Aspectos de la cuantización de Teorías Topológicas.

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22 de febrero de 2010

Lagrangiano.

Acción de de una hoja de mundo de dos dimensiones

$$\chi = \sigma_1 \int \sqrt{-\gamma} R \ d\overline{\Sigma}, \tag{1}$$

la variación de la acción para la hoja de mundo está dada por

$$\delta \ \chi = \sigma_1 \int \sqrt{-\gamma} \ \left(\frac{1}{2} R \ \eta^{\mu\nu} - R^{\mu\nu} \right) \delta g_{\mu\nu} \ d\overline{\Sigma} + \sigma_1 \int \overline{\nabla}_\mu \ \psi^\mu \ d\overline{\Sigma}. \tag{2}$$

Lagrangiano.

La deformación de la métrica de fondo

$$\delta g_{\mu\nu} = \nabla_\mu \xi_\nu + \nabla_\nu \xi_\mu, \tag{3}$$

donde ξ_μ es un campo vectorial de deformación ortogonal a la hoja de mundo

$$\eta_\mu{}^\sigma \xi_\sigma = 0, \tag{4}$$

porque elimina la deformación tangencial no observable fisicamente.

La variación de la hoja de mundo en términos de este campo vectorial, queda como

$$\begin{aligned}(\frac{1}{2}R\ \eta^{\mu\nu} - R^{\mu\nu})\delta g_{\mu\nu} &= \xi^\nu\ \overline{\nabla}_\mu(2R^\mu{}_\nu - R\ \eta^\mu{}_\nu) \\ &= (2R^{\sigma\rho} - R\eta^{\sigma\rho})K_{\sigma\rho\nu}\xi^\nu, \end{aligned} \tag{5}$$

entonces las ecuaciones de movimiento para la hoja de mundo

$$\sigma_1(2R^{\sigma\rho} - R\eta^{\sigma\rho})K_{\sigma\rho\nu} = 0. \tag{6}$$

Primera flutuación de la ecuación de movimiento.

La fluctuación a primer orden de

$$\delta(2R^{\sigma\rho} - R\eta^{\sigma\rho}) =$$

$$\frac{1}{2}\overline{C}^{\mu\nu\alpha\beta}(2\delta R_{\mu\nu} - R\delta g_{\mu\nu}) = \widetilde{\Box} h^{\alpha\beta} - \widetilde{\nabla}^{\alpha}\widetilde{\nabla}_{\sigma} h^{\beta\sigma} - \widetilde{\nabla}^{\beta}\widetilde{\nabla}_{\sigma} h^{\alpha\sigma} + \widetilde{\nabla}^{\alpha}\widetilde{\nabla}^{\beta} h - \eta^{\alpha\beta}(\widetilde{\Box} h - \widetilde{\nabla}^{\rho}\widetilde{\nabla}^{\sigma} h_{\rho\sigma}), \quad (7)$$

donde la derivada covariante tangencial ajustada

$$\widetilde{\nabla}_{\kappa} A_{\rho} = \eta_{\rho}{}^{\sigma}\, \overline{\nabla}_{\kappa} \bar{A}_{\sigma} + \perp_{\rho}{}^{\sigma}\, \overline{\nabla}_{\kappa} \hat{A}_{\sigma} = \overline{\nabla}_{\kappa} A_{\rho} - K_{\kappa}{}^{\alpha}{}_{\rho} \bar{A}_{\alpha} + K_{\kappa\rho}{}^{\alpha} \hat{A}_{\alpha}, \quad (8)$$

donde el campo vectorial arbitrario A_{ρ}

$$A_{\mu} = \bar{A}_{\mu} + \hat{A}_{\mu}, \quad \bar{A}_{\mu} = \eta^{\nu}{}_{\mu} A_{\nu} \quad \hat{A}_{\mu} = \perp^{\nu}{}_{\mu} A_{\nu}. \quad (9)$$

Primera fluctuación de la ecuación de movimiento.

