Donagi

$$\mathrm{F}: \quad 3 \pm 4^0_{\mathbb{C}}$$

ell fibred

$$\mathrm{F}: \quad 3 \pm 3_{\mathbb{C}}\, 1^0_{\mathbb{C}} = \mathrm{IIB}: \quad 3 \pm 3_{\mathbb{C}}$$

IIB graviton=closed string in $3_{\mathbb{C}}$

$$1^0_{\mathbb{C}} \subset 4^0_{\mathbb{C}} \xrightarrow[\text{ell}]{\pi} 3_{\mathbb{C}}$$

$$[3_{\mathbb{C}}] = K_{3_{\mathbb{C}}}$$

$$4^0_{\mathbb{C}} = \frac{(x{:}y{:}z) \in [3_{\mathbb{C}}]^{-2} \times [3_{\mathbb{C}}]^{-3} \times 3_{\mathbb{C}}}{y^2 = x^3 + 3 f_z x + 2 g_z}$$

$$f_z \in [3_{\mathbb{C}}]^{-4}$$

$$g_z \in [3_{\mathbb{C}}]^{-6}$$

$$\tau_z = i\, \mathfrak{e}^{-\not{O}_{\mathbb{R}}} + \not{O}_{\mathbb{I}}$$

$$\frac{j(\tau_z)}{(24)^3} = \frac{f_z^3}{f_z^3 + g_z^2}$$

$$H_2^{\mathbb{Z}}\left(1^0_{\mathbb{C}}\right) = \mathbb{Z} < \alpha_z : \beta_z > \ni p\,\alpha_z + q\,\beta_z$$

abelian gauge boson=open string ending on same 7brane $2^a_{\mathbb{C}}$

$$2_{\mathbb{C}} = \frac{z \in 3_{\mathbb{C}}}{f_z^3 + g_z^2 = 0} = \frac{z \in 3_{\mathbb{C}}}{\text{pinched p-q cycle } p\alpha_z + q\beta_z}$$

(p q) dyonic $D7$: $\quad 3 \pm 2_{\mathbb{C}}$

$$\text{1 moduli} \begin{cases} H^{1:1}\left(4^0_{\mathbb{C}}\right) \boxminus H^{1:1}\left(3_{\mathbb{C}}\right) \times \mathbb{Z} 1^0_{\mathbb{C}} & \text{IIB 7branes/RR 2forms} \\ H^{2:1}\left(3_{\mathbb{C}}\right) & \text{IIB RR 4-pot} \end{cases}$$

$$\text{0 moduli} \begin{cases} H^{2:1}\left(4^0_{\mathbb{C}}\right) \boxminus H^{2:1}\left(3_{\mathbb{C}}\right) \times \mathbb{Z} 1^0_{\mathbb{C}} & \text{Wilson lines IIB 7branes/RR 2form periods} \\ H^{1:1}\left(3_{\mathbb{C}}\right) & \text{Kahler defo } 3_{\mathbb{C}} \\ H^{3:1}\left(4^0_{\mathbb{C}}\right) & \text{7brane defo + complex defo } 3_{\mathbb{C}} \end{cases}$$

non-abelian gauge boson=open string ending on different 7branes $2^a_{\mathbb{C}} \cap 2^b_{\mathbb{C}} = 1^{ab}_{\mathbb{C}}$