speed, high performance front-end electronics, in the triggering electronics, and in the mechanical engineering of the final three telescopes in an upgraded VERITAS telescope array. Other possible applications of the R&D would be considered as well. We request continued support of a postdoc.

B. DES

The Dark Energy Survey is an experiment which will greatly improve our understanding of the expanding universe. Argonne has recently been accepted for membership in the collaboration. The scientific staff and post-doc will contribute to the critical path of the experiment, namely testing and analysis of the 520 mega-pixel CCD imager. HEP engineers will lead the design and implementation of the controls systems, including the shutter, filter, cooling, and precise control of the camera position. HEP will also contribute significantly to the mechanical design and testing of the camera itself, including corrector lenses.

FY2008-2009 Goals: HEP scientists will contribute to the preparations for supernovae data, including run-plan issues such as exposure time at each location, overlap with existing surveys, and fraction of data taken on elliptical galaxies.

C. Airfly

The Airfly experiment is an international effort to measure the amount of fluorescence light emitted by air when a beam of electrons passes by. It is important to know this for high energy cosmic ray measurements which use fluorescence light to estimate the energy of the cosmic ray. Argonne is unique in that it has three accelerators that are quite useful for these calibrations. Data have been taken in the HEP, CHM, and APS divisions at Argonne; five HEP staff members are involved in the experiment. We have one publication ready for journal submission in FY2007.

FY2008-2009 Goals: We expect to complete all measurements and publish several additional papers on these results.