Definiendo el campo de *spin 2*

$$H_{\mu\nu} \equiv h_{\mu\nu} - \frac{1}{2}\eta_{\mu\nu}h, \tag{10}$$

la primera fluctuacón de las ecuaciones de movimiento sobre la hoja de mundo en términos de este campo la escribimos como

$$\frac{1}{2}\delta(2R^{\alpha\beta} - R\eta^{\alpha\beta}) = \frac{1}{2}\overline{C}^{\mu\nu\alpha\beta}(2\delta R_{\mu\nu} - R\delta g_{\mu\nu}) =$$
$$2\left[\widetilde{\Box}\, H^{\sigma\rho} - \widetilde{\nabla}^{(\sigma}\, \widetilde{\nabla}_{\gamma}\, H^{\rho)\gamma} - \widetilde{\nabla}_{\gamma}\, \widetilde{\nabla}^{(\sigma}\, H^{\rho)\gamma} + \eta^{\sigma\rho}\, \widetilde{\nabla}_{\alpha}\, \widetilde{\nabla}_{\beta}\, H^{\alpha\beta}\right] - RH^{\sigma\beta}. \tag{11}$$

Constricciones.

Para esta primera fluctuación existen n constricciones vectoriales dadas por

$$\widetilde{\nabla}_\alpha(RH^{\alpha\beta}) = 0, \tag{12}$$

y una constricción escalar

$$\widetilde{\nabla}_\alpha\widetilde{\nabla}_\beta(RH^{\alpha\beta}) = 0. \tag{13}$$

Entonces tenemos $n+1$ constricciones para el campo de espn 2 sobre la hoja de mundo

Constricciones.

Caso $R \neq 0$.

$$\widetilde{\Box} H^{\alpha\beta} + H^{\beta\sigma}\widetilde{\nabla}^{\alpha}\widetilde{\nabla}_{\sigma}\ln R + H^{\alpha\sigma}\widetilde{\nabla}^{\beta}\widetilde{\nabla}_{\sigma}\ln R + \widetilde{\nabla}_{\sigma}\ln R(\widetilde{\nabla}^{\alpha}H^{\beta\sigma} + \widetilde{\nabla}^{\beta}H^{\alpha\sigma}) - \eta^{\alpha\beta}(\widetilde{\nabla}^{\rho}\widetilde{\nabla}^{\sigma}\ln R - 2\widetilde{\nabla}^{\rho}\ln R\widetilde{\nabla}^{\sigma}\ln R)H_{\rho\sigma} = k\overline{T}^{\alpha\beta} \quad (14)$$

Constricciones.

Caso R=0.

$$\widetilde{\Box}\begin{pmatrix} H_{\mu\nu} \\ \overline{V}_{\mu} \\ \sigma \end{pmatrix} = \begin{pmatrix} k\overline{T}_{\mu\nu} \\ -\frac{R}{2}\overline{V}_{\mu} \\ -R \end{pmatrix} \tag{15}$$

Función de Partición

La función de particón esta dada por

$$Z = \Sigma_{g=0}^{\infty} Z_g, \tag{16}$$

donde

$$Z_g = \int \frac{\mathcal{D}H}{V(Diff(\Sigma_g))} e^{-S(H,n)}, \tag{17}$$

donde la acción

$$S = \int d\overline{\Sigma}(-\widetilde{\nabla}_\sigma H_{\alpha\beta} \widetilde{\nabla}^\sigma H^{\alpha\beta} + 2\widetilde{\nabla}^\alpha H_{\alpha\beta} \widetilde{\nabla}_\sigma H^{\sigma\beta} - \widetilde{\nabla}^\sigma H \widetilde{\nabla}^\rho H_{\rho\sigma} - kH_{\alpha\beta}\overline{T}^{\alpha\beta}). \tag{18}$$

Topologías ortogonales

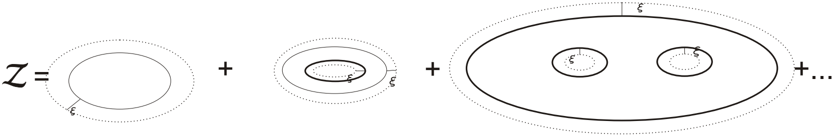

Figura: Topologias.

