BUD-11A (1-07)
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U. S. DEPARTMENT OF ENERGY
FIELD WORK PROPOSAL

1. WORK PROPOSAL NO.:	2. REVISION NO.:	3. DATE PREPARED:	3a. CONTRACTOR NO.:
2417.2		03-15-07	52110

4. WORK PROPOSAL TITLE:
Accelerator R&D (AWA)

5. BUDGET & REPORTING CODE:	6. WORK PROPOSAL TERM: Begin: End:	7. IS THIS WORK PACKAGE INCLUDED IN THE INST. PLAN?	7a. PRINCIPAL INVESTIGATORS:
KA-15-01-02		☒ YES ☐ NO	Gai, W.

8. HEADQUARTERS/OPERATIONS OFC PROGRAM MANAGER:	11. HEADQUARTERS ORGANIZATION:	14. DOE ORG. CODE:
Staffin, R. No. 301-903-3624	High Energy Physics	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? ☐ YES ☒ NO

18. WORK PROPOSAL DESCRIPTION (Approach, anticipated benefit in 200 words or less):

This task covers basic research in new concepts and methods for particle physics accelerators. The work is primarily directed towards R&D on advanced acceleration physics and technologies that promise significant advances over what can be achieved using conventional techniques. Current research is focused on high brightness and high current electron beam generation; new acceleration methods, such as electron beam-driven wakefield acceleration; and advanced accelerating structure development. We perform research at both the Argonne Wakefield Accelerator Facility and other research facilities.

19. CONTRACTOR WORK PROPOSAL MANAGER:		20. OPERATIONS OFFICE REVIEW OFFICIAL:	
H. Weerts	03-15-07		03-15-07
SIGNATURE	DATE	SIGNATURE	DATE

21. DETAIL ATTACHMENTS: (See specific attachments.)

☐ a. Facility requirements	☒ e. Approach	☐ i. NEPA requirements	☐ m. ES&H considerations
☐ b. Publications	☒ f. Technical progress	☒ j. Milestones	☐ n. Human/Animal Subjects
☒ c. Purpose (mandatory)	☒ g. Future accomplishments	☐ k. Deliverables	☐ o. Security requirements
☐ d. Background	☒ h. Relationships to other projects	☐ l. Performance Measures/Expectations	☒ p. Other (specify)

WORK PROPOSAL REQUIREMENTS FOR OPERATING/EQUIPMENT OBLIGATIONS AND COSTS

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22. STAFFING (in staff years)	PRIOR YEARS	FY 2007	FY 2008 ESTIMATE	FY 2008 REVISED	FY 2009 REQUEST	FY 2009 AUTHORIZED	FY 2010	FY 2011	TOTAL TO COMPLETE
a. SCIENTIFIC		4.0	4.0	4.0			0.0	0.0	
b. OTHER DIRECT		2.5	1.5	1.5			0.0	0.0	
c. TECHNICAL SERVICES*		0.0	0.0	0.0			0.0	0.0	
d. TOTAL DIRECT		6.5	5.5	5.5			0.0	0.0	
23. OBLIGATIONS AND COSTS (in thousands)									
a. TOTAL OBLIGATIONS		1360	1538	1588			0	0	
b. TOTAL COSTS		1488	1535	1585			0	0	
24. EQUIPMENT (in thousands)									
a. EQUIPMENT OBLIGATIONS		506	124	143			0	0	
b. EQUIPMENT COSTS		496	144	143			0	0	

25. MILESTONE SCHEDULE (Tasks)	FY 2009 DOLLARS PROPOSED	FY 2009 DOLLARS AUTHORIZED	PROPOSED SCHEDULE	AUTHORIZED SCHEDULE

26. REPORTING REQUIREMENTS

Supplemental Funds for completion of the RF station:

We are heavily leveraging AWA and ANL funds in order to double the rf power from 30 MW to 60 MW, enabling vastly improved wakefield performance. We have acquired: a 30 MW klystron tube (Litton L-3702) valued at $250K along with its tank, socket, HV pulse transformer, and solenoid valued at an additional $83K from LANL; a thyratron and its firing circuit valued at $40K from ANL-APS; the PFN PS valued at $40k from ANL-HEP; and an rf circulator and waveguide valued at $40K from our own funds. Thus, we already have $453K worth of equipment in place. To complete the modulator we still need items such as: PFN capacitors and inductors ($17K), new controls and interlocks ($40K), waveguide ($20K), low-level rf circuitry($50K), electrical contract work($15K), power supplies for solenoids, thyratron and klystron filaments ($20K), HV cabling ($5K), radiation shielding ($5K), and miscellaneous construction materials ($10K), for a total of $182K plus another $50K contingency. In addition, we will require 1 FTE (technician/engineer) for 1 year at a cost of $103K. Adding in Lab Indirect, the total request we are making is for $396K.

