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On the Occurrence of Naked Singularities in General Relativity. II*

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Abstract. It is shown that naked "shell crossing" singularities can occur in the gravitational collapse of a spherically symmetric ball of perfect fluid for a large family of equations of state in which the pressure has an (arbitrarily large) upper bound, and, moreover, that this behaviour is stable with respect to spherically symmetric perturbations of the initial data, as well as with respect to perturbations of the equation of state.

I. Introduction

In a previous paper [1], we displayed explicit solutions of Einstein's field equations for the gravitational collapse of an isolated, spherically symmetric object, in which regular initial data evolve into naked singularities – contrary to the widely accepted [2] conjecture that, according to general relativity, collapse *inevitably* leads to black holes which hide the singularities. In one family of these solutions (inhomogeneous dust clouds), the singularities are associated with "shell crossing", or caustics in the congruence of matter flow lines. One might be inclined to dismiss these solutions by asserting that i) such caustics become quite innocuous if the pressure is nonzero, ii) these singularities are in any case unstable.

We shall, however, show here that naked "shell crossing" singularities can occur in the collapse of a spherically symmetric ball of perfect fluid for a large family of equations of state in which the pressure has an (arbitrarily large) upper bound, and, moreover, that this behaviour is stable with respect to (spherically symmetric) initial conditions and equation of state.

The restriction of bounded pressure is not necessarily so unphysical as it may seem. Our upper bound can be arbitrarily large, say 10^{114} erg/cm^3

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