Derivada covariante externa.

$$\nabla_R = \lambda_R{}^{\nu} \nabla_{\nu} \tag{19}$$

$$\hat{\rho}_R{}^S{}_T = \lambda^S{}_{\nu} \nabla_R \lambda_T{}^{\nu} \tag{20}$$

$$\perp_{RS} = \lambda_R{}^{\nu} \lambda_{S\nu} \tag{21}$$

Conexiones y coeficientes de rotación.

$$\hat{\omega}_R{}^A{}_B = \iota^A{}_\nu \nabla_R \iota_B{}^\nu \tag{22}$$

$$\eta_{AB} = \iota_A{}^\nu \iota_{B\nu} \tag{23}$$

$$\hat{K}_{RS}{}^A = \iota^A{}_\nu \nabla_R \lambda_S{}^\nu = -\lambda_S{}^\nu \nabla_R \iota^A{}_\nu \tag{24}$$

$$\hat{\rho}_\lambda{}^\mu{}_\nu = \perp_\lambda{}^\rho \perp_\sigma{}^\mu \perp_\nu{}^\tau \beta_\rho{}^\sigma{}_\tau = \perp_\sigma{}^\mu \lambda^R{}_\nu \, \hat{\nabla}_\lambda \, \lambda_R{}^\sigma \tag{25}$$

Conexiones.

$$\hat{\omega}_{\lambda}{}^{\mu}{}_{\nu} = \perp_{\lambda}{}^{\rho}\eta_{\sigma}{}^{\mu}\eta_{\nu}{}^{\tau}\beta_{\rho}{}^{\sigma}{}_{\tau} = \eta_{\sigma}{}^{\mu}\iota^{A}{}_{\nu}\,\hat{\nabla}_{\lambda}\,\iota_{A}{}^{\sigma} \tag{26}$$

$$\hat{\rho}_{\lambda(\mu\nu)} = 0, \quad \eta_{\alpha}{}^{\lambda}\hat{\rho}_{\lambda\mu\nu} = \eta_{\alpha}{}^{\mu}\hat{\rho}_{\lambda\mu\nu} = 0 \tag{27}$$

$$\hat{\omega}_{\lambda(\mu\nu)} = 0, \quad \eta_{\alpha}{}^{\lambda}\hat{\omega}_{\lambda\mu\nu} = \perp_{\alpha}{}^{\mu}\hat{\omega}_{\lambda\mu\nu} = 0 \tag{28}$$

$$\hat{K}_{\lambda}{}^{\mu}{}_{\nu} = \perp_{\lambda}{}^{\rho}\perp_{\sigma}{}^{\mu}\eta_{\nu}{}^{\tau}\beta_{\rho}{}^{\sigma}{}_{\tau} = \perp_{\sigma}{}^{\mu}\iota^{A}{}_{\nu}\,\hat{\nabla}_{\lambda}\,\iota_{A}{}^{\sigma} \tag{29}$$

$$\eta_{\alpha}{}^{\lambda}\hat{K}_{\lambda\mu}{}^{\nu} = \eta_{\alpha}{}^{\mu}\hat{K}_{\lambda\mu}{}^{\nu} = \perp_{\nu}{}^{\alpha}\hat{K}_{\lambda\mu}{}^{\nu} = 0 \tag{30}$$

Cuarto tensor fundamental.

$$\hat{\nabla}_{\mu} = \perp_{\mu}{}^{\nu} \nabla_{\nu} \tag{31}$$

$$\perp_{\nu}{}^{\sigma} \hat{\nabla}_{\mu} \perp_{\sigma}{}^{\xi} \equiv \hat{K}_{\mu\nu}{}^{\xi} \tag{32}$$

$$\hat{K}_{[\mu\nu]}{}^{\xi} = 0 \tag{33}$$

$$\perp_{\xi}{}^{\alpha} \hat{K}_{\mu\nu}{}^{\xi} = \eta_{\alpha}{}^{\mu} \hat{K}_{\mu\nu}{}^{\xi} = 0 \tag{34}$$

$$\eta_{\xi}{}^{\pi} \hat{K}_{\mu\nu}{}^{\xi} = \hat{K}_{\mu\nu}{}^{\pi} \tag{35}$$

