
Cuaderno de notas de trabajo

Carlos Graef Fernández

Cuaderno 57

$\mathcal{T}$ --- región cuatridimensional en el espacio tiempo.

Π --- hipersuperficie que limita a $\mathcal{T}$.
(tridimensional)

h_{ij} --- tensor potencial gravitacional de un punto masa M .

Teorema de Green.

$$\iiint_{\mathcal{T}} \left[\square h^{jk} \right] \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] - h^{jk} \square \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] d\mathcal{T}$$

$$= \iint_{\Pi} \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla h^{jk} - \left\{ \nabla \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \right\} h^{jk} \cdot d\vec{\Pi}$$

$$\boxed{\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i}}$$

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$$- \frac{2M}{(\hat{V} \cdot \hat{A})^3} r_i V_j V_k + \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^3} r_i V_j V_k$$

$$- \frac{2M}{(\hat{V} \cdot \hat{A})^2} r_i V_j A_k - \frac{2M}{(\hat{V} \cdot \hat{A})^2} r_i A_j V_k$$

$$+ \frac{M}{(\hat{V} \cdot \hat{A})^3} r_i \Delta_{jk} - \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^3} r_i \Delta_{jk}$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{A})^3} V_i V_j r_k - \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^3} V_i V_j r_k$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{A})^2} V_i A_j r_k - \frac{M}{(\hat{V} \cdot \hat{A})^2} V_i \Delta_{jk}$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{A})^2} A_i V_j r_k - \frac{M}{(\hat{V} \cdot \hat{A})^3} \Delta_{ij} r_k$$

$$+ \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^3} \Delta_{ij} r_k + \frac{M}{(\hat{V} \cdot \hat{A})^2} \Delta_{ij} V_k$$

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$$\boxed{\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i}}$$

$$- \frac{2M}{(\hat{V} \cdot \hat{r})^3} (011) + \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} (011)$$

$$- \frac{2M}{(\hat{V} \cdot \hat{r})^2} (012) - \frac{2M}{(\hat{V} \cdot \hat{r})^2} (021)$$

$$+ \frac{M}{(\hat{V} \cdot \hat{r})^3} (045) - \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} (045)$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^3} (110) - \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} (110)$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^2} (120) - \frac{M}{(\hat{V} \cdot \hat{r})^2} (145) \leftarrow (145)$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^2} (210) - \frac{M}{(\hat{V} \cdot \hat{r})^3} (450)$$

$$+ \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} (450) + \frac{M}{(\hat{V} \cdot \hat{r})^2} (451)$$

$$\boxed{\nabla_h^{jk}}$$

$$\left[\begin{aligned} & + \frac{2M}{(\hat{V} \cdot \hat{r})^3} V^j V^k - \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} V^j V^k \\ & + \frac{2M}{(\hat{V} \cdot \hat{r})^2} V^j A^k + \frac{2M}{(\hat{V} \cdot \hat{r})^2} A^j V^k \\ & - \frac{M}{(\hat{V} \cdot \hat{r})^3} \Delta^{jk} + \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} \Delta^{jk} \end{aligned} \right] \hat{r}$$

$$+ \left[- \frac{2M}{(\hat{V} \cdot \hat{r})^2} V^j V^k + \frac{M}{(\hat{V} \cdot \hat{r})^2} \Delta^{jk} \right] \hat{V}$$

(C. number 1)

$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla^j h^{ik}$$

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Términos en $\hat{r}$

$$\begin{aligned} & - \frac{2M^2}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i + \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i - \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i \\ & + \frac{2M^2}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i + \frac{4M^2}{(\hat{V} \cdot \hat{r})^4} A_i \\ & + \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i - \frac{2M^2(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i + \frac{2M^2(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i \\ & - \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i - \frac{4M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4} A_i \\ & - \frac{4M^2(\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{r})^4} \hat{r}_i + \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i \\ & - \frac{2M^2(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i + \frac{4M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4} A_i \\ & - \frac{4M^2(\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{r})^4} \hat{r}_i + \frac{4M^2(\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{r})^3} \hat{V}_i \\ & + \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4} A_i \end{aligned}$$

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$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla h^{jk}$$

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Continuación de términos en $\hat{r}$

$$- \frac{M^2}{(\hat{V} \cdot \hat{A})^6} \hat{r}_i + \frac{M^2 (\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^6} \hat{r}_i$$

$$+ \frac{M^2}{(\hat{V} \cdot \hat{A})^5} \hat{V}_i - \frac{2M^2}{(\hat{V} \cdot \hat{A})^4} A_i$$

$$+ \frac{M^2 (\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^6} \hat{r}_i - \frac{M^2 (\hat{A} \cdot \hat{A})^2}{(\hat{V} \cdot \hat{A})^6} \hat{r}_i$$

$$- \frac{M^2 (\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^5} \hat{V}_i + \frac{2M^2 (\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^4} A_i$$

com probando
págs 12 y 13.

$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla^k h^{jk}$$

términos en $\hat{r}$

$$\frac{\partial h_{jk}}{\partial x^i}$$

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El Gradiente del Campo Gravitacional de
Birkhoff. Revista Mexicana de Física.
Vol. X, 3. 1961. pág. ~~181~~ 192.

$$+ \frac{2M}{(V \cdot r)^2} r_i V_j A_k + \frac{2M}{(V \cdot r)^2} r_i A_j V_k + \frac{2M(A \cdot r)}{(V \cdot r)^3} r_i V_j V_k$$

$$- \frac{M}{(V \cdot r)^3} r_i \Delta_{jk} - \frac{M(A \cdot r)}{(V \cdot r)^3} r_i \Delta_{jk}$$

$$+ \frac{2M}{(V \cdot r)^2} r_i V_j A_k + \frac{2M}{(V \cdot r)^2} r_i A_j V_k - \frac{2M(A \cdot r)}{(V \cdot r)^3} r_i V_j V_k$$

$$+ \frac{M(A \cdot r)}{(V \cdot r)^3} r_i \Delta_{jk} + \frac{2M}{(V \cdot r)^3} r_i V_j V_k - \frac{M}{(V \cdot r)^3} r_i \Delta_{jk}$$

$$- \frac{2M}{(V \cdot r)^2} V_i V_j V_k + \frac{M}{(V \cdot r)^2} V_i \Delta_{jk}$$

$$\frac{\partial h_{jk}}{\partial x^i}$$

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$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^3} \hat{r}_i \hat{V}_j \hat{V}_k^0 - \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} \hat{r}_i \hat{V}_j \hat{V}_k^0$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^2} \hat{r}_i \hat{V}_j \hat{A}_k^0 + \frac{2M}{(\hat{V} \cdot \hat{r})^2} \hat{r}_i \hat{A}_j \hat{V}_k^0$$

$$- \frac{M}{(\hat{V} \cdot \hat{r})^3} \hat{r}_i \Delta_{jk}^0 + \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} \hat{r}_i \Delta_{jk}^0$$

$$- \frac{2M}{(\hat{V} \cdot \hat{r})^2} \hat{V}_i \hat{V}_j \hat{V}_k^0 + \frac{M}{(\hat{V} \cdot \hat{r})^2} \hat{V}_i \Delta_{jk}^0$$

$$\frac{\partial h_{ij}}{\partial x^k}$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^3} \hat{V}_i \hat{V}_j \hat{r}_k^0 - \frac{2M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} \hat{V}_i \hat{V}_j \hat{r}_k^0$$

$$- \frac{2M}{(\hat{V} \cdot \hat{r})^2} \hat{V}_i \hat{V}_j \hat{V}_k^0 + \frac{2M}{(\hat{V} \cdot \hat{r})^2} \hat{V}_i \hat{A}_j \hat{r}_k^0$$

$$+ \frac{2M}{(\hat{V} \cdot \hat{r})^2} \hat{A}_i \hat{V}_j \hat{r}_k^0 - \frac{M}{(\hat{V} \cdot \hat{r})^3} \Delta_{ij} \hat{r}_k^0$$

$$+ \frac{M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^3} \Delta_{ij} \hat{r}_k^0 + \frac{M}{(\hat{V} \cdot \hat{r})^2} \Delta_{ij} \hat{V}_k^0$$

