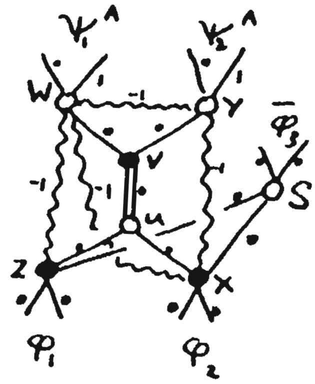
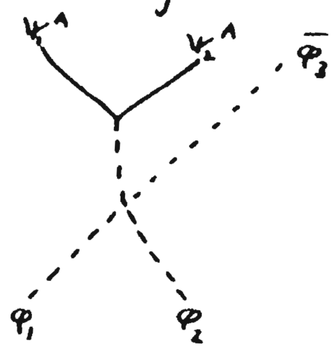
Some Yukawa Interaction Diagrams

In $\mathbb{T}\mathbb{N}$ 29 A.P.H was led to consider the twistor diagram



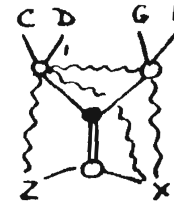
as the translation of the Feynman diagram

$\longleftrightarrow$



To integrate the top part of this diagram explicitly one uses a boundary contour for both Y and W separately (see R.P. in A.T.T.) After an integration by parts, the $\underset{\vee}{u}$-pole can be surrounded by an S^2-contour giving, for elementary states:

$F(\overset{1}{z}, \overset{1}{x}) =$

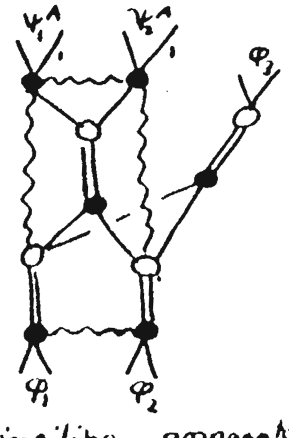


$$= \int_0^\infty \frac{\overline{ZX}\rho(\overline{CG}\,\overline{GHZX} + \overline{GCZX}\,\overline{GH}\rho)\,d\rho}{\overline{GHZX}\left(\overline{CD}\,\overline{GHZX} + \overline{CD}\underset{Z\quad X}{\sqcup\!\sqcup}\overline{GH}\rho + \overline{CDZX}\,\overline{GH}\rho^2\right)^2}$$

$F(\overset{1}{z},\overset{1}{x})$ is a function of the field points $\overset{\leftrightarrow}{GH}$, $\overset{\leftrightarrow}{CD}$ and $\overset{\leftrightarrow}{ZX}$ only. It is exactly $\Box^{-1}(\psi_{1A}(x)\,\psi_2{}^A(x))$ in space-time.

Now one completes the S-integral, leaving a spinor integral in $\overset{\leftrightarrow}{ZX}$.

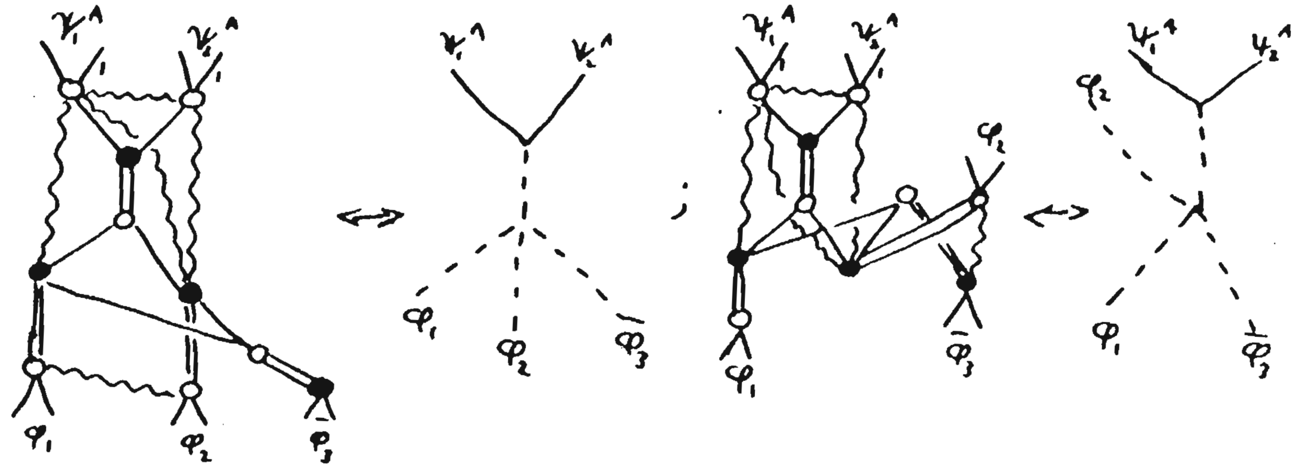
One can recast this into the form



which fits in better with the skeleton diagram structure of $\mathbb{T}\mathbb{N}$ 29.

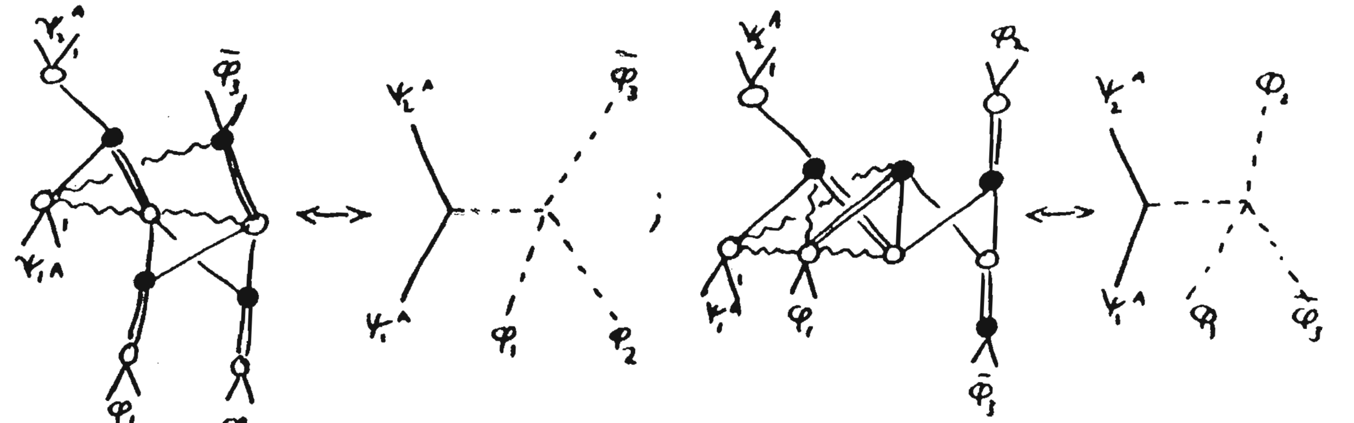
The other channels for the time-like propagator can now be written down with reference to the channels of the single box. Here one has to take seriously the identification of φ and $\bar{\varphi}$ with dual twistor functions, and twistor functions.

Thus one finds



These three channels have all been calculated explicitly, and agree with the Feynman diagrams.

The channels with a space-like propagator of this Feynman diagram are harder to check explicitly. The main difficulty being that the space-like propagator, with the two spinors, has less coincidences available, and thus is harder to integrate. Nevertheless the correspondences



have been written down by A.P.H. These satisfy the right differential properties, and are interpretable as scattering amplitudes