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Re: Unifying gravity and electromagnetism

- *Subject*: Re: Unifying gravity and electromagnetism
- *From*: uunet!world!sweetser@ncar.UCAR.EDU (Doug B Sweetser)
- *Date*: 28 Jan 2000 00:00:00 GMT
- *Approved*: spr@rosencrantz.stcloudstate.edu (sci.physics.research)
- *Newsgroups*: sci.physics.research
- *Organization*: The World Public Access UNIX, Brookline, MA
- *References*: <FonwFJ.F56@world.std.com> <3888D654.59554742@hate.spam.net>

Uncle Al asked a very good question:

>Assume gravity unifies with electromagnetism, bing bang boom. What
>electromagnetic diagnostics would give hints of gravitational
>interactions in kind? Refractive index, optical absorption,
>polarization, chirality, evanescent waves, dielectric constant,
>permeability, permativity... What would I look at (literally) to say
>"this matter will be gravitationaly different from this other matter
>according to this diagnostic?"

Let's first state which familiar laws will not be changed at all by this unification proposal:

```
  Homogeneous Field equations (also called vector identities)
  div B = 0             No monopoles
  dB/dt + Curl E = 0    Faraday's Law

  Conservation laws for fields
  drho/dt + div J = 0   charge conservation
```

The Maxwell equations are invariant under an arbitrary scalar gauge transformation. In an earlier discussion of this thread, I was able to show that the field equations were unchanged if that scalar field solved a particular homogeneous equation. This additional constraint is created as part of the process of constructing a unified field theory, so it's not a bug, it's a feature.

The equations that will show "mixing" of the electric and gravitational fields (not g and B) are Gauss' and Ampere's law, the non-homogeneous Maxwell equations. Here is how it happens with Gauss' law:

```
  E = -dA/dt - Grad phi
  div E = - div dA/dt - div Grad phi = source charge density

  g = dphi/dt - div A
  dg/dt = d^2 phi/dt^2 - d div A/dt = source mass density

  dg/dt + div E = d^2 phi/dt^2 - 2 div dA/dt - laplacian phi
  dg/dt - div E = d^2 phi/dt^2 + laplacian phi
```

The Grad phi of E interferes constructively or destructively with the div A in g. A similar exercise for Ampere's law:

```
  E = -dA/dt - Grad phi   B = Curl A
  -dE/dt + Curl B = d^2 A/dt^2 - d Grad phi/dt + Curl Curl A =
  = source current density

  g = dphi/dt - div A
```

```
  Grad G = Grad dphi/dt - Grad div A =
  = source mass flow density

  Grad G - dE/dt + Curl B = d^2 A/dt^2 + Curl Curl A - Grad div A
  Grad G + dE/dt - Curl B = d^2 A/dt^2 + 2 d Grad phi/dt + Grad div A -
                                       - Curl Curl A
```

Grad phi of E interferes this time with the dphi/dt term.

At this point, I have more equations than I know how to interpret :-)
The Maxwell equations are a set of four equations (6 terms) that take a serious effort to understand. This unified field theory has four quaternion equations, each one having all 6 differential components found in the complete set of the Maxwell equations (with varying signs) plus two more terms involving the gravitational field.

On dimensional grounds, we might suspect that effects are far beyond subtle. The electromagnetic force between two electrons is 42 orders of magnitude greater than the gravitational force. It is quite likely that whatever type of mixing event predicted by this theory will require exceedingly refined care to see, even if the equations make it look obvious.

So far the only experimental confirmation of the unification theory is that gravity works only one way, while electromagnetism can be both attractive and repulsive. This is because g is invariant under spatial or temporal reflection. With all the transformations I have done, g doesn't change. Going backward in time changes an electron into a positron, but the mass keeps its sign. Although this may appear to be a very obvious property of a gravitational field, it usually must be imposed by hand instead of being a natural consequence of the equations themselves.

Thanks for the good question! Even if I wasn't able to be explicit, it helped me narrow the focus, which is an important initial step.

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- **Follow-Ups**:
  - **Re: Unifying gravity and electromagnetism**
    - *From:* Uncle Al <UncleAl0@hate.spam.net>
  - **Re: Unifying gravity and electromagnetism**
    - *From:* Charles Francis <charles@clef.demon.co.uk>

- **References**:
  - **Unifying gravity and electromagnetism**
    - *From:* uunet!world!sweetser@ncar.UCAR.EDU (Doug B Sweetser)
  - **Re: Unifying gravity and electromagnetism**
    - *From:* Uncle Al <UncleAl0@hate.spam.net>

- Prev by Date: **Re: What is the evidence for Gluons**
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