$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right]$$

$$- \frac{2M}{(\vec{V} \cdot \vec{A})^3} r_i \vec{V}_j \vec{V}_k + \frac{2M(\hat{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^3} r_i \vec{V}_j \vec{V}_k$$

$$+ \frac{2M}{(\vec{V} \cdot \vec{A})^2} r_i \vec{V}_j A_k - \frac{2M}{(\vec{V} \cdot \vec{A})^2} r_i A_j \vec{V}_k$$

$$+ \frac{M}{(\vec{V} \cdot \vec{A})^3} r_i \Delta_{jk} - \frac{M(\hat{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^3} r_i \Delta_{jk}$$

$$+ \frac{2M}{(\vec{V} \cdot \vec{A})^3} \vec{V}_i \vec{V}_j r_k - \frac{2M(\hat{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^3} \vec{V}_i \vec{V}_j r_k$$

$$+ \frac{2M}{(\vec{V} \cdot \vec{A})^2} \vec{V}_i A_j r_k - \frac{M}{(\vec{V} \cdot \vec{A})^2} \vec{V}_i \Delta_{jk}$$

$$+ \frac{2M}{(\vec{V} \cdot \vec{A})^2} A_i \vec{V}_j r_k - \frac{M}{(\vec{V} \cdot \vec{A})^3} \Delta_{ij} r_k$$

$$+ \frac{M(\hat{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^3} \Delta_{ij} r_k + \frac{M}{(\vec{V} \cdot \vec{A})^2} \Delta_{ij} \vec{V}_k$$

Comproba!

$$\nabla_{hjk}$$

$$\left[\begin{aligned} & + \frac{2M}{(\vec{V} \cdot \hat{A})^3} V^j V^k - \frac{2M(\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^3} V^j V^k \\ & + \frac{2M}{(\vec{V} \cdot \hat{A})^2} V^j A^k + \frac{2M}{(\vec{V} \cdot \hat{A})^2} A^j V^k \\ & - \frac{M}{(\vec{V} \cdot \hat{A})^3} \Delta^{jk} + \frac{M(\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^3} \Delta^{jk} \end{aligned} \right] \hat{r}$$

$$+ \left[- \frac{2M}{(\vec{V} \cdot \hat{A})^2} V^j V^k + \frac{M}{(\vec{V} \cdot \hat{A})^2} \Delta^{jk} \right] \hat{V}$$

$$\left(\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right) \nabla^i h^{jk}$$

Términos en $\vec{r}$

$$- \frac{2M^2}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i + \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i$$

$$+ \frac{2M^2}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i - \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i$$

$$+ \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} A_i$$

$$+ \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i - \frac{2M^2(\vec{A} \cdot \vec{A})^2}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i$$

$$- \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i + \frac{2M^2(\vec{A} \cdot \vec{A})^2}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i$$

$$- \frac{4M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} A_i$$

$$- \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} (\vec{A} \cdot \vec{A}) \vec{r}_i$$

$$+ \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i - \frac{2M^2(\vec{A} \cdot \vec{A})^2}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i$$

$$+ \frac{4M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} A_i$$



$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla^k$$

Términos en $\hat{r}$ (continuación)

$$- \frac{4M^2}{(\hat{V} \cdot \hat{r})^4} (\hat{A} \cdot \hat{A}) \hat{r}_i \quad \checkmark$$

$$+ \frac{4M^2}{(\hat{V} \cdot \hat{r})^3} (\hat{A} \cdot \hat{A}) \hat{V}_i \quad \checkmark + \frac{2M^2 (\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4} A_i \quad \checkmark$$

$$- \frac{M^2}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i \quad \checkmark + \frac{M^2 (\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i \quad \checkmark$$

$$+ \frac{M^2}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i \quad \checkmark - \frac{2M^2}{(\hat{V} \cdot \hat{r})^4} A_i \quad \checkmark$$

$$+ \frac{M^2 (\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i \quad \checkmark - \frac{M^2 (\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{r})^6} \hat{r}_i \quad \checkmark$$

$$- \frac{M^2 (\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^5} \hat{V}_i \quad \checkmark + \frac{2M^2 (\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4} A_i \quad \checkmark$$

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$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla^j m^k$$

terminos en ∇

$$+ \frac{2M^2}{(V, A)^5} r_i - \frac{2M^2 (A, r)}{(V, r)^5} r_i$$

$$- \frac{2M^2}{(V, A)^4} V_i + \frac{2M^2 (A, r)}{(V, r)^4} V_i$$

$$- \frac{4M^2}{(V, A)^3} A_i$$

$$+ \frac{M^2}{(V, A)^5} r_i - \frac{M^2 (A, r)}{(V, r)^5} r_i$$

$$- \frac{M^2}{(V, A)^4} V_i + \frac{2M^2}{(V, A)^3} A_i$$

$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla^k h^{jk}$$

Términos en $\hat{r}$

$$-\frac{3M^2}{(\hat{r} \cdot \hat{r})^6} \hat{r}_i + \frac{6M^2(\hat{A} \cdot \hat{A})}{(\hat{r} \cdot \hat{r})^6} \hat{r}_i - \frac{3M^2(\hat{A} \cdot \hat{A})^2}{(\hat{r} \cdot \hat{r})^6} \hat{r}_i$$

$$-\frac{8M^2}{(\hat{r} \cdot \hat{r})^4} (\hat{A} \cdot \hat{A}) \hat{r}_i$$

$$+ \frac{3M^2}{(\hat{r} \cdot \hat{r})^5} \hat{r}_i - \frac{3M^2(\hat{A} \cdot \hat{r})}{(\hat{r} \cdot \hat{r})^5} \hat{r}_i$$

$$+ \frac{4M^2}{(\hat{r} \cdot \hat{r})^3} (\hat{A} \cdot \hat{A}) \hat{r}_i$$

$$+ \frac{2M^2}{(\hat{r} \cdot \hat{r})^4} A_i + \frac{4M^2(\hat{A} \cdot \hat{r})}{(\hat{r} \cdot \hat{r})^4} A_i$$

Términos en $\hat{V}$

$$+ \frac{3M^2}{(\hat{r} \cdot \hat{r})^5} \hat{r}_i - \frac{3M^2(\hat{A} \cdot \hat{r})}{(\hat{r} \cdot \hat{r})^5} \hat{r}_i$$

$$-\frac{3M^2}{(\hat{r} \cdot \hat{r})^4} \hat{r}_i + \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{r} \cdot \hat{r})^4} \hat{r}_i$$

$$-\frac{2M^2}{(\hat{r} \cdot \hat{r})^3} A_i$$

$$\left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \nabla^j h^{jk}$$

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$$\begin{aligned} & -\frac{3M^2}{(V \cdot A)^6} \vec{r}_i + \frac{6M^2(\vec{A} \cdot \vec{A})}{(V \cdot A)^6} \vec{r}_i - \frac{3M^2(\vec{A} \cdot \vec{A})^2}{(V \cdot A)^6} \vec{r}_i - \frac{8M^2}{(V \cdot A)^4} (\vec{A} \cdot \vec{A}) \vec{r}_i \\ & + \frac{3M^2}{(V \cdot A)^5} \vec{V}_i - \frac{3M^2(\vec{A} \cdot \vec{A})}{(V \cdot A)^5} \vec{V}_i + \frac{4M^2(\vec{A} \cdot \vec{A})}{(V \cdot A)^3} \vec{V}_i \\ & + \frac{2M^2}{(V \cdot A)^4} A_i + \frac{4M^2(\vec{A} \cdot \vec{A})}{(V \cdot A)^4} A_i \end{aligned}$$

$$\begin{aligned} & + \left[\begin{aligned} & + \frac{3M^2}{(V \cdot A)^5} \vec{r}_i - \frac{3M^2(\vec{A} \cdot \vec{A})}{(V \cdot A)^5} \vec{r}_i \\ & - \frac{3M^2}{(V \cdot A)^4} \vec{V}_i + \frac{2M^2(\vec{A} \cdot \vec{A})}{(V \cdot A)^4} \vec{V}_i \\ & - \frac{2M^2}{(V \cdot A)^3} A_i \end{aligned} \right] \end{aligned}$$

$$+ \frac{\partial^2}{\partial x^j \partial x^i} \left[\frac{M[2V_j V_k - \Delta_{jk}]}{(V \cdot A)} \right]$$

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págs. 109
a 139.

