Chapter 1 : Research work of Stefano Scopel

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Summary of my Research Work My research activity is mainly devoted to the study of dark matter particle candidates, with particular emphasis on supersymmetric models and the neutralino. My main contributions may be summarized as follows: Neutralino relic abundance calculation. I have worked in the calculation of the present-day neutralino relic density [2]. This implies the evaluation of the neutralino annihilation cross section taking into account all the possible final states, and the calculation of its thermal average in the early Universe, including resonance and thresholds effects. Recently I have calculated the cosmological lower limit of the neutralino mass in models without gaugino unification, improving previous results[36 , 39 , 40]. Neutralino and WIMP direct detection consists in the measurements of the recoil energy deposited in low-background underground detectors by dark matter particles scattering elastically off target nuclei. Many experimental direct searches are under way, one of which, the DAMA experiment, has detected an annual modulation feature in the data. I have contributed to show for the first time in a series of publications [24 , 18 , 14 , 13 , 10], that this effect can be compatible to a neutralino signal. I have extensively worked in the calculation of expected direct detection signals, consisting in the evaluation of the neutralino nucleus elastic cross section[28 , 3 , 1] , nuclear form factors [9], hadronic matrix elements[33 , 19] and the modeling of the WIMP velocity distribution in the Galaxy[32 , 18 , 12]. I have also collaborated to various experimental collaborations for direct dark matter search: The neutralino annihilation rate is increased whenever their density is enhanced. The density build-up produced by gravitational WIMP capture in celestial bodies like the Earth or the Sun is expected to lead to a flux of high energy neutrinos, the only final states which are not stopped inside. These neutrinos are in principle measurable by underground detectors MACRO, Super Kamiokande which can reveal the up-going muons produced by the neutrino conversion in the rock underneath the laboratory. I have worked in the evaluation of these signals [24, 15 , 6 , 1] , which imply the calculation of the capture rate of neutralinos in the celestial body, calculation of neutralino annihilation cross section and of the balance between capture and annihilation; calculation of the neutrino contribution from all final states taking into account neutrino oscillation , and of the neutrino conversion into muons. I have shown how the current upper limits for neutralino dark matter coming from Super Kamiokande may be either evaded or strongly enhanced depending on the astrophysical assumptions [24]. Dark matter and solar physics. I have critically analyzed the possible links between the issue of WIMP capture in the Sun and the constraints which can be derived from solar physics. In particular I have shown that no constraints can be derived at present from helioseismology and 8 B neutrinos for WIMPs with mass above 30 GeV[34]. Solar axions may be detected by making use of crystal detectors of the same type as those used in direct WIMP searches and double-beta decay. I have developed an analytical calculation of expected rates, extending existing results for Germanium to the case of other target nuclei , and clarifying for the first time the realistic potentialities of this kind of research[16]. The analysis of the data of DAMA lead to the publication of the most stringent laboratory limit on the axion-photon coupling in the highest range of the allowed axion mass. Dark halo velocity distribution. I have collaborated to several studies where the effect of the uncertainty of the velocity distribution function including effects due to different density profiles, anisotropy of the velocity dispersion tensor, flatness, triaxiality or corotation of the halo have been systematically included in the analysis of direct detection experiments and in particular of the DAMA annual modulation data[32 , 18 , 12]. I have also shown for the first time how the anisotropy of the WIMP velocity dispersion may lead to a temporal distortion of the modulation effect[37]. I have studied in detail and developed computer programs to calculate supersymmetric scenarios: Supergravity - inspired SUGRA model, where particular boundary conditions are adopted for soft breaking terms at the Grand Unification scale and the Electro-Weak symmetry is broken radiatively[13]; alternative scenarios, where SUGRA boundary conditions are relaxed [6 , 5]; phenomenological models where all physical parameters are directly defined at the EW scale with the smaller

number of theoretical assumptions [36 , 28 , 10]. Implications on the neutralino relic abundance and on dark matter searches of accelerator measurements. I have developed codes to study the impact of updated accelerator bounds on the couplings and masses of supersymmetric particles, like the calculation of susy corrections to FCNC effects like the b to s gamma decay, the evaluation of the susy contribution to the anomalous magnetic moment of the muon, the evaluation of detection rates of susy Higgs bosons at LEP[29]. Aspects related to low-background detectors. I have worked at the underground Laboratory of Nuclear Physics of Canfranc Spain where I have developed some skills directly related to experimental dark matter searches, in particular in data analysis and background study radioactive contaminations and cosmogenics. A 7 , Gerbier, Hao-huai Kuang, A. B , B , [arXiv: A , [arXiv: D 59 , [arXiv: Ortiz de Solorzano, J. D 61 , [arXiv: Ortiz de Solorzano, A. A , D 62, [arXiv: Ortiz de Solorzano, S. D 63 , [arXiv: B , 6 D 66 , [arXiv: D 66, [arXiv: D 67, [arXiv: B, [arXiv: Scopel, "Lower bound on the neutralino mass from new data on cmb and implications for relic neutralinos" , Phys.

Chapter 2 : [astro-ph/] High-Energy Neutrino Astronomy

This is a collection of review articles and more specialized papers on the main issues of early universe physics. Both theoretical and experimental fields of research are dealt with.

Shifu Jonathan Bluestein Languange: It includes neither instruction on deadly killing techniques, nor mystical tales of so called super-human masters. Rather, it is a vast compilation of seriously thought-out observations made on the subject by the author, as well as many other martial artists and scientists, with a slight touch of history and humour. The goal of this project had from the start been to surpass the current standard in the martial arts literary market, and offer readers worldwide something which they have never seen before. In essence, a book in which are found countless answers for martial arts practitioners which they cannot be read elsewhere, which address commonly discussed martially-related topics with breadth and depth unparalleled in other works to this day in any language. It holds among its pages no less than , words, containing knowledge which would be coveted by many. The aim of this book is to present the reader a coherent, clear-cut, and in-depth view of some of the most perplexing and controversial subjects in the world of martial arts, as well as providing a healthy dose of philosophical outlook on these subjects from various individuals. There are books by authors who will tell you that some aspects of the martial arts are too complex for concrete, coherent and defined explanations. Others have used ambiguous terminology to explain what they could not pronounce otherwise. This is no such book. This book was written to provide you with the solid, applicable answers and ideas that you could actually understand, and take away with you. This book is mainly comprised of three parts: The Internal Martial Arts of China receive a special, lengthier treatment in this part of the book. The Wisdom of Martial Spirits: Teachers, and the Things They Hold Dear This part includes various interesting and comprehensive interviews with distinguished martial arts masters, spanning dozens of pages each. Every one of the interviewees is a person whose views and ideas are thought provoking and well-worth reading. The teachers interviewed in this book are: It is my sincere hope that any person who reads this book will benefit from the time he or she had spent doing so. May this work encourage others to continue intelligent writing and research in the field, as I was pushed forth and built upon the knowledge others have shared before me. May you have a pleasant reading experience!

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Chapter 6 : Gennaro Miele (Author of Thinking, Observing and Mining the Universe)

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Consider a model of partially directed paths from the origin in the square lattice, constrained to the region between the Y-axis and the line Y = qX, and ending in a vertex in this line (with.