

**BROOKHAVEN NATIONAL LABORATORY
 PROPOSAL INFORMATION QUESTIONNAIRE
 LABORATORY DIRECTED RESEARCH AND DEVELOPMENT PROGRAM**

PRINCIPAL INVESTIGATOR	W. Marciano / A. Deshpande	PHONE	Ext. 3151
DEPARTMENT/DIVISION	Physics/PO	DATE	04/04/2009
OTHER INVESTIGATORS	Krishna Kumar (UMass), Werner Vogelsang (BNL)		
TITLE OF PROPOSAL	Electroweak Physics with an Electron Ion Collider		
PROPOSAL TERM (month/year)	From 10/09	Through	09/11

SUMMARY OF PROPOSAL

Description of Project: The Electron-Ion Collider (EIC), with its unique availability of high-energy electron-nucleus and polarized electron-proton collisions, is hoped to provide groundbreaking insights into the dynamics of the strong interactions. It has recently been discussed that the EIC might also make significant contributions to our understanding of the electroweak interactions. However, no detailed studies have been carried out so far. We propose this LDRD to explore the opportunities for electroweak physics that an EIC might provide. Our main objectives will be to carry out theoretical calculations of electroweak observables at the EIC, as well as studies of the required machine and experimental capabilities. Among the physics topics we have in mind for our investigations are:

- Opportunities for studies of nucleon and nuclear structure through electroweak deep-inelastic scattering (DIS). The exchange of W and Z bosons in DIS leads to novel structure functions that contain information on parton distributions, complementary to that obtained in ordinary DIS through photon exchange. This is a promising avenue for polarized ep collisions in particular.
- It has been proposed that precision studies of parity-violation in DIS at an EIC could allow a new and independent measurement of the Weinberg angle and its running with energy scale. This information is much needed, in view of the somewhat inconclusive status of comparisons between previous measurements and theory. The theoretical treatment will require inclusion of radiative strong and electroweak corrections.
- It is conceivable that with sufficient luminosity the EIC might allow to set limits on lepton flavor violations in the electron-tau sector, or to constrain new neutral-current interactions. This requires careful assessment of limits from other experiments.

In each case we plan to determine the requirements that an EIC would need to fulfill in order for significant scientific results to emerge, both regarding the machine itself, as well as the detectors.

Scope: We propose to hire a theorist as a post doc who would lead the theoretical aspects of the investigations mentioned above. We envisage that he/she would work closely with the experimentalists involved in the EIC project to accommodate the detailed aspects of the measurements and their required sensitivity. This will include detector condition simulations and background studies. Our proposal also includes funds for visiting scientists, including the proposers of this LDRD.

Expected Results: Development of a science case for electroweak physics at an EIC, and determination of required machine parameters and detection capabilities.

**LDRD
BUDGET REQUEST BY FISCAL YEAR
Physics Department
Electroweak Physics with an Electron Ion Collider
PI- Vogelsang/Marciano/Deshpande**

COST ELEMENT	FISCAL YEAR 2010	FISCAL YEAR 2011	FISCAL YEAR 2012	Total Cost
Labor *				
Post Doc @80%	\$ 50,779.00	\$ 52,810.16	\$ -	\$ 103,589.16
Fringe @ 28.00%	\$ 14,218.12	\$ 14,786.84	\$ -	\$ 29,004.96
Salary: Physicist	\$ -	\$ -	\$ -	\$ -
Salary: Professional	\$ -	\$ -	\$ -	\$ -
Salary: Technician	\$ -	\$ -	\$ -	\$ -
Fringe @ 38.00%	\$ -	\$ -	\$ -	\$ -
Total Labor	\$ 64,997.12	\$ 67,597.00	\$ -	\$ 132,594.12
Materials	\$ 5,000.00	\$ -	\$ -	\$ 5,000.00
Supplies-	\$ -	\$ -	\$ -	\$ -
Travel	\$ 10,500.00	\$ 10,710.00	\$ -	\$ 21,210.00
Total MST	\$ 15,500.00	\$ 10,710.00	\$ -	\$ 26,210.00
Visitors & Workshop				
Per Diem	\$ 8,470.00	\$ 4,480.00	\$ -	\$ 12,950.00
Housing	\$ 12,230.00	\$ 6,000.00	\$ -	\$ 18,230.00
Air fare / Car rental esc	\$ 14,500.00	\$ 7,600.00	\$ -	\$ 22,100.00
Graduate Student (2 p/t)	\$ 22,500.00	\$ 18,080.00	\$ -	\$ 40,580.00
Organizational Burden @ 12.60%	\$ 8,189.64	\$ 8,517.22	\$ -	\$ 16,706.86
Electric Power @ 1.92%	\$ 1,247.94	\$ 1,297.86	\$ -	\$ 2,545.81
ITD Allocation @ 3.4% of TMC	\$ 3,943.59	\$ 3,464.82	\$ -	\$ 7,408.41
TOTAL DIRECT COST	\$ 151,578.29	\$ 127,746.91	\$ -	\$ 279,325.20
G&A Burden	\$ 11,425.26	\$ 9,898.88	\$ -	\$ 21,324.14
Common Support	\$ 29,263.31	\$ 25,710.58	\$ -	\$ 54,973.89
Materials Burden @ 8.25%	\$ 4,331.25	\$ 3,002.18	\$ -	\$ 7,333.43
TOTAL PROJECT COST	\$ 196,598.11	\$ 166,358.54	\$ -	\$ 362,956.65
	FY 10 FTE	FY 11 FTE	FY 12 FTE	Total FTE's
TBD Post Doc	0.85	0.85	0.00	1.70
TBD Scienific	0.00	0.00	0.00	0.00
TBD Scienific	0.00	0.00	0.00	0.00
TBD Scientif	0.00	0.00	0.00	0.00
TBD Scienific	0.00	0.00	0.00	0.00
TBD Professional	0.00	0.85	0.00	0.85
TBD Technical	0.00	0.00	0.00	0.00
Total FTE's	0.85	1.70	0.00	2.55
List all materials costing over \$5000	None	None	None	None