Términos en r_i

$$\begin{aligned} & + \frac{6M}{(V \cdot A)^5} r_i V_j V_k - 12 \frac{M(\hat{A} \cdot \hat{r})}{(V \cdot A)^5} r_i V_j V_k + \frac{6M(\hat{A} \cdot \hat{r})^2}{(V \cdot A)^5} r_i V_j V_k \\ & - \frac{2M(\hat{B} \cdot \hat{r})}{(V \cdot A)^4} r_i V_j V_k + \frac{6M}{(V \cdot A)^4} r_i V_j A_k - \frac{6M(\hat{A} \cdot \hat{r})}{(V \cdot A)^4} r_i V_j A_k \\ & + \frac{2M}{(V \cdot A)^3} r_i V_j B_k + \frac{6M}{(V \cdot A)^4} r_i A_j V_k - \frac{6M(\hat{A} \cdot \hat{r})}{(V \cdot A)^4} r_i A_j V_k \\ & + \frac{4M}{(V \cdot A)^3} r_i A_j A_k + \frac{2M}{(V \cdot A)^3} r_i B_j V_k + \frac{6M(\hat{A} \cdot \hat{r})}{(V \cdot A)^5} r_i \Delta_{jk} \\ & - \frac{3M}{(V \cdot A)^5} r_i \Delta_{jk} - \frac{3M(\hat{A} \cdot \hat{r})^2}{(V \cdot A)^5} r_i \Delta_{jk} + \frac{M(\hat{B} \cdot \hat{r})}{(V \cdot A)^4} r_i \Delta_{jk} \\ & - \frac{6M}{(V \cdot A)^4} V_i V_j V_k + \frac{6M(\hat{A} \cdot \hat{r})}{(V \cdot A)^4} V_i V_j V_k - \frac{4M}{(V \cdot A)^3} V_i V_j A_k \\ & - \frac{4M}{(V \cdot A)^3} V_i A_j V_k + \frac{3M}{(V \cdot A)^4} V_i \Delta_{jk} - \frac{3M(\hat{A} \cdot \hat{r})}{(V \cdot A)^4} V_i \Delta_{jk} \\ & - \frac{2M}{(V \cdot A)^3} A_i V_j V_k + \frac{M}{(V \cdot A)^3} A_i \Delta_{jk} \end{aligned}$$

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$$\frac{\partial^2}{\partial x^l \partial x^i} \left[\frac{M[2V_j V_k - \Delta_{jk}]}{(V \cdot A)^4} \right]$$

Términos en V_l

$$\begin{aligned} & - \frac{6M}{(V \cdot A)^4} r_i V_j V_k + \frac{6M(A \cdot A)}{(V \cdot A)^4} r_i V_j V_k - \frac{4M}{(V \cdot A)^3} r_i V_j A_k \\ & - \frac{4M}{(V \cdot A)^3} r_i A_j V_k + \frac{3M}{(V \cdot A)^4} r_i \Delta_{jk} - \frac{3M(A \cdot A)}{(V \cdot A)^4} r_i \Delta_{jk} \\ & + \frac{4M}{(V \cdot A)^3} V_i V_j V_k - \frac{2M}{(V \cdot A)^3} V_i \Delta_{jk} \end{aligned}$$

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$$\frac{\partial^2}{\partial x^l \partial x^i} \left[\frac{M[2\vec{V}_j \cdot \vec{V}_k - \Delta_{jk}]}{(\vec{V} \cdot \vec{r})} \right]$$

Términos en A_0

$$- \frac{2M}{(\vec{V} \cdot \vec{r})^3} \vec{r} \cdot \vec{V}_j \vec{V}_k + \frac{M}{(\vec{V} \cdot \vec{r})^3} \vec{r} \cdot \Delta_{jk}$$

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$$\frac{\partial^2}{\partial x^l \partial x^i} \left[\frac{M[2V_j V_k - \Delta_{jk}]}{(\vec{V} \cdot \vec{A})} \right]$$

Términos en Δ_{il}

$$+ \frac{2M}{(\vec{V} \cdot \vec{A})^3} V_j V_k - \frac{2M(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^3} V_j V_k + \frac{2M}{(\vec{V} \cdot \vec{A})^2} V_j A_k$$

$$+ \frac{2M}{(\vec{V} \cdot \vec{A})^2} A_j V_k - \frac{M}{(\vec{V} \cdot \vec{A})^3} \Delta_{jk} + \frac{M(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^3} \Delta_{jk}$$

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$$- \frac{\partial^2}{\partial x^i \partial x^k} \left[\frac{M [2V_i V_j - \Delta_{ij}]}{(\vec{V} \cdot \vec{r})} \right]$$

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Términos en: $\vec{r}$

$$\begin{aligned} & - \frac{6M}{(\vec{V} \cdot \vec{r})^5} V_i V_j r_k + \frac{12M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} V_i V_j r_k - \frac{6M(\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^5} V_i V_j r_k \\ & + \frac{2M(\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i V_j r_k - \frac{6M}{(\vec{V} \cdot \vec{r})^4} V_i A_j r_k + \frac{6M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i A_j r_k \\ & - \frac{2M}{(\vec{V} \cdot \vec{r})^3} V_i B_j r_k - \frac{6M}{(\vec{V} \cdot \vec{r})^4} A_i V_j r_k + \frac{6M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} A_i V_j r_k \\ & - \frac{4M}{(\vec{V} \cdot \vec{r})^3} A_i A_j r_k - \frac{2M}{(\vec{V} \cdot \vec{r})^3} B_i V_j r_k - \frac{6M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} \Delta_{ij} r_k \\ & + \frac{3M}{(\vec{V} \cdot \vec{r})^5} \Delta_{ij} r_k + \frac{3M(\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^5} \Delta_{ij} r_k - \frac{M(\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} \Delta_{ij} r_k \\ & + \frac{6M}{(\vec{V} \cdot \vec{r})^4} V_i V_j V_k - \frac{6M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i V_j V_k + \frac{4M}{(\vec{V} \cdot \vec{r})^3} V_i A_j V_k \\ & + \frac{4M}{(\vec{V} \cdot \vec{r})^3} A_i V_j V_k - \frac{3M}{(\vec{V} \cdot \vec{r})^4} \Delta_{ij} V_k + \frac{3M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} \Delta_{ij} V_k \\ & + \frac{2M}{(\vec{V} \cdot \vec{r})^3} V_i V_j A_k - \frac{M}{(\vec{V} \cdot \vec{r})^3} \Delta_{ij} A_k \end{aligned}$$

$$-\frac{\partial^2}{\partial x^i \partial x^k} \left[\frac{M(2V_i V_j - \Delta_{ij})}{(\vec{V} \cdot \vec{r})^4} \right]$$

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Términos en $\vec{V}_e$

$$+ \frac{6M}{(\vec{V} \cdot \vec{r})^4} V_i V_j r_k - \frac{6M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i V_j r_k + \frac{4M}{(\vec{V} \cdot \vec{r})^3} V_i A_{jk}$$

$$+ \frac{4M}{(\vec{V} \cdot \vec{r})^3} A_i V_j r_k - \frac{3M}{(\vec{V} \cdot \vec{r})^4} \Delta_{ij} r_k + \frac{3M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} \Delta_{ij} r_k$$

$$- \frac{4M}{(\vec{V} \cdot \vec{r})^3} V_i V_j V_k + \frac{2M}{(\vec{V} \cdot \vec{r})^3} \Delta_{ij} V_k$$

$$-\frac{\partial^2}{\partial x^l \partial x^k} \left[\frac{M[2V_i V_j - \Delta_{ij}]}{(V \cdot r)^3} \right]$$

