The disintegration of emulsion nuclei initiated by high energy hadrons is a complicated phenomenon involving multiparticle production and emission of nucleons and heavy fragments from a nuclear breakup. The widely used two-stage cascade-evaporation model, which is successful in interpreting the low GeV interactions, cannot describe wholly all the disintegration phenomena at comparatively high incident energies. As for example, multiparticle production phenomenon in high energy disintegrations cannot be reconciled with the conventional model of nuclear cascading. Over the whole range of available energy—from low accelerator energy to very high cosmic ray energy—the heavy prong-multiplicity remains almost constant while the secondary particle-multiplicity increases by a large extent. The excitation and subsequent evaporation of nucleus cannot be attributed to cascade-multiplication of these particles. Also the overall excess of particle-multiplicity in a nuclear reaction over the corresponding value in proton-proton interaction is considerably smaller than that would be predicated by simple cascade-multiplication.

Multiparticle production mechanism in hadron-nucleon (h-N) collision is obviously less complicated than that in
hadron-nucleus (h-A) collision. Various theoretical and phenomenological models for h-N collisions formulated on the basis of widely varying postulates, have been proposed by several authors. Multiplicity predictions from these models may be used as inputs to the theory of multiparticle production in h-A collision.

Fishbane and Trefjil used both Single-Step Mechanism (SSM) class of models such as multiperipheral model and Double-Step Mechanism (DSM) class of models such as nova model as inputs to obtain average multiplicity in h-A collision. It has been observed that even the modified cascade model by Artykov et al. or by Peshenkov et al. or the tube model by Pelenkij and Landau can not explain all the features of multiparticle production at high energy interactions. In recent years major advances in theory of multihadron production in h-A collision have been made by several authors.

The importance of study of multiparticle production in h-A collision is that herein the nucleus enables one to read the final-state particles immediately after their creation. The nucleus may be considered as a miniature laboratory wherein the details of hadron dynamics is manifested. Hadron-nucleus collision provides informations about the space-time characters of
the hadronic matter. The space-time development of particle 
production is possible to be investigated by Gottfried's model. 

Moreover, SSN and DSM classes of h-N interaction models may be 
tested by applying them to the mechanism of multiparticle pro-
duction in h-A collisions and comparing the calculated results 
with the experimental data.

Emission-mechanisms of light and heavy ions from a nu-
clear breakup have been described by Weisskopf, Ringe, 
Fujimoto and Yamaguchi and Le Couteur by considering the 
evaporation of particles in a state of thermodynamic equilibrium. 
But the emission of very high energy particles and fragments 
and complete disintegrations of target nuclei cannot be explai-
ned by two-stage cascade-evaporation model. Ericson suggests 
that at very high excitation no long-lived compound nucleus can 
exist and the evaporation of particles may occur during the 
entire stage of disintegration. Griffin, Flann and Rudis 
proposed models for nuclear-decay from a pre-equilib-
rium stage. Thus the study of emission-mechanisms of nucleons 
and heavy-fragments is important in order to understand the 
actual mechanisms of interactions and to investigate the multi-
nucleon-clustering in nuclear matter.
Nuclear photographic emulsion method is a unique technique which provides informations regarding both the production-mechanism of secondaries and emission-mechanism of nucleons and cluster of nucleons in a nuclear disintegration.

In this work of thesis I have extended the study of nuclear disintegrations by analysing the interactions produced by 50 GeV/c negative pion, 69 GeV/c and 200 GeV/c proton with emulsion nuclei. In particular, the present work is based on the study of different aspects of secondary shower particles produced in those interactions. Also different aspects of particles and fragments produced in a nuclear disintegration and appearing as heavy prongs have been studied. Attempts have been made to interpret these interaction-characteristics in terms of recent nuclear-interaction models.
A summary of the present works is given in the following chapters.

CHAPTER 1: A review of the existing literature on the theoretical and experimental aspects of multiparticle production phenomena and emission mechanisms of nucleons and fragments caused by high energy nuclear disintegration.

CHAPTER 2: Properties of nuclear photographic emulsion and importance of nuclear emulsion in the study of high energy nuclear interaction phenomena. Processing techniques of nuclear emulsion and measurement techniques of various parameters for studying the phenomena of nuclear interactions are discussed.
CHAPTER - 5: Energy dependences of charged particle multiplicity produced in p-p and π-p interactions are studied. Multiplicity data used for this study are obtained from PRC and other sources exposed to conventional accelerators and ISR and these data are analysed on the basis of recent theoretical models. Some aspects of charged particle multiplicity studied in fourth and fifth chapters will be compared with the results of this study.

CHAPTER - 4: Average charged particle multiplicity, \( \langle n_g \rangle \), in \( \pi \)-emulsion and p-emulsion collisions at 50 GeV and 69 and 200 GeV respectively is studied in detail. Dependences of \( \langle n_g \rangle \) on laboratory energy, \( \sqrt{s_{Lab}} \), and on available CM energy, \( \sqrt{s_{CM}} \), are studied in detail using data from present study and from other workers over the energy range from 9 GeV to 400 GeV.

CHAPTER - 5: Normalized mean multiplicity in hadron-emulsion collisions for different \( N_h \) values are calculated at 50 GeV \( \pi \)−, 69 GeV p and 200 GeV p interactions. Energy and nuclear size dependences of normalized mean multiplicity in
SERPUKHOV and FNAL energies are analysed by using data from present work and from works of other workers. Various modified forms of normalised mean multiplicity are also discussed.

CHAPTER - 6: Dispersion of multiplicity distributions, D, and two-particle correlation parameter, \( f_2 \), are studied for the secondary particles obtained from 50 GeV \( \pi \), 69 GeV \( p \) and 200 GeV \( p \) interactions with emulsion nuclei. Dependences of D and \( f_2 \) on \( \langle n_b \rangle \) and momentum of the incident particles, \( p_T \), is studied.

For the sake of comparison D and \( f_2 \) parameters for \( p-p \) and \( \pi-p \) interactions are also analysed using multiplicity data from other authors over an energy range from 4 GeV to 400 GeV.

CHAPTER-7: Angular distributions of shower particles at 50 GeV \( p \), 69 GeV \( p \) and 200 GeV \( p \) interactions are studied in terms of two variables viz. (a) \( \cos \theta \) and (b) \( x = -\log\tan \theta/2 \). Also pseudorapidity distributions of the secondary particles at these energies is studied.

CHAPTER-8: Emission characteristics of particles and fragments obtained from nuclear disintegration at 50 GeV \( \pi \), 69 GeV \( p \) and 200 GeV \( p \) interactions are studied.
Heavy prong distributions, energy distributions of proton, angular distributions of black and grey tracks and angular distributions of heavy fragments are studied for above interactions. Complete disintegrations of silver and bromine nuclei at 50 GeV \( \pi^- \) interactions are also studied.