Orbiting Scalar Charges

Gabrielle Allen

Date: 2002/06/29 18:37:17

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.