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Términos en A_ℓ

$$+ \frac{2M}{(V \cdot r)^3} V_i V_j r_k - \frac{M}{(V \cdot r)^3} \Delta_{ij} r_k$$

$$- \frac{\partial^2}{\partial x^l \partial x^k} \left[\frac{M[2V_i V_j - \Delta_{ij}]}{(\vec{V} \cdot \vec{A})} \right]$$

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Términos en Δ_{kl}

$$- \frac{2M}{(\vec{V} \cdot \vec{A})^3} V_i V_j + \frac{2M(\hat{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^3} V_i V_j - \frac{2M}{(\vec{V} \cdot \vec{A})^2} V_i A_j$$

$$- \frac{2M}{(\vec{V} \cdot \vec{A})^2} A_i V_j + \frac{M}{(\vec{V} \cdot \vec{A})^3} \Delta_{ij} - \frac{M(\hat{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^3} \Delta_{ij}$$

$$\frac{2M V^j V^k}{(\vec{V} \cdot \vec{A})} \frac{\partial^2}{\partial x^l \partial x^i} \left[\frac{M(2\vec{V}_j \cdot \vec{V}_k - \Delta_{jk})}{(\vec{V} \cdot \vec{A})} \right]$$

Términos en $\vec{r}_i$

$$+ \frac{6M^2}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i - \frac{12M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i + \frac{6M^2(\vec{A} \cdot \vec{A})^2}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i$$

$$- \frac{2M^2(\vec{B} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i - \frac{8M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \vec{r}_i - \frac{6M^2}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i$$

$$+ \frac{6M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i - \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} A_i$$

$$- \frac{M \Lambda^{jk}}{(\vec{V} \cdot \vec{A})} \frac{\partial^2}{\partial x^l \partial x^i} \left[\frac{M(2\vec{V}_j \cdot \vec{V}_k - \Delta_{jk})}{(\vec{V} \cdot \vec{A})} \right]$$

Términos en $\vec{r}_i$

$$+ \frac{6M^2}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i - \frac{12M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i + \frac{6M^2(\vec{A} \cdot \vec{A})^2}{(\vec{V} \cdot \vec{A})^6} \vec{r}_i$$

$$- \frac{2M^2(\vec{B} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i - \frac{6M^2}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i$$

$$+ \frac{6M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{V}_i - \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} A_i$$

$$\frac{2M V^i V^k}{(V \cdot A)} \left[- \frac{\partial^2}{\partial x^l \partial x^k} \left\{ \frac{M [2V_i V_j - \Delta_{ij}]}{(V \cdot A)} \right\} \right]$$

$$\left\{ \nabla \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right] \right\} h^{jk}$$

$$= - \left\{ \nabla \frac{\partial h_{ij}}{\partial x^k} \right\} h^{jk} + \left\{ \nabla \frac{\partial h_{jk}}{\partial x^i} \right\} h^{jk}$$

$$= h^{jk} \nabla \frac{\partial h_{jk}}{\partial x^i} - h^{jk} \nabla \frac{\partial h_{ij}}{\partial x^k}$$

$$h^{jk} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l} - h^{jk} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l} = \text{Nil}$$

$$\frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Términos en

① $r_i V_j V_k$	④ $r_i V_j A_k$	⑤ $r_i V_j B_k$	⑥ $r_i A_j V_k$	⑦ $r_i A_j A_k$	⑧ $r_i B_j V_k$
$+ \frac{6M}{(\hat{V} \cdot \hat{r})^5}$ $- \frac{12M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^5}$ $+ \frac{6M(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{r})^5}$ $- \frac{2M(\hat{B} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4}$	$+ \frac{6M}{(\hat{V} \cdot \hat{r})^4}$ $- \frac{6M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4}$	$+ \frac{2M}{(\hat{V} \cdot \hat{r})^3}$	$+ \frac{6M}{(\hat{V} \cdot \hat{r})^4}$ $- \frac{6M(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4}$	$+ \frac{4M}{(\hat{V} \cdot \hat{r})^3}$	$+ \frac{2M}{(\hat{V} \cdot \hat{r})^3}$

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$r_i \Delta_{jk}$ ⁽⁹⁾	$V_i V_j V_k$ ⁽²⁾	$V_i V_j A_k$ ⁽⁵⁾	$V_i A_j V_k$ ⁽⁷⁾	$V_i \Delta_{jk}$ ⁽¹⁰⁾	$A_i V_j V_k$ ⁽³⁾	$A_i \Delta_{jk}$ ⁽¹¹⁾
$-\frac{3M}{(V \cdot A)^5}$ $+\frac{6M(A \cdot A)}{(V \cdot A)^5}$ $-\frac{3M(A \cdot A)^2}{(V \cdot A)^5}$ $+\frac{M(A \cdot A)}{(V \cdot A)^4}$	$-\frac{6M}{(V \cdot A)^4}$ $+\frac{6M(A \cdot A)}{(V \cdot A)^4}$	$-\frac{4M}{(V \cdot A)^3}$	$-\frac{4M}{(V \cdot A)^3}$	$+\frac{3M}{(V \cdot A)^4}$ $-\frac{3M(A \cdot A)}{(V \cdot A)^4}$	$-\frac{2M}{(V \cdot A)^3}$	$+\frac{M}{(V \cdot A)^3}$

$$\frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Términos

en

V_e

①

$$r_i V_j V_k$$

③

$$r_i V_j A_k$$

④

$$r_i A_j V_k$$

⑤

$$r_i A_j A_k$$

$$- \frac{6M}{(\vec{V} \cdot \vec{A})^4}$$

$$- \frac{4M}{(\vec{V} \cdot \vec{A})^3}$$

$$- \frac{4M}{(\vec{V} \cdot \vec{A})^3}$$

$$+ \frac{3M}{(\vec{V} \cdot \vec{A})^4}$$

$$+ \frac{6M(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4}$$

$$- \frac{3M(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4}$$

$$V_i V_j V_k \quad \textcircled{2}$$

$$+ \frac{4M}{(V \cdot r)^3}$$

$$V_i \Delta_{jk} \quad \textcircled{6}$$

$$- \frac{2M}{(V \cdot r)^3}$$

$$\frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Terminos en

A_e

$$-\frac{2M}{(V \cdot A)^3} r_i V_j V_k + \frac{M}{(V \cdot A)^3} r_i \Delta_{jk}$$

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$$\frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Términos en Δ_{il}

$\begin{aligned} & \vec{V}_j \vec{V}_k \\ & + \frac{2M}{(\vec{V} \cdot \hat{A})^3} \\ & - \frac{2M(\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^3} \end{aligned}$	$\begin{aligned} & \vec{V}_j A_k \\ & + \frac{2M}{(\vec{V} \cdot \hat{A})^2} \end{aligned}$	$\begin{aligned} & A_j \vec{V}_k \\ & + \frac{2M}{(\vec{V} \cdot \hat{A})^2} \end{aligned}$	$\begin{aligned} & \Delta_{jk} \\ & - \frac{M}{(\vec{V} \cdot \hat{A})^3} \\ & + \frac{M(\hat{A} \cdot \hat{r})}{(\vec{V} \cdot \hat{A})^3} \end{aligned}$
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~~ijk~~

$$\frac{2M \vec{V} \vec{V}^k}{(\vec{V} \cdot \vec{r})^4} \quad \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

