$$
\begin{aligned}
\frac{d\,[\mathrm{betaGamma}]}{dt} &= -(\mathrm{k_{alphaGDPbetaGammabinding}} \times [\mathrm{alpha_GDP}] \times [\mathrm{betaGamma}]) + \mathrm{k_{alphaFGTPgSbetaGammaunbinding}} \times [\mathrm{alphaF_GTP} \\
\frac{d\,[\mathrm{GDP}]}{dt} &= \mathrm{k_{alphaGDPunbinding}} \times [\mathrm{alpha_GDP}] + \mathrm{k_{exchange}} \times [\mathrm{R_alpha_GDP_betaGamma}] \times [\mathrm{GTPgS}] \\
[\mathrm{total_alpha}] &= [\mathrm{alpha}] + [\mathrm{alpha_GDP}] + [\mathrm{alpha_GDP_betaGamma}] + [\mathrm{R_alpha_GDP_betaGamma}] + [\mathrm{R_alphaF_GTPgS_betaGam} \\
\frac{d\,[\mathrm{GTPgS}]}{dt} &= -(\mathrm{k_{alphaGTPgSbinding}} \times [\mathrm{alpha}] \times [\mathrm{GTPgS}]) - \mathrm{k_{exchange}} \times [\mathrm{R_alpha_GDP_betaGamma}] \times [\mathrm{GTPgS}] \\
[\mathrm{fluorescent}] &= [\mathrm{R_alphaF_GTPgS_betaGamma}] + [\mathrm{alphaF_GTPgS}] + [\mathrm{alphaF_GTPgS_betaGamma}] \\
\frac{d\,[\mathrm{R_alpha_GDP_betaGamma}]}{dt} &= \mathrm{k_{RalphaGDPbetaGammabinding}} R\,[\mathrm{alpha_GDP_betaGamma}] - \mathrm{k_{exchange}} \times [\mathrm{R_alpha_GDP_betaGamma}] \times [\mathrm{GTPgS}] \\
\frac{d\,[\mathrm{alpha_GDP_betaGamma}]}{dt} &= \mathrm{k_{alphaGDPbetaGammabinding}} \times [\mathrm{alpha_GDP}] \times [\mathrm{betaGamma}] - \mathrm{k_{RalphaGDPbetaGammabinding}} R\,[\mathrm{alpha_GDP_betaGam} \\
\frac{d\,[\mathrm{R}]}{dt} &= -(\mathrm{k_{RalphaGDPbetaGammabinding}} R\,[\mathrm{alpha_GDP_betaGamma}]) + \mathrm{k_{RalphaFGTPgSbetaGammaunbinding}} \times [\mathrm{R_alphaF_GTPg} \\
\frac{d\,[\mathrm{alphaF_GTPgS_betaGamma}]}{dt} &= \mathrm{k_{RalphaFGTPgSbetaGammaunbinding}} \times [\mathrm{R_alphaF_GTPgS_betaGamma}] - \mathrm{k_{alphaFGTPgSbetaGammaunbinding}} \times [\mathrm{alphaF_G} \\
\frac{d\,[\mathrm{R_alphaF_GTPgS_betaGamma}]}{dt} &= \mathrm{k_{exchange}} \times [\mathrm{R_alpha_GDP_betaGamma}] \times [\mathrm{GTPgS}] - \mathrm{k_{RalphaFGTPgSbetaGammaunbinding}} \times [\mathrm{R_alphaF_GTPgS_betaG} \\
\frac{d\,[\mathrm{alpha}]}{dt} &= \mathrm{k_{alphaGDPunbinding}} \times [\mathrm{alpha_GDP}] - \mathrm{k_{alphaGTPgSbinding}} \times [\mathrm{alpha}] \times [\mathrm{GTPgS}] - \mathrm{kd_{alpha}} \times [\mathrm{alpha}] \\
\frac{d\,[\mathrm{alphaF_GTPgS}]}{dt} &= \mathrm{k_{alphaGTPgSbinding}} \times [\mathrm{alpha}] \times [\mathrm{GTPgS}] + \mathrm{k_{alphaFGTPgSbetaGammaunbinding}} \times [\mathrm{alphaF_GTPgS_betaGamma}] \\
\frac{d\,[\mathrm{alpha_GDP}]}{dt} &= -(\mathrm{k_{alphaGDPunbinding}} \times [\mathrm{alpha_GDP}]) - \mathrm{k_{alphaGDPbetaGammabinding}} \times [\mathrm{alpha_GDP}] \times [\mathrm{betaGamma}]
\end{aligned}
$$