Cuarto tensor fundamental.

$$\hat{\nabla}_\mu \perp_{\nu\xi} = 2\hat{K}_{\mu[\nu\xi]} \tag{36}$$

$$\dot{\hat{u}}^\beta = \hat{u}^\alpha \nabla_\alpha \hat{u}^\beta \tag{37}$$

$$\eta_\beta{}^\gamma \dot{\hat{u}}^\beta = \hat{u}^\alpha \hat{u}^\beta \hat{K}_{\alpha\beta}{}^\gamma \tag{38}$$

$$\perp_\beta{}^\gamma \dot{\hat{u}}^\beta = \dot{\hat{u}}^\gamma - \eta_\beta{}^\gamma \dot{\hat{u}}^\beta \tag{39}$$

$$\hat{K}^\xi = \hat{K}_\mu{}^{\mu\xi} \tag{40}$$

$$\perp_\beta{}^\alpha \hat{K}^\beta = 0 \tag{41}$$

Cuarto tensor fundamental.

$$\hat{C}_{\alpha\beta}{}^{\gamma} = \hat{k}_{\alpha\beta}{}^{\gamma} - (n-p)^{-1} \perp_{\alpha\beta} \hat{K}^{\gamma} \tag{42}$$

$$\hat{K}_{\lambda\mu}{}^{\nu} \quad \rightarrow \quad \hat{K}_{\lambda\mu}{}^{\nu} + \perp_{\lambda\mu} \eta^{\nu\gamma} \nabla_{\gamma} \sigma \tag{43}$$

$$\hat{K}^{\nu} \quad \rightarrow \quad e^{2\sigma} \left(\hat{K}\nu + (n-p) \eta^{\nu\gamma} \nabla_{\gamma} \sigma \right) \tag{44}$$

$$C_{\lambda\mu}{}^{\nu} \quad \rightarrow \quad C_{\lambda\mu}{}^{\nu} \tag{45}$$

El quinto tensor fundamental y la ecuación de Codazzi.

$$\hat{\Xi}_{\kappa\lambda\mu}{}^{\nu} = \perp_{\lambda}{}^{\rho}\perp_{\mu}{}^{\sigma}\eta_{\tau}{}^{\nu}\,\hat{\nabla}_{\kappa}\,\hat{K}_{\rho\sigma}{}^{\tau} \tag{46}$$

$$\hat{\nabla}_{\kappa}\,\hat{K}_{\lambda\mu}{}^{\nu} = \hat{\Xi}_{\kappa\lambda\mu}{}^{\nu} + 2\hat{K}_{\kappa}{}^{\sigma}{}_{(\lambda}\hat{H}_{\mu)\sigma}{}^{\nu} - \hat{K}_{\kappa}{}^{\nu}{}_{\sigma}\hat{H}_{\lambda\mu}{}^{\sigma} \tag{47}$$

$$\hat{\Xi}_{\kappa[\lambda\mu]}{}^{\nu} = 0 \tag{48}$$

$$\eta_{\alpha}{}^{\kappa}\hat{\Xi}_{\kappa\lambda\mu}{}^{\nu} = \eta_{\alpha}{}^{\lambda}\hat{\Xi}_{\kappa\lambda\mu}{}^{\nu} = \perp_{\nu}{}^{\alpha}\hat{\Xi}_{\kappa\lambda\mu}{}^{\nu} = 0 \tag{49}$$

La ecuación clásica de Codazzi

$$\hat{\Xi}_{[\kappa\lambda]\mu}{}^{\nu} = \perp_{\kappa}{}^{\pi}\perp_{\lambda}{}^{\sigma}\perp_{\mu}{}^{\rho}\eta_{\gamma}{}^{\nu}B_{\pi\sigma}{}^{\gamma}{}_{\rho} \tag{50}$$

Curvatura interna ortogonal y la ecuación de Gauss.

