Universidade de São Paulo
Instituto de Física de São Carlos

XII Semana Integrada do Instituto de Física de São Carlos

Livro de Resumos

São Carlos
2022

Semana Integrada do Instituto de Física de São Carlos

SIFSC 12

Coordenadores

Prof. Dr. Osvaldo Novais de Oliveira Junior
Diretor do Instituto de Física de São Carlos – Universidade de São Paulo

Prof. Dr. Javier Alcides Ellena
Presidente da Comissão de Pós Graduação do Instituto de Física de São Carlos – Universidade de São Paulo

Profa. Dra. Tereza Cristina da Rocha Mendes
Presidente da Comissão de Graduação do Instituto de Física de São Carlos – Universidade de São Paulo

Comissão Organizadora

Adonai Hilario
Arthur Deponte Zutião
Elisa Goettems
Gabriel dos Santos Araujo Pinto
Henrique Castro Rodrigues
Jefter Santiago Mares
João Victor Pimenta
Julia Martins Simão
Letícia Martinelli
Lorany Vitoria dos Santos Barbosa
Lucas Rafael Oliveira Santos Eugênio
Natasha Mezzacappo
Paulina Ferreira
Vinícius Pereira Pinto
Willian dos Santos Ribela

Normalização e revisão – SBI/IFSC

Ana Mara Marques da Cunha Prado
Maria Cristina Cavarette Dziabas
Maria Neusa de Aguiar Azevedo
Sabrina di Salvo Mastrantonio

Ficha catalográfica elaborada pelo Serviço de Informação do IFSC

Semana Integrada do Instituto de Física de São Carlos
(12: 10 out. - 14 out. : 2022: São Carlos, SP.)
Livro de resumos da XII Semana Integrada do Instituto de Física de São Carlos/ Organizado por Adonai Hilario [et al.]. São Carlos: IFSC, 2022.
446 p.
Texto em português.
1. Física. I. Hilario, Adonai, org. II. Titulo

ISBN: 978-65-993449-5-4 CDD: 530

PG10

Search for exotic particles (Q-balls) in ultra-high energetic astroparticles.

PAULA, Tales de; SOUZA, Vitor de; ARBELETCHE, Luan Bonneau

ferrazdepaula@ifsc.usp.br

With an energy range from 10^{17} eV up to 10^{21} eV, Ultra-High-Energy Cosmic Rays (UHECR) particles can traverse the cosmos and reach Earth's atmosphere, starting a cascade of reactions, the so called extensive air showers, by interacting with its nuclei. Measurements about the primary particle can only be made indirectly by detection of the shower by large observatories, and, being so rare, much of the study on UHECR is done by Monte Carlo approach of air showers based on hadronic interaction models. With that said, and despite the significant advances of technology, much of UHECR is unknown. Its biggest mystery is its origin, and a better understanding of it is a fundamental piece of the puzzle to better understand the Universe, both on a microscopic and macroscopic scale. One possible candidate are exotic particles (1), and there is a very stable hypothesized supersymmetric particle that, despite being a candidate for cold dark matter, strongly interacts with matter, the Q-ball. (2) Since the UHECR energies are beyond human technology, UHECR data is a unique sample to search for new physics. In this work we propose the study of air showers initiated by Q-ball based on simulations by Conex. (3) The objectives are to propose a method to differentiate air showers initiated by this exotic particle from others, and to apply this method in the Pierre Auger Observatory dataset for search for Q-balls. Results show that the method unambiguously differentiate the showers.

Palavras-chave: Física de astropartículas. Raios Cósmicos. Chuveiros atmosféricos.

Agência de fomento: CAPES (88887.602973/2021-00)

Referências:

1 BIERMANN, P.L. The origin of the highest energy cosmic rays. **Journal of Physics G** : nuclear and particle physics, IOP Publishing, v. 23, n. 1, p. 1, 1997. DOI: https://doi.org/10.1088/0954-3899/23/1/002.

2 ARAFUNE, J. *et al*. Experimental bounds of masses and fluxes of nontopological solitons. **Physical Review D**, APS, v. 62, n. 10, p. 105013, 2000. DOI: https://doi.org/10.1103/PhysRevD.62.105013.

3 MAYOTTE, E. W. **Searching for slow-developing cosmic-ray showers** : Looking for evidence of exotic primaries at the Pierre Auger Observatory. 2016. PhD Thesis - Colorado School of Mines, Colorado, 2016.