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

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Advanced Accelerator R&D

a) FY2006-2007 Accomplishments: During the last year (FY06-07) we performed several significant experiments at the AWA: 1) Passed an 80 nC beam through a dielectric wakefield accelerator (DWFA) structure yielding > 80MV/m, doubling last year's gradient. 2) Measured the energy gain of a witness beam from a ramped bunch train passing through a DWFA structure that confirmed the transformer ratio enhancement concept (Euclid collaboration). 3) Fabricated a series of Cs_2Te photocathodes in an effort to produce high QE. Up to now, the highest QE obtained is ~ 2 x 10^-3, which is roughly 2 orders of magnitude lower than expected. To deal with this, we are consulting Cs_2Te deposition experts, modifying our process, recipe, and hardware accordingly. 4) Operated the AWA facility for the AIRFLY collaboration resulting in the first ever measurement of the nitrogen fluorescence yield curve in the 3-14 MeV energy range. 5) Machined the cells of a new witness gun: a 1.5-cell rf photocathode gun called *G3*. 6) Performed detailed 6-D phase space measurement of the AWA beam at low charge (1-5 nC); the results agree well with simulation. 7) In agreement with LANL, we are borrowing a klystron from them by way of a long-term loan. This new rf station can be used to double the AWA drive beam energy.

b) FY2008 Plans: 1) Continue to raise the gradient in the DWFA structure to well over the 100 MV/m. 2) Begin Cs_2Te cathode operation in order to generate and characterize high-current electron pulse trains. 3) Conduct 2-D and 4-D transverse phase space measurements of single and pulse train e-beams, particularly for Q=10-100nC. 4) Start a longitudinal-to-transverse "Emittance Exchange" experiment at the AWA (in collaboration with NIU and APS). 5) Continue to perform laboratory particle astrophysics experiments. 6) Complete G3 fabrication: make photocathode and rf coupler, add water cooling, and perform tuning and final brazing. 7) Beam-test novel e-beam diagnostics (in collaboration with UMD and FNAL). 8) Install and test new RF station.

c) FY2009 Plans: 1) Continue to demonstrate high-gradients in DFWA structures and other structures. 2) Perform high-power rf extraction from high-current pulse trains. 3) Study new beam physics phenomenon related to high-intensity pulse trains. 4) Continue to provide the facility for external collaborator's use for acceleration, diagnostics, and laboratory particle astrophysics experiments.

Currently, we are supporting 4 students doing Ph.D. theses using the AWA facility.

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Other Accelerator R&D activities:

a) FY2006-2007 Accomplishments: 1) We constructed and high-power tested new types of DLA structures at NRL and SLAC and furthered our physics understanding of breakdown and multipacting with dielectric-loaded accelerator (DLA) technology. We delivered an X-band injector to NRL. 2) We performed end-to-end simulations of ILC positron sources that provided critical information for the ILC baseline design.

b) FY2008 Goals: 1) At NRL we plan to commission the new injector and continue to test new DLA structure designs. We will also test other types of high-gradient structures such as photonic band gap and left-handed meta-material accelerators. 2) In the ILC collaboration we will continue to study and optimize the e^+ source for the baseline layout. We will perform initial designs for the ILC keep-alive source.

c) FY2009 Plans: 1) Working with collaborators from NRL and Euclid, we hope to demonstrate high-gradient acceleration of the electron beam at NRL. 2) We will carry out the complete simulation of a realistic ILC e^+ source for the ILC Global Design Effort.

New Initiatives:

Working with collaborators from APS and NIU, we are beginning to plan a beam physics experiment called “Emittance Exchange” with the potential to eliminate the ILC damping ring. We will also begin developing two advanced structures: PGB and a heavily damped DLA.