$$\hat{R}_{RS}{}^{T}{}_{U} = 2\,\hat{\nabla}_{[R}\,\hat{\rho}_{S]}{}^{T}{}_{U} + 2\hat{\rho}_{[R}{}^{TW}\hat{\rho}_{S]WU} - 2\,\hat{\nabla}_{[R}{}^{W}{}_{S]}\,\hat{\rho}_{W}{}^{T}{}_{U} \quad (51)$$

$$\hat{R}_{\kappa\lambda}{}^{\mu}{}_{\nu} = \lambda^{R}{}_{\kappa}\lambda^{S}{}_{\lambda}\lambda^{\mu}{}_{T}\lambda^{U}{}_{\nu}\hat{R}_{RS}{}^{T}{}_{U}$$

$$\hat{R}_{\kappa\lambda}{}^{\mu}{}_{\nu} = 2\perp^{\alpha}{}_{\lambda}\lambda^{\mu}{}_{\beta}\lambda^{\gamma}{}_{\nu}\,\hat{\nabla}_{[\kappa}\,\hat{\rho}_{\alpha]}{}^{\beta}{}_{\gamma} - 2\hat{\rho}_{[\kappa}{}^{\mu\beta}\hat{\rho}_{\lambda]\beta\nu} \quad (52)$$

$$\hat{R}_{\mu\nu}{}^{\alpha\beta} = \hat{R}_{[\mu\nu]}{}^{[\alpha\beta]} = \hat{R}^{\alpha\beta}{}_{\mu\nu} \quad (53)$$

$$\hat{R}_{[\lambda\mu\nu]\sigma} = 0 \quad (54)$$

Curvatura interna ortogonal y la ecuación de Gauss.

$$\eta_{\alpha}{}^{\delta}\hat{R}_{\delta\beta\gamma\epsilon} = 0 \tag{55}$$

$$\hat{R}_{\alpha\beta} = \hat{R}_{\alpha\delta\beta}{}^{\delta}, \qquad \hat{R} = \hat{R}_{\alpha}{}^{\alpha} \tag{56}$$

$$\hat{R}_{[\alpha\beta]} = 0, \qquad \eta_{\gamma}{}^{\alpha}\hat{R}_{\alpha\beta} \tag{57}$$

Curvatura interna ortogonal y la ecuación de Gauss.

Analogo a la traza de Shouten, el tensor de Ricci ajustado

$$\tilde{\hat{R}}_{\alpha\beta} = \hat{R}_{\alpha\beta} - \frac{1}{2(n-p-1)} \hat{R} \perp_{\alpha\beta} \tag{58}$$

que satisface

$$\tilde{\hat{R}}_{[\alpha\beta]} = 0 \quad \text{y} \quad {\eta_\delta}^{\alpha} \tilde{\hat{R}}_{\alpha\beta} \tag{59}$$

cuando $p = n - 2$

$$\hat{R}_{\kappa\lambda}{}^{\mu\nu} = \hat{R} \gamma_{[\kappa}{}^{[\mu} \gamma_{\lambda]}{}^{\nu]} \tag{60}$$

entonces

$$\tilde{\hat{R}}^{\nu}_{\mu} = 0 \tag{61}$$

Curvatura interna ortogonal y la ecuación de Gauss.

Cuando $p \leq n-3$

$$\hat{R}_{\kappa\lambda}{}^{\mu\nu} = \hat{C}_{\kappa\lambda}{}^{\mu\nu} + \frac{4}{n-p-2}\gamma_{[\kappa}{}^{[\mu}\hat{R}_{\lambda]}{}^{\nu]} \quad (62)$$

$$\hat{C} = 0, \quad \eta_{\kappa}{}^{\sigma}\hat{C}_{\sigma\lambda}{}^{\mu\lambda} = 0 \quad (63)$$

$$\tilde{\hat{R}}_{\lambda\mu\nu} = \perp_{\nu}{}^{\beta}\perp_{[\mu}{}^{\alpha}\hat{\nabla}_{\lambda]}\tilde{\hat{R}}_{\alpha\beta} \quad (64)$$

Curvatura interna ortogonal y la ecuación de Gauss.

