J. of Ramanujan Society of Math. and Math. Sc. **ISSN : 2319-1023**
Vol.4, No.2 (2015), pp. 103-112

Spherical Gravitational Collapse of a Radiating Star

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Dedicated to Prof. Hari M. Srivastava on his 75^{th} ***birth anniversary***

Abstract: In the present paper we have obtained a new model by using the Tewari [1] algorithm for a collapsing radiating star and the matching conditions required for the description of physically meaningful fluid. The interior matter fluid is shear-free spherically symmetric isotropic and undergoing radial heat flow. The interior metric obeyed all the relevant physical and thermodynamic conditions and matched with Vaidya exterior metric over the boundary. Initially the interior solutions represent a static configuration of perfect fluid which then gradually starts evolving into radiating collapse. The apparent luminosity as observed by the distant observer at rest at infinity and the effective surface temperature are zero in remote past at the instant when the collapse begins and at the stage when collapsing configuration reaches the horizon of the black hole.

Keywords: Exact solutions, Collapsing radiating star, Black hole.

1. Introduction

When a body does not have substantially strong pressure gradient force, it may continue collapsing because of its own gravity, this phenomena is called gravitational collapse. It is one of the important issues in relativistic astrophysics whether the end state of gravitational collapse is a black hole or a naked singularity (Joshi and Malafarina [2] and references therein). In relativistic astrophysics, a detailed description of gravitational collapse of massive stars and the modeling of the structure of compact objects under various conditions is the most interesting phenomena.The study of the gravitational collapse was started by Oppenheimer and Snyder [3], in which they assumed a spherically symmetric distribution of state in the form of dust with Schwarzschild exterior. Later on taking into account the outgoing radiation from collapsing spherical fluid Vaidya [4] initiated the problem and the modified equations proposed by Misner [5] for an adiabatic distribution of matter.