

# Near-Field Behavior of Static Spherically Symmetric Solutions of Einstein SU(2)–Yang/Mills Equations

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## 1. Background

### 1.1. Introduction

Static spherically symmetric solutions of the Einstein SU(2)–Yang/Mills equations both with and without cosmological constant have been studied extensively over the last decade. Among the few analytical and several numerical results is a rigorous proof of the existence of a 1-parameter family of such solutions in which each solution in the family is smooth at the origin of spherical symmetry (see [14]). These solutions give boundary conditions at the center of spherical symmetry that must be satisfied for solutions to be smooth in a neighborhood of the origin. Many studies have considered the global behavior of such solutions.

Smoller and Wasserman [7] proved the existence of a discrete family of solutions that are everywhere smooth. These solutions exist only with vanishing cosmological constant. Breitenlohner, Forgács, and Maison [1], also considering only the case of vanishing cosmological constant, classified solutions that are smooth near the origin. References [5] and [6] describe classes of solutions that exist in the case of a positive cosmological constant.

Other studies have considered solutions of the equations without cosmological constant with given boundary conditions at infinity. For example, Wasserman [16] describes the number of singularities such solutions can have. It has already been mentioned that, in the case of zero cosmological constant, there exist conditions at infinity that yield solutions that are globally smooth in Schwarzschild coordinates. Winstanley [17] proved the existence of such solutions in the case of negative cosmological constant. However, no such solutions can exist in the presence of a positive cosmological constant (see [5]). Specifically, with a positive cosmological constant present, each solution that is smooth at the origin gives rise to a singularity at some finite Schwarzschild radius. Reference [3] describes the nature of such a singularity. Smoller, Wasserman, and Yau [13], considering only the case of vanishing cosmological constant, analyzed the behavior of solutions that satisfy certain conditions at this singularity.

In this paper we consider the Einstein SU(2)–Yang/Mills equations with arbitrary cosmological constant in Schwarzschild coordinates and take arbitrary