Emergent Universe with Interactive fluids

B. C. Paul[*]

Physics Department, North Bengal University,

Siliguri, Dist. : Darjeeling, Pin : 734 013, West Bengal, India

A. S. Mazumdar[†]

S. N. Bose Centre for Basic Sciences JD Block, Slat Lake Sector -III Kolkata-700068

Abstract

Emergent universe scenario obtained in a flat space-time in the general theory of relativity with a non-linaer equation of state (EoS) is investigated in the presence of interacting fluids. The interesting aspect of the emergent universe is that there is no Big Bang singularity as the universe emerged out of a static Einstein state in the infinite past. There is no quantum gravity effect as the universe in the Einstein static phase was sufficiently big enough in size so that it is unimportant. The present universe came up due to evolution of the universe which can be realized by a scalar field. A flat emergent universe universe which we consider here can be realized with a non-linear equation of state (EOS) $p = A\rho - B\sqrt{\rho}$ with A and B are arbitrary constants. It comes out that the non-linear EoS corresponds to three types of fluid composition of the universe which is determined by A. Once A is fixed it corresponds to a definite kind of fluid composition. To obtain the present universe scenario we propose interactive fluids. We consider here two types of interacting fluids models : (i) emergent universe with an interaction of the fluids needed for an emergent universe with another pressureless fluid and (ii) emergent universe with interacting fluids among the three fluids permitted from the EoS. It comes out that a viable cosmological model is permitted for coupling parameter where the fluids of one form transforms to a fluid composition that are observed at the present phase of expansion of the universe.

[*]Electronic mail : bcpaul@iucaa.ernet.in

[†]Electronic mail : archan@bose.res.in