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Términos en $\vec{r}_i$

$$+ \frac{12 M^2}{(\vec{V} \cdot \vec{r})^6} \vec{r}_i - \frac{24 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^6} \vec{r}_i + \frac{12 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^6} \vec{r}_i$$

$$- \frac{4 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} \vec{r}_i + \frac{4 M^2 (\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{r})^4} \vec{r}_i + \frac{4 M^2 (\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{r})^4} \vec{r}_i$$

$$- \frac{6 M^2}{(\vec{V} \cdot \vec{r})^6} \vec{r}_i + \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^6} \vec{r}_i - \frac{6 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^6} \vec{r}_i + \frac{2 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} \vec{r}_i$$

$$- \frac{12 M^2}{(\vec{V} \cdot \vec{r})^5} \vec{V}_i + \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} \vec{V}_i - \frac{6 M^2}{(\vec{V} \cdot \vec{r})^5} \vec{V}_i - \frac{6 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} \vec{V}_i$$

$$- \frac{4 M^2}{(\vec{V} \cdot \vec{r})^4} A_i + \frac{2 M^2}{(\vec{V} \cdot \vec{r})^4} A_i$$

$$\left[+ \frac{6 M^2}{(\vec{V} \cdot \vec{r})^6} - \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^6} + \frac{6 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^6} - \frac{2 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} + \frac{8 M^2 (\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{r})^4} \right] \vec{r}_i$$

$$+ \left[- \frac{6 M^2}{(\vec{V} \cdot \vec{r})^5} + \frac{6 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} \right] \vec{V}_i$$

$$+ \left[- \frac{2 M^2}{(\vec{V} \cdot \vec{r})^4} \right] A_i$$

$$\frac{2M V^j V^k}{(\vec{V} \cdot \vec{A})} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

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Términos en $\vec{V}_i$

$$\left(-\frac{12M^2}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i \right) + \left(\frac{12M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i \right) + \left(\frac{6M^2}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i \right) + \left(-\frac{6M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i \right)$$

$$+ \frac{8M^2}{(\vec{V} \cdot \vec{A})^4} \vec{V}_i - \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} \vec{V}_i$$

$$\left[-\frac{6M^2}{(\vec{V} \cdot \vec{A})^5} + \frac{6M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^5} \right] \vec{r}_i$$

$$+ \left[+\frac{4M^2}{(\vec{V} \cdot \vec{A})^4} \right] \vec{V}_i$$

$$\frac{2M V^j V^k}{(\vec{V} \cdot \vec{A})} \quad \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Términos en Δ_{il}

$$+ \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{4M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} - \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} + \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4}$$

$$\left[+ \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \right] \Delta_{il}$$

$$\frac{2M V^k}{(\dot{V}, A)} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

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Términos em A_ℓ

$$- \frac{4M^2}{(\dot{V}, A)^4} \Gamma_i + \frac{2M^2}{(\dot{V}, A)^4} \Gamma_i$$

$$- \frac{2M^2}{(\dot{V}, A)^4} \Gamma_i$$

$$-\frac{M \Delta^{jk}}{(V \cdot A)^4} \quad \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

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Términos en r_l

$$\begin{aligned}
 & \left[-\frac{6M^2}{(V \cdot A)^6} r_i + \frac{12M^2(A \cdot A)}{(V \cdot A)^6} r_i - \frac{6M^2(\hat{A} \cdot A)^2}{(V \cdot A)^6} r_i \right] + \frac{2M^2(\hat{B} \cdot A)}{(V \cdot A)^5} r_i \\
 & + \frac{6M^2}{(V \cdot A)^6} r_i - \frac{2M^2(V \cdot \hat{B})}{(V \cdot A)^4} r_i - \frac{4M^2(\hat{A} \cdot \hat{A})}{(V \cdot A)^4} r_i - \frac{2M^2(V \cdot \hat{B})}{(V \cdot A)^4} r_i \\
 & + \frac{12M^2}{(V \cdot A)^6} r_i - \frac{24M^2(A \cdot A)}{(V \cdot A)^6} r_i + \frac{12M^2(\hat{A} \cdot \hat{A})^2}{(V \cdot A)^6} r_i - \frac{4M^2(\hat{B} \cdot A)}{(V \cdot A)^5} r_i \\
 & + \frac{6M^2}{(V \cdot A)^5} V_i - \frac{6M^2(A \cdot A)}{(V \cdot A)^5} V_i - \frac{12M^2}{(V \cdot A)^5} V_i + \frac{12M^2(A \cdot A)}{(V \cdot A)^5} V_i \\
 & + \frac{2M^2}{(V \cdot A)^4} A_i - \frac{4M^2}{(V \cdot A)^4} A_i \\
 & \left[+ \frac{6M^2}{(V \cdot A)^6} - \frac{12M^2(A \cdot A)}{(V \cdot A)^6} + \frac{6M^2(\hat{A} \cdot A)^2}{(V \cdot A)^6} + \frac{2M^2(V \cdot \hat{B})}{(V \cdot A)^4} \right. \\
 & \left. - \frac{4M^2(\hat{B} \cdot A)}{(V \cdot A)^5} \right] r_i \\
 & + \left[-\frac{6M^2}{(V \cdot A)^5} + \frac{6M^2(A \cdot A)}{(V \cdot A)^5} \right] V_i \\
 & + \left[-\frac{2M^2}{(V \cdot A)^4} \right] A_i
 \end{aligned}$$

$$- \frac{M \Delta^{jk}}{(\vec{V} \cdot \vec{A})} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

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Términos en V_i

$$+ \frac{6M^2}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i - \frac{6M^2(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i - \frac{12M^2}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i + \frac{12M^2(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \vec{r}_i$$

$$- \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} \vec{V}_i + \frac{8M^2}{(\vec{V} \cdot \vec{A})^4} \vec{V}_i$$

$$\left[- \frac{6M^2}{(\vec{V} \cdot \vec{A})^5} + \frac{6M^2(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \right] \vec{r}_i$$

$$+ \left[+ \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} \right] \vec{V}_i$$

$$- \frac{M \Delta^{jk}}{(\vec{V} \cdot \vec{A})} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Términos en A_l

$$+ \left[\frac{2M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} \right] r_i$$

$$- \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} r_i$$

$$- \frac{M \Delta^{jk}}{(\vec{V} \cdot \vec{A})} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l}$$

Términos en Δ_{il}

$$- \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} + \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} + \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{4M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4}$$

$$\left[+ \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{2M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \right] \Delta_{il}$$

$$\left[h^{jk} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^l} \right]$$

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Términos en r_e

$$\left[\begin{aligned} &+ \frac{12 M^2}{(\vec{V} \cdot \vec{A})^6} - \frac{24 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^6} + \frac{12 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{A})^6} + \frac{10 M^2 (\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{A})^4} \\ &- \frac{6 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \end{aligned} \right] \vec{r}_i$$

$$+ \left[- \frac{12 M^2}{(\vec{V} \cdot \vec{A})^5} + \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \right] V_i$$

$$+ \left[- \frac{4 M^2}{(\vec{V} \cdot \vec{A})^4} \right] A_i$$

$$h^{jk} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^i}$$

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Términos en V_0

$$\left[-\frac{12 M^2}{(V \cdot A)^5} + \frac{12 M^2 (A \cdot A)}{(V \cdot A)^5} \right] r_i$$

$$+ \left[+ \frac{8 M^2}{(V \cdot A)^4} \right] V_i$$

$$h^{jk} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^i}$$

43

Términos en A_0

$$- \frac{4M^2}{(V \cdot r)^4} r_i$$

$$h^{jk} \frac{\partial^2 h_{jk}}{\partial x^i \partial x^i}$$

44

Términos en Δ_{il}

$$\left[+ \frac{4M^2}{(\vec{r} \cdot \vec{r})^4} - \frac{4M^2(\vec{A} \cdot \vec{r})}{(\vec{r} \cdot \vec{r})^4} \right] \Delta_{il}$$

