Fiscal Vear:	EV 2008	Task Last Undated.	FY 12/03/2009
PI Namo:	Chainette Empreis A Dh D		
Project Title:	Ouentum Multiple Seattering Model of Heavy Ion Fragmentation (OMSERG)		
Troject Thie.	Quantum Multiple Seattering Mode	for many for magnetitation (QMSFRO)	
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHRadiation h	health	
Joint Agency Name:		TechPort:	Yes
Human Research Program Elements:	(1) SR:Space Radiation		
Human Research Program Risks:	 (1) ARS:Risk of Acute Radiation S (2) Cancer:Risk of Radiation Carci (3) CNS:Risk of Acute (In-flight) at (4) Degen:Risk of Cardiovascular D Secondary Spaceflight Stressors 	yndromes Due to Solar Particle Events (SPE nogenesis nd Late Central Nervous System Effects froi visease and Other Degenerative Tissue Effec	.s) m Radiation Exposure ts From Radiation Exposure and
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	not available	Fax:	FY
PI Organization Type:	NASA CENTER	Phone:	(702) 895-4320
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Zip Code:	89154-3037	Congressional District:	1
Comments:	Formerly at NASA Johnson Space Center, until summer 2013 (Ed., Oct 2013)		
Project Type:	Ground	Solicitation / Funding Source:	Directed Research
Start Date:	09/01/2008	End Date:	08/31/2010
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		No. of Master' Degrees:	
No. of Master's Candidates:		No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
Contact Monitor:	Cucinott1a, Francis	Contact Phone:	281-483-0968
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Saganti, Prem (Prairie View A&M Kim, Myung-Hee (Wyle Laborato	1) ries)	
Grant/Contract No.:	NNX07AT25A		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The quantum multiple scattering model of neavy ion fragmentation (QMSFRG) is an important input to risk evaluation and radiation shielding calculations. Several areas of development in nuclear data base development and output deliverables with the QMSFRG model will be the focus of this directed research as guided by previous results. Applications include biophysical models of biological damage as ions passed through complex tissue structures (Ponomarev and Cucinotta, 2006), radiation transport code applications (Wilson et al, 1991) including shielding evaluations (Cucinotta et al., 2006), and in comparisons of models to flight experiments (Badhwar and Cucinotta, 2000; Cucinotta et al., 2000), and space radiation risk assessments (Cucinotta et al., 2001). It is important to note that although measurements of nuclear fragmentation cross sections are a step in code development for biophysical, shielding, and risk analysis, only theoretical models can provide a complete data base for such studies. Past nuclear fragmentation models have relied on parameterizations of experiments or semi-classical physics models. These approaches have been shown to fail badly in heavy ion radiation transport code comparisons to experiments (Wilson et al., 1986). Typical fragmentation measurements do not measure all secondary products and are usually restricted to fragments from ZP-1 to ZP/2 where ZP is the projectile charge. Lower charged fragments make important contributions to the galactic cosmic ray (GCR) transport. Parametric models include no underlying physical description and thus fail outside the range of measurements. This failure is amplified when one considers the large number of projectiles, target, and energies of interest and the lack of measurements for most of these reaction partners. Important aspects of nuclear reactions are not reproduced in Monte-Carlo models of heavy ion reactions and indicate the need for a quantum description that is capable of being implemented for GCR data bases. This features include the ro
	(GCR) computational evaluations. For the two-year period of performance we have the following Specific Aims:
	Specific Aim 1: To develop Computer Subroutines from the QMSFRG model that will generate require cross section data for application within the high-charge-and energy (HZE) transport computer program (HZETRN) code in collaboration with Dr. John Wilson, NASA Langley Research Center (LaRC). A 190-ion grid for 9 projectile energies on arbitrary target materials (Hydrogen to Lead) applicable GCR shielding problems will be generated with appropriate interpolation schemes for other materials and energies. Furthermore, to prepare a data base generator for Monte-Carlo transport code applications (Dr. M.Y. Kim, Lead) and tested in the Geant4 code in collaboration with Dr. Maria Grazia Pia, INFN (Italian National Institute of Nuclear and Particle Physics), Genoa, Italy.
	Specific Aim 2: To report on the extension of the light ion production cross sections in the QMSFRG model for nuclear coalescence formation of light particles (d, t, h, a), and the resulting losses to n and p production (Dr. F.A. Cucinotta, Lead). Also, data bases of light-particle production multiplicities will be generated. Comparisons to experimental data will be reported.
	Specific Aim 3: To improve the model energy density formalisms used in the nuclear de-excitation process in QMSFRG Master decay-solutions (Dr. P. Saganti, Lead). Cross-comparisons of different models and to experimental data will be reported.
	Specific Aim 4: To implement the NASA Johnson Space Center (JSC) Selected Core formalism for the description of pre-fragment excitation functions in nuclear abrasion for selected GCR nuclei (12C, 16O, 20Ne, and 28Si) and to extend the formalism for alpha-clusters (Dr. P. Saganti, Lead). Fragmentation cross section calculations will be compared to experimental data.
	Future work will extend the quantum multiple scattering theory to explicit pion channels, to consider other light particle clusters, and to produce data bases of light and heavy particle energy spectra.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2008.
Bibliography Type:	Description: (Last Updated: 02/11/2021)