Identidad de Bianchi

$$\perp_{[\kappa}{}^{\alpha} \perp_{\lambda}{}^{\beta} \hat{\nabla}_{\mu]} \hat{R}_{\alpha\beta}{}^{\sigma\tau} = 2\hat{R}_{[\kappa\lambda}{}^{\gamma[\tau} \hat{K}_{\mu]\gamma}{}^{\sigma]} \tag{65}$$

$$\hat{R}_{\kappa\lambda}{}^{\mu\nu} = 2\hat{K}_{[\kappa}{}^{\mu\sigma} \hat{K}_{\lambda]\nu\sigma} + \perp_{\kappa}{}^{\alpha} \perp_{\lambda}{}^{\beta} \perp_{\gamma}{}^{\mu} \perp_{\nu}{}^{\delta} B_{\alpha\beta}{}^{\gamma}{}_{\delta} \tag{66}$$

Lagrangiano.

Acción de Hilbert para una *p*-brana normal

$$\hat{\chi} = \sigma_2 \int \sqrt{-\hat{\gamma}}\hat{R}\ d\hat{\Sigma} \tag{67}$$

Variación para la acción de Hilbert

$$\delta\ \hat{\chi} = \sigma_2 \int \sqrt{-\hat{\gamma}}\ \left(\frac{1}{2}\hat{R}\perp^{\mu\nu} - \hat{R}^{\mu\nu}\right)\delta g_{\mu\nu}\ d\hat{\Sigma} + \sigma_2 \int \hat{\nabla}_{\mu}\ \hat{\psi}^{\mu}\ d\hat{\Sigma} \tag{68}$$

Lagrangiano.

Variación de la métrica de fondo

$$\delta g_{\mu\nu} = \nabla_{\mu}\xi_{\nu} + \nabla_{\nu}\xi_{\mu} \tag{69}$$

suponemos en este trabajo una norma tangencial para la variación

$$\perp_{\mu}{}^{\sigma}\xi_{\sigma} = 0 \tag{70}$$

La variación de la p-brana queda

$$\begin{aligned}(\frac{1}{2}\hat{R}\perp^{\mu\nu} - \hat{R}^{\mu\nu})\delta g_{\mu\nu} &= \xi^{\nu}\ \hat{\nabla}_{\mu}(2\hat{R}^{\mu}{}_{\nu} - \hat{R}\perp^{\mu}{}_{\nu}) \\ &= (2\hat{R}^{\sigma\rho} - \hat{R}\perp^{\sigma\rho})\hat{K}_{\sigma\rho\nu}\xi^{\nu} \end{aligned} \tag{71}$$

las ecuaciones de movimiento para la p-brana normal está dada por

$$\sigma_1(2\hat{R}^{\sigma\rho} - \hat{R}\perp^{\sigma\rho})\hat{K}_{\sigma\rho\nu} = 0. \tag{72}$$

Primera flutuación de la ecuación de movimiento.

$$\frac{1}{2}\hat{C}^{\mu\nu\alpha\beta}(2\delta\hat{R}_{\mu\nu} - \hat{R}\delta g_{\mu\nu}) = \widetilde{\hat{\Box}} f^{\alpha\beta} - \widetilde{\hat{\nabla}}^{\alpha}\widetilde{\hat{\nabla}}_{\sigma} f^{\beta\sigma} - \widetilde{\hat{\nabla}}^{\beta}\widetilde{\hat{\nabla}}_{\sigma} f^{\alpha\sigma} + \widetilde{\hat{\nabla}}^{\alpha}\widetilde{\hat{\nabla}}^{\beta} f - \perp^{\alpha\beta}(\widetilde{\hat{\Box}} f - \widetilde{\hat{\nabla}}^{\rho}\widetilde{\hat{\nabla}}^{\sigma} f_{\rho\sigma}) \quad (73)$$

$$\widetilde{\hat{\nabla}}_{\mu} A_{\alpha\beta} \equiv \hat{\nabla}_{\mu} A_{\alpha\beta} - \hat{K}_{\mu}{}^{\rho}{}_{\alpha} A_{\rho\beta} - \hat{K}_{\mu}{}^{\rho}{}_{\beta} A_{\alpha\rho} \quad (74)$$