Términos

①	②	③	④	⑤	⑥	⑦
$V_i V_j r_k$	$V_i V_j V_k$	$V_i V_j A_k$	$V_i A_j r_k$	$V_i B_j r_k$	$A_i V_j r_k$	$A_i A_j r_k$
$+ \frac{6M}{(V \cdot A)^5}$	$- \frac{6M}{(V \cdot A)^4}$	$- \frac{2M}{(V \cdot A)^3}$	$+ \frac{6M}{(V \cdot A)^4}$	$+ \frac{2M}{(V \cdot A)^3}$	$+ \frac{6M}{(V \cdot A)^4}$	$+ \frac{4M}{(V \cdot A)^3}$
$- \frac{12M(A \cdot A)}{(V \cdot A)^5}$	$+ \frac{6M(A \cdot r)}{(V \cdot A)^4}$		$- \frac{6M(A \cdot r)}{(V \cdot A)^4}$		$- \frac{6M(A \cdot A)}{(V \cdot A)^4}$	
$+ \frac{6M(A \cdot A^2)}{(V \cdot A)^5}$						
$- \frac{2M(B \cdot A)}{(V \cdot A)^4}$						

$$\frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

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Términos

en

$\bar{r}$

$$A_i A_j r_k$$

$$+ \frac{4M}{(\bar{V} \cdot \bar{r})^3}$$

$$B_i V_j r_k$$

$$+ \frac{2M}{(\bar{V} \cdot \bar{r})^3}$$

$$\Delta_{ijk}$$

$$- \frac{3M}{(\bar{V} \cdot \bar{r})^5}$$

$$\Delta_{ijk}$$

$$+ \frac{3M}{(\bar{V} \cdot \bar{r})^4}$$

$$\Delta_{ijk}$$

$$+ \frac{M}{(\bar{V} \cdot \bar{r})^3}$$

$$+ \frac{6M(\bar{A} \cdot \bar{r})}{(\bar{V} \cdot \bar{r})^5}$$

$$- \frac{3M(\bar{A} \cdot \bar{r})}{(\bar{V} \cdot \bar{r})^4}$$

$$- \frac{3M(\bar{A} \cdot \bar{r})}{(\bar{V} \cdot \bar{r})^5}$$

$$+ \frac{M(\bar{B} \cdot \bar{r})}{(\bar{V} \cdot \bar{r})^4}$$

$$\frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Términos

① $V_i V_j r_k$	② $V_i V_j V_k$	③ $V_i A_j r_k$	④ $A_i V_j r_k$	⑤ Δg_k
$-\frac{6M}{(V \cdot A)^4}$ $+\frac{6M(A \cdot A)}{(V \cdot A)^4}$	$+\frac{4M}{(V \cdot A)^3}$	$-\frac{4M}{(V \cdot A)^3}$	$-\frac{4M}{(V \cdot A)^3}$	$+\frac{3M}{(V \cdot A)^4}$ $-\frac{3M(A \cdot A)}{(V \cdot A)^4}$

$$\frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

terminos

$$\Delta_{jk}$$

$$+ \frac{3M}{(\vec{V} \cdot \vec{A})^4}$$

$$- \frac{3M(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^4}$$

$$m \vec{V}_0$$

$$\Delta_{jk} \vec{V}_k$$

$$- \frac{2M}{(\vec{V} \cdot \vec{A})^3}$$

$$\frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Termes en A_l

$$- \frac{2M}{(\vec{V} \cdot \vec{A})^3} V_i V_j r_k + \frac{M}{(\vec{V} \cdot \vec{A})^3} \Delta_{ij} r_k$$

$$\frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Términos en Δ_{kl}

$$\left[\frac{2M}{(\vec{V} \cdot \vec{A})^4} \right] \vec{A}_i$$

$V_i V_j$	$V_i A_j$	$A_i V_j$	Δ_{ij}
$+ \frac{2M}{(\vec{V} \cdot \vec{A})^3}$	$+ \frac{2M}{(\vec{V} \cdot \vec{A})^2}$	$+ \frac{2M}{(\vec{V} \cdot \vec{A})^2}$	$- \frac{M}{(\vec{V} \cdot \vec{A})^3}$
$- \frac{2M(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^3}$			$+ \frac{M(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^3}$

$$- \frac{2 M V^j V^k}{(\vec{V} \cdot \vec{r})} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Términos en $\vec{r}$

$$\begin{aligned} & - \frac{12 M^2}{(\vec{V} \cdot \vec{r})^5} V_i + \frac{24 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} V_i - \frac{12 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^5} V_i + \frac{4 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i \\ & + \frac{12 M^2}{(\vec{V} \cdot \vec{r})^5} V_i - \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} V_i - \frac{4 M^2 (\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{r})^3} V_i \\ & - \frac{12 M^2}{(\vec{V} \cdot \vec{r})^4} A_i + \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} A_i - \frac{4 M^2}{(\vec{V} \cdot \vec{r})^3} B_i \\ & + \frac{6 M^2}{(\vec{V} \cdot \vec{r})^5} V_i - \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} V_i + \frac{6 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^5} V_i \\ & - \frac{2 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i - \frac{6 M^2}{(\vec{V} \cdot \vec{r})^5} V_i + \frac{6 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} V_i \end{aligned}$$

$$\begin{aligned} & + \frac{6 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^5} V_i - \frac{6 M^2 (\vec{A} \cdot \vec{r})^2}{(\vec{V} \cdot \vec{r})^5} V_i + \frac{2 M^2 (\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} V_i \\ & - \frac{4 M^2 (\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{r})^3} V_i - \frac{12 M^2}{(\vec{V} \cdot \vec{r})^4} A_i + \frac{12 M^2 (\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{r})^4} A_i \\ & - \frac{4 M^2}{(\vec{V} \cdot \vec{r})^3} B_i \end{aligned}$$

$$- \frac{2M^2 V^k}{(\vec{V} \cdot \vec{A})} \frac{\partial h_{ij}}{\partial x^k \partial x^l}$$

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Terminos en V_i

$$+ \frac{12M^2}{(\vec{V} \cdot \vec{A})^4} \cancel{V_i} - \frac{12M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \cancel{V_i} - \frac{8M^2}{(\vec{V} \cdot \vec{A})^4} \cancel{V_i} + \frac{8M^2}{(\vec{V} \cdot \vec{A})^3} \cancel{A_i}$$

$$- \frac{6M^2}{(\vec{V} \cdot \vec{A})^4} \cancel{V_i} + \frac{6M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \cancel{V_i} + \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} \cancel{V_i}$$

$$+ \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} V_i - \frac{6M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} V_i + \frac{8M^2}{(\vec{V} \cdot \vec{A})^3} A_i$$

$$+ \frac{6M^2}{(\vec{V} \cdot \vec{A})^4} V_i + \frac{6M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} V_i$$

$$- \frac{2M V^j V^k}{(V \cdot A)} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Términos en A_0

$$+ \frac{4M^2}{(V \cdot A)^3} V_i - \frac{2M^2}{(V \cdot A)^3} \cancel{V}_i$$

$$+ \frac{2M^2}{(V \cdot A)^3} V_i$$

$$-\frac{2M V^i V^k}{(\vec{V} \cdot \vec{A})} \quad \frac{\partial^2 h_{ij}}{\partial x^k \partial x^e}$$

Términos en Δ_{kl}

$$-\frac{4M^2}{(\vec{V} \cdot \vec{A})^4} V_i V_e + \frac{4M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} V_i V_e - \cancel{4M^2}$$

$$-\frac{4M^2}{(\vec{V} \cdot \vec{A})^3} A_i V_e + \frac{2M^2}{(\vec{V} \cdot \vec{A})^4} V_i V_e - \frac{2M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} V_i V_e$$

$$-\frac{2M^2}{(\vec{V} \cdot \vec{A})^4} V_i V_e + \frac{2M^2 (\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} V_i V_e - \frac{4M^2}{(\vec{V} \cdot \vec{A})^3} A_i V_e$$



$$+ \frac{M \delta^k}{(V \cdot A)} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

