IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Theoretical Study of Ultrarelativistic Heavy ion Collisions

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Abstract

In recent years, Ultrarelativitic heavy ion collisions allow us to study of densest and hottest forms of matter. In the Ultrarelativistic heavy ion collision process when the particle collide with each other a new particle is produced is called the Quark-Gluon plasma. When a lot of nucleon collids occur in the ultrarelativistic process. Different types of collision appear in collision such as distance collision, close collision, grazing collision, ultra-pheripheral collision. It is quantum field theory which describes the gauge invariant ineraction of charge particle which photon. The SSNTDs have been help for a theoretical study of heavy ion collision in ultrarelativistic. Kaufmann and wolfgang experiment is quit help of theoretical study of ultrarelativistic

And I have analysis ultrarelativistic heavy ion collision based on several model. The objective of this research paper is to give an overall analysis of what distinguishes the theoretical treatment from the standard approach which new effect can be calculate with new method.

Introduction :

Generally, when we study the slow motion particle it is called Newtonian physics. And the study about the fastest motion of the particle which speed is comparable to speed of light is called relativistic physics. But when we study by the particle those whose speed of is very close to the speed of light at very high temperature and densities is called ultrarelativistic. The main purpose of ultrarelativistic heavy ion collision in the production and observation of the Quark-Gluon plasma which yields information about quantum chromodynamics (QCD) at high temperature and densities.

The field is quite interdisciplinary at is contains elements from particle physics, statistical field theory, particle, kinetic, Fluid dynamic and nuclear physics. The study of ultrarelativistic heavy ion collision thus provides a unique opportunity to search for the predicted state of matter known as the Quark-Gluon plasma. Such a new phase of matter can be produced in ultrarelativistic heavy ion collisions. The term heavy ion is used for the nucleus more massive than helium. Heavy ion Physics has attracted much attention during the last three decades. The behavior of a heavy nuclens under extreme conditions of temperature, density, angular momentum etc., is a very important aspect of heavy ion physics. The recent progress in heavy ion collision theoretical study can be attributed to the development in accelerator technologies and ion-separation facilities. The energy of accelerated heavy ions is usually calssified into the following three groups.

(i) Low energy ($E \leq 20$ Mev/nucleon)

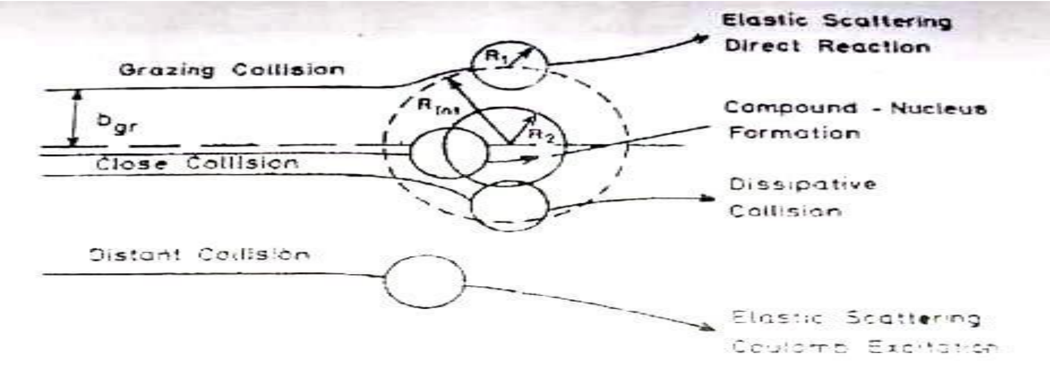
(ii) Intermediate energy ($20 < E < 200$ Mev/nucleon)

(iii) Relativistic energy ($E \geq 200$ Mev/nucleon)

Kaufmann and Wolfgang study of reaction between heavy ions has opened new avenues for understanding the properties of atomic nuclei. This comes about, in first place, because the collisions of energetic heavy ions give rise to novel nuclear states and species e.g., the transuranic nuclei beyond the range of nucleogenesis, the higher neutron or proton rich nucleus high-spin states. Nuclear molecular states and compressed nuclear matter etc. Secondly, it has been learnt that in heavy ion reactions, different reaction mechanisms are possible e.g. the deep-inelastic process in which a large fraction of the relative kinetic energy is transferred to internal excitations but very little mass exchange takes place between the interacting nuclei or the quasi-fussion reactions in which the reacting nuclei from a mano-nucleus but revert to fission channel without forming a compound nucleus. Several new theoretical model have been but forward to explain some of the observed heavy-ion phenomena. In these approaches, however, the validity of some of the assumptions mode is not certain; nor are the value of some of the parameters accurately known. The solid state nuclear track detectors (SSNTDs) are best suited to study the heavy ion interactions because of their unique properties. The SSNTDs are simply the dielectric materials which offer a high detection geometry and are able to store tracks of particles produced in an interaction. Improvements in SSNTDs have been made for better sensitivity with respect to charge and energy resolution. Consequently, detailed kinematical analysis of nuclear reactions has now become feasible. With solid state nuclear track detector one can study each single ion atom encounter as an isolated event, with all its special features. The SSNTDs have been extensively used for the study of heavy ion collisions.

Classification of heavy ion collisions :

When two nuclei come close together, a nuclear reaction and occur that results in new nuclei being formed. Every nucleus is surrounded by an electronic potential barrier, that opposes both the entry and escape of positively charged particles.



Distant, grazing and close collision in the classical picture of heavy ion reactions

According to classical picture there are three types of collision.

(i) Distant collisions :- For impact parameters which are considerably larger than 'b_{gr}' the nuclear interaction is negligible. The trajectories of these distant collisions are completely determined by the coulomb interaction between the nucleus can occur along these (coulomb) trajectories.

(ii) Grazing collisions :- For grazing collisions ($b=b_{gr}$) the nuclear interaction between projectile and target is small by definition. Therefore, we expect reactions to dominate where only a few degree of freedom of the projectile and target are involved. These are the direct reactions.

(iii) Close collisions :- For impact parameter considerably smaller than 'b_{gr}' we expect a strong disturbance of the projectile and target by their strong mutual nuclear interaction.

Conclusion :

The field occurring in ultrarelativistic heavy ion collisions are very strong, so one may expect that some new kind of nonperturbative effect could arise. The theoretical approach leads to transparent treatment of ultrarelativistic heavy ion collisions without ambiguities and provides the correct views in cases where the standard model fails. As such, the physical interpretation of the effects and prospects of ultrarelativistic heavy ion collision are of great important.

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