THEORETICAL STUDY OF NUCLEAR FORCES AT HIGH ENERGIES IN FRAMEWORK OF QUARK GLUON THEORY

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BY

Eman Reda Abo El- yazeed

B.Sc. (Physics 2003)
M.Sc. (Physics 2008)

Assistant Lecturer of Physics at Department of Physics, Faculty of Women for Arts, Science and Education, Ain Shams University.

Supervised By

Prof. Dr. Ali Mohamed Khalaf

Professor of Theoretical Physics, Department of Physics, Faculty of Science, Al-Azhar University.

Dr. Hala Mahmoud Khalel

Assistant Professor of Theoretical Physics, Department of Physics, Faculty of Women for Arts, Science and Education, Ain Shams University.

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Name: Eman Reda Abo El-yazeed

Degree: M.Sc.

Department: Physics

Faculty: Faculty of Women for Arts, Science and Education

University: Ain Shams

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إيمان رضا أبو اليزيد

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ماجستر علوم (فيزياء نظريه ٢٠٠٨)
مدرس مساعد بقسم الفيزياء كلية البنات للاداب والعلوم و التربيه جامعة عين شمس

تحت إشراف

الاستاذ الدكتور/ على محمد خلف

قسم الفيزياء كلية العلوم جامعة الازهر .

الدكتوره/ هاله محمود خليل

قسم الفيزياء كلية البنات للاداب والعلوم و التربيه جامعة عين شمس.

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ا.د. على محمد خلف

أستاذ الفيزياء النظريه- قسم الفيزياء- كلية العلوم- جامعة الازهر

د. هاله محمود خليل

أستاذ مساعد الفيزياء النظريه- قسم الفيزياء

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ا.د. على محمد خلف

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د. هاله محمود خليل

أستاذ مساعد الفيزياء النظريه- قسم الفيزياء

كلية البنات للاداب والعلوم و التربيه جامعة عين شمس

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Chapter 1

Introduction

A precise description of the nucleon-nucleon (NN) interaction is an unsolved fundamental problem in nuclear and hadronic physics.

Firstly we will briefly review the empirically known features of nuclear force. There are five important properties of the NN interaction: (i) Nuclear forces are of short range (finite range). (ii) The nuclear force is attractive in its intermediate range. (iii) The nuclear force has a repulsive core. (iv) There is a tensor force. (v) There is a spin-orbit force. According to these properties, the first theoretical attempts concentrated on driving a force of finite range from some more fundamental idea was Yukawa [1], who achieved this by constructing a strict analogy to quantum electrodynamics (QED). His first consideration was carried out in the framework of classical field theory. Yukawa suggested that a meson could be responsible for the interaction energy between proton and neutron.

It was convenient to divide the range of the NN interaction into three regions (i) classical or long range, $r > 2$ fm where r denotes the distance between the centers of the two nucleons. (ii)