Orbiting Scalar Charges

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Abstract

1 Introduction

This thorn provides a source term to the scalar field evolution for two rotating binary charges.

2 Physical System

The 3D scalar wave equation with a source term $\rho(t, x, y, z)$ is written

$$\nabla\phi = 4\pi\rho$$

Each scalar source with charge Q and radius R contributes

$$\rho = \frac{3Q}{4\pi R^3}$$

3 Numerical Implementation

The only involved part of this thorn arise in working out where the sources are located (if at all) on each local grid for a multiprocessor run. The source terms are not numerically evolved, but are calculated exactly, based on the physical time and their orbital velocity.

A routine is scheduled to run *after* the homogeneous equation for the scalar field has been evolved, and simply updates the value of the scalar field by adding on the source contribution.