Primera fluctuación de la ecuación de movimiento.

$$F_{\mu\nu} \equiv f_{\mu\nu} - \frac{1}{2}\perp_{\mu\nu} f \tag{75}$$

$$\frac{1}{2}\delta(2\hat{R}^{\alpha\beta} - \hat{R}\perp^{\alpha\beta}) = \frac{1}{2}\hat{C}^{\mu\nu\alpha\beta}(2\delta\hat{R}_{\mu\nu} - \hat{R}\delta g_{\mu\nu}) = \widetilde{\hat{\Box}} F^{\alpha\beta} - \widetilde{\hat{\nabla}}^{\alpha}\widetilde{\hat{\nabla}}_{\sigma} F^{\beta\sigma} - \widetilde{\hat{\nabla}}^{\beta}\widetilde{\hat{\nabla}}_{\sigma} F^{\alpha\sigma} + \perp^{\alpha\beta}\widetilde{\hat{\nabla}}^{\rho}\widetilde{\hat{\nabla}}^{\sigma} F_{\rho\sigma} \tag{76}$$

Constricciones.

$$\widetilde{\hat{\nabla}}_{\alpha}(\hat{R}F^{\alpha\beta}) = 0 \tag{77}$$

$$\widetilde{\hat{\nabla}}_{\alpha}\widetilde{\hat{\nabla}}_{\beta}(\hat{R}F^{\alpha\beta}) = 0 \tag{78}$$

Constricciones.

Caso $\hat{R} \neq 0$.

$$\widetilde{\hat{\Box}} F^{\alpha\beta} + F^{\beta\sigma} \widetilde{\hat{\nabla}}^{\alpha} \widetilde{\hat{\nabla}}_{\sigma} \ln \hat{R} + F^{\alpha\sigma} \widetilde{\hat{\nabla}}^{\beta} \widetilde{\hat{\nabla}}_{\sigma} \ln \hat{R} \\ + \widetilde{\hat{\nabla}}_{\sigma} \ln \hat{R} (\widetilde{\hat{\nabla}}^{\alpha} F^{\beta\sigma} + \widetilde{\hat{\nabla}}^{\beta} F^{\alpha\sigma}) \\ - \perp^{\alpha\beta} (\widetilde{\hat{\nabla}}^{\rho} \widetilde{\hat{\nabla}}^{\sigma} \ln \hat{R} - 2 \widetilde{\hat{\nabla}}^{\rho} \ln \hat{R} \widetilde{\nabla}^{\sigma} \ln \hat{R}) F_{\rho\sigma} = k \hat{T}^{\alpha\beta} \tag{79}$$

Constricciones.

Caso R=0.

$$\widetilde{\hat{\Box}} \begin{pmatrix} F_{\mu\nu} \\ \hat{V}_{\mu} \\ \sigma \end{pmatrix} = \begin{pmatrix} k\,\hat{T}_{\mu\nu} \\ -\frac{\hat{R}}{2}\hat{V}_{\mu} \\ -\hat{R} \end{pmatrix} \tag{80}$$

Topologías tangenciales

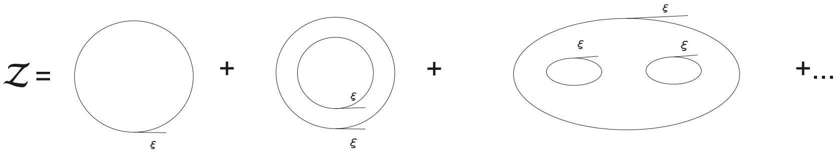

Figura: Topologias.

Topologías generales

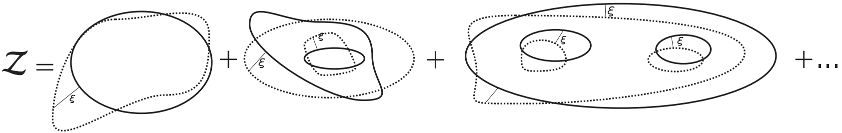

Figura: Topologias.

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