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Términos en r_i

$$\begin{aligned} & + \frac{6M^2}{(V \cdot A)^5} V_i - \frac{12M^2(A \cdot A)}{(V \cdot A)^5} V_i + \frac{6M^2(A \cdot A)^2}{(V \cdot A)^5} V_i - \frac{2M^2(B \cdot A)}{(V \cdot A)^4} V_i \\ & - \frac{6M^2}{(V \cdot A)^4} V_i + \frac{6M^2(A \cdot A)}{(V \cdot A)^5} V_i + \frac{6M^2(A \cdot A)}{(V \cdot A)^5} V_i - \frac{6M^2(A \cdot A)^2}{(V \cdot A)^5} V_i \\ & + \frac{6M^2(B \cdot A)}{(V \cdot A)^4} V_i + \frac{6M^2}{(V \cdot A)^4} A_i - \frac{6M^2(A \cdot A)}{(V \cdot A)^4} A_i \\ & + \frac{4M^2(A \cdot A)}{(V \cdot A)^4} A_i + \frac{2M}{(V \cdot A)^3} B_i - \frac{3M^2}{(V \cdot A)^6} r_i \\ & + \frac{6M^2(A \cdot A)}{(V \cdot A)^6} r_i - \frac{3M^2(A \cdot A)^2}{(V \cdot A)^6} r_i + \frac{M^2(B \cdot A)}{(V \cdot A)^5} r_i \\ & + \frac{3M^2}{(V \cdot A)^5} V_i - \frac{3M^2(A \cdot A)}{(V \cdot A)^5} r_i + \frac{M^2}{(V \cdot A)^4} A_i \end{aligned}$$

$$\begin{aligned} & + \frac{3M^2}{(V \cdot A)^5} V_i + \frac{4M^2(B \cdot A)}{(V \cdot A)^4} V_i - \frac{3M^2}{(V \cdot A)^6} r_i \\ & + \frac{3M^2(A \cdot A)}{(V \cdot A)^6} r_i - \frac{3M^2(A \cdot A)^2}{(V \cdot A)^6} r_i + \frac{M^2(B \cdot A)}{(V \cdot A)^5} r_i \\ & + \frac{7M^2}{(V \cdot A)^4} A_i - \frac{2M^2(A \cdot A)}{(V \cdot A)^4} A_i + \frac{2M}{(V \cdot A)^3} B_i \end{aligned}$$

$$+ \frac{M \Delta^{jk}}{(V \cdot A)} \frac{\partial h_{ij}}{\partial x^k \partial x^l}$$

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Termos em V_i

$$- \frac{6M^2}{(V \cdot A)^4} V_i + \frac{6M^2 (A \cdot A)}{(V \cdot A)^4} V_i + \frac{4M^2}{(V \cdot A)^4} V_i - \frac{4M^2 (A \cdot A)}{(V \cdot A)^4} V_i$$

$$- \frac{4M^2}{(V \cdot A)^3} A_i + \frac{3M^2}{(V \cdot A)^5} V_i - \frac{3M^2 (A \cdot A)}{(V \cdot A)^5} V_i - \frac{2M^2}{(V \cdot A)^4} V_i$$

$$- \frac{4M^2}{(V \cdot A)^4} V_i - \frac{4M^2 (A \cdot A)}{(V \cdot A)^4} V_i + \frac{3M^2}{(V \cdot A)^5} V_i$$

$$- \frac{3M^2 (A \cdot A)}{(V \cdot A)^5} V_i - \frac{4M^2}{(V \cdot A)^3} A_i$$

$$\frac{M \Delta^{jk}}{(\vec{V} \cdot \vec{A})} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Términos en A_e .

$$-\frac{2M^2}{(\vec{V} \cdot \vec{A})^3} \vec{V}_i + \frac{M^2}{(\vec{V} \cdot \vec{A})^4} \vec{r}_i$$

$$\frac{M \Delta^{ik}}{(V \cdot r)^4} \quad \frac{\partial^2 h_{ij}}{2x^k \partial x^l}$$

Términos raros.

$$+ \frac{2M^2}{(V \cdot r)^4} V_i V_e - \frac{2M^2 (\hat{A} \cdot \hat{r})}{(V \cdot r)^4} V_i V_e + \frac{2M^2}{(V \cdot r)^3} V_i A_e$$

$$+ \frac{2M^2}{(V \cdot r)^3} \mathbf{A}_i V_e - \frac{M^2}{(V \cdot r)^4} \Delta_{il} + \frac{M^2 (\hat{A} \cdot \hat{r})}{(V \cdot r)^4} \Delta_{il}$$

$$- \hbar^{jk} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

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Términos em $\vec{r}$

$$+ \frac{6M^2(\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^5} \vec{V}_i - \frac{6M^2(\hat{A} \cdot \hat{A})^2}{(\hat{V} \cdot \hat{A})^5} \vec{V}_i + \frac{8M^2(\hat{B} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^4} \vec{V}_i$$

$$- \frac{4M^2(\hat{V} \cdot \hat{B})}{(\hat{V} \cdot \hat{A})^3} \vec{V}_i - \frac{12M^2}{(\hat{V} \cdot \hat{A})^4} A_i + \frac{12M^2(\hat{A} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^4} A_i$$

$$- \frac{4M^2}{(\hat{V} \cdot \hat{A})^3} B_i + \frac{3M^2}{(\hat{V} \cdot \hat{A})^5} \vec{V}_i + \frac{4M^2(\hat{B} \cdot \hat{A})}{(\hat{V} \cdot \hat{A})^4} \vec{V}_i$$

$$- \frac{3M^2}{(\hat{V} \cdot \hat{A})^6} \vec{r}_i + \frac{3M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^6} \vec{r}_i - \frac{3M^2(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{A})^6} \vec{r}_i$$

$$+ \frac{M^2(\hat{B} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^5} \vec{r}_i + \frac{7M^2}{(\hat{V} \cdot \hat{A})^4} A_i + \frac{2M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^4} A_i + \frac{2M^2}{(\hat{V} \cdot \hat{A})^5} B_i$$

$$- \frac{3M^2}{(\hat{V} \cdot \hat{A})^6} \vec{r}_i + \frac{3M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^6} \vec{r}_i - \frac{3M^2(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{A})^6} \vec{r}_i + \frac{M^2(\hat{B} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^5} \vec{r}_i$$

$$+ \frac{3M^2}{(\hat{V} \cdot \hat{A})^5} \vec{V}_i + \frac{6M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^5} \vec{V}_i - \frac{6M^2(\hat{A} \cdot \hat{r})^2}{(\hat{V} \cdot \hat{A})^5} \vec{V}_i + \frac{6M^2(\hat{B} \cdot \hat{r})}{(\hat{V} \cdot \hat{A})^4} \vec{V}_i$$

$$- \frac{4M^2(\hat{V} \cdot \hat{B})}{(\hat{V} \cdot \hat{A})^3} \vec{V}_i - \frac{5M^2}{(\hat{V} \cdot \hat{r})^4} A_i + \frac{14M^2(\hat{A} \cdot \hat{r})}{(\hat{V} \cdot \hat{r})^4} A_i$$

$$- \frac{2M^2}{(\hat{V} \cdot \hat{A})^3} B_i$$

$$+ \frac{3M^2}{(V \cdot r)^5} r_i - \frac{3M^2 (\hat{A} \cdot \hat{r})}{(V \cdot r)^5} r_i - \frac{2M^2}{(V \cdot r)^4} V_i - \frac{10M^2 (\hat{A} \cdot \hat{r})}{(V \cdot r)^4} V_i$$

$$+ \frac{2M^2}{(V \cdot r)^3} A_i$$

$$- \frac{1}{h} \frac{\partial^2 h_i}{\partial x^k \partial x^k}$$

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Términos en V_i .

$$+ \frac{2M}{(V \cdot A)} V_i - \frac{6M(A \cdot A)}{(V \cdot A)^4} V_i + \frac{8M^2}{(V \cdot A)^3} A_i$$

$$\cancel{\frac{2M^2}{(V \cdot A)^4} V_i}$$

$$- \frac{4M^2}{(V \cdot A)^4} V_i - \frac{4M^2(A \cdot A)}{(V \cdot A)^4} V_i + \frac{3M^2}{(V \cdot A)^5} V_i$$

$$- \frac{3M^2(A \cdot A)}{(V \cdot A)^5} V_i - \frac{4M^2}{(V \cdot A)^3} A_i$$

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$$- \frac{2M^2}{(V \cdot A)^4} V_i - \frac{10M^2(A \cdot A)}{(V \cdot A)^4} V_i + \frac{3M^2}{(V \cdot A)^5} V_i - \frac{3M^2(A \cdot A)}{(V \cdot A)^5} V_i$$

$$+ \frac{4M^2}{(V \cdot A)^3} A_i - \frac{2M^2}{(V \cdot A)^4} V_i + \frac{2M^2(A \cdot A)}{(V \cdot A)^4} V_i$$

$$- \frac{4M^2}{(V \cdot A)^3} A_i + \frac{2M^2}{(V \cdot A)^4} V_i - \frac{2M^2(A \cdot A)}{(V \cdot A)^4} V_i$$

$$+ \frac{2M^2}{(V \cdot A)^3} A_i$$



$$- h^{jk} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

Términos en A_l

$$+ \frac{2M^2}{(\vec{V} \cdot \vec{A})^3} V_i - \frac{2M^2}{(\vec{V} \cdot \vec{A})^3} V_i + \frac{M^2}{(\vec{V} \cdot \vec{A})^4} r_i$$

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adicionales.

$$+ \frac{M^2}{(\vec{V} \cdot \vec{A})^4} r_i + \frac{2M^2}{(\vec{V} \cdot \vec{A})^3} V_i \leftarrow$$

$$-h^{jk} \frac{\partial^2 h_{ij}}{\partial x^k \partial x^l}$$

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Términos en Δ_{il}

$$-\frac{M^2}{(V_{,r})^4} \Delta_{il} + \frac{M^2 (\hat{A}_{,r})}{(V_{,r})^4} \Delta_{il}$$

$$-h^{jk} \frac{\partial}{\partial x^l} \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right]$$

Términos en r_e

$$\left[\begin{aligned} &+ \frac{9M^2}{(\vec{V} \cdot \vec{A})^6} - \frac{21M^2(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^6} + \frac{9M^2(\vec{A} \cdot \vec{A})^2}{(\vec{V} \cdot \vec{A})^6} + \frac{10M^2(\vec{V} \cdot \vec{B})}{(\vec{V} \cdot \vec{A})^4} \\ &- \frac{5M^2(\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} \end{aligned} \right] \vec{r}_i$$

$$+ \left[\begin{aligned} &-\frac{9M^2}{(\vec{V} \cdot \vec{A})^5} + \frac{12M^2(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^5} + \frac{6M^2(\vec{B} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^4} \\ &- \frac{4M^2(\vec{B} \cdot \vec{V})}{(\vec{V} \cdot \vec{A})^3} \end{aligned} \right] \vec{V}_i$$

$$+ \left[-\frac{9M^2}{(\vec{V} \cdot \vec{A})^4} + \frac{14M^2(\vec{A} \cdot \vec{r})}{(\vec{V} \cdot \vec{A})^4} \right] A_i$$

$$+ \left[-\frac{2M^2}{(\vec{V} \cdot \vec{A})^3} \right] B_i$$



$$- h^{jk} \frac{\partial}{\partial x^k} \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right]$$

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Términos en $\bar{e}$

$$\left[\begin{aligned} & + \frac{12 M^2}{(\vec{V} \cdot \hat{A})^6} - \frac{24 M^2 (\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^6} + \frac{12 M^2 (\hat{A} \cdot \hat{A})^2}{(\vec{V} \cdot \hat{A})^6} + \frac{10 M^2 (\vec{V} \cdot \hat{B})}{(\vec{V} \cdot \hat{A})^4} \\ & - \frac{6 M^2 (\hat{B} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^5} - \frac{3 M^2}{(\vec{V} \cdot \hat{A})^6} + \frac{3 M^2 (\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^6} - \frac{3 M^2 (\hat{A} \cdot \hat{A})^2}{(\vec{V} \cdot \hat{A})^6} \\ & + \frac{M^2 (\hat{B} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^5} \end{aligned} \right] \bar{e}$$

$$+ \left[\begin{aligned} & - \frac{12 M^2}{(\vec{V} \cdot \hat{A})^5} + \frac{12 M^2 (\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^5} + \frac{3 M^2}{(\vec{V} \cdot \hat{A})^5} + \frac{6 M^2 (\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^5} \\ & - \frac{6 M^2 (\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^5} + \frac{6 M^2 (\hat{B} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^4} - \frac{4 M^2 (\hat{B} \cdot \vec{V})}{(\vec{V} \cdot \hat{A})^3} \end{aligned} \right] \bar{V}_i$$

$$+ \left[- \frac{4 M^2}{(\vec{V} \cdot \hat{A})^4} - \frac{5 M^2}{(\vec{V} \cdot \hat{A})^4} + \frac{14 M^2 (\hat{A} \cdot \hat{A})}{(\vec{V} \cdot \hat{A})^4} \right] A_i$$

$$+ \left[- \frac{2 M^2}{(\vec{V} \cdot \hat{A})^3} \right] B_i$$

$$-h^{jk} \frac{\partial}{\partial x^l} \left(\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right)$$

págs. 42, 58
(57)

Términos en V_i

$$\left[\begin{aligned} & -\frac{12 M^2}{(V \cdot A)^5} + \frac{12 M^2 (A \cdot A)}{(V \cdot A)^5} \\ & + \frac{3 M^2}{(V \cdot A)^5} - \frac{3 M^2 (A \cdot A)}{(V \cdot A)^5} \end{aligned} \right] \bar{r}_i$$

$$+ \left[\begin{aligned} & + \frac{8 M^2}{(V \cdot A)^4} - \frac{2 M^2}{(V \cdot A)^4} - \frac{10 M^2 (A \cdot A)}{(V \cdot A)^4} \end{aligned} \right] \bar{V}_i$$

$$+ \frac{2 M^2}{(V \cdot A)^3} A_i$$

$$\left[\begin{aligned} & -\frac{9 M^2}{(V \cdot A)^5} + \frac{9 M^2 (A \cdot A)}{(V \cdot A)^5} \end{aligned} \right] \bar{r}_i$$

$$+ \left[\begin{aligned} & \frac{6 M^2}{(V \cdot A)^4} - \frac{10 M^2 (A \cdot A)}{(V \cdot A)^4} \end{aligned} \right] \bar{V}_i$$

$$+ \frac{2 M^2}{(V \cdot A)^3} A_i$$

$$-h^{jk} \frac{\partial}{\partial x^l} \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^i} \right]$$

págs 43 y 59. 63

Términos en A_l

$$\left[-\frac{4M^2}{(V \cdot A)^4} + \frac{M^2}{(V \cdot A)^4} \right] r_i$$

$$+ \frac{2M^2}{(V \cdot A)^3} V_i$$

$$\left[-\frac{3M^2}{(V \cdot A)^4} \right] r_i + \frac{2M^2}{(V \cdot A)^3} V_i$$

$$-h^{jk} \frac{\partial}{\partial x^l} \left[\frac{\partial h_{ij}}{\partial x^k} - \frac{\partial h_{jk}}{\partial x^l} \right]$$

págs 44 y 60

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Términos en Δ_{il}

$$\left[+ \frac{4M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{4M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} - \frac{M^2}{(\vec{V} \cdot \vec{A})^4} + \frac{M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \right] \Delta_{il}$$

$$\left[\frac{3M^2}{(\vec{V} \cdot \vec{A})^4} - \frac{3M^2(\vec{A} \cdot \vec{A})}{(\vec{V} \cdot \vec{A})^4} \right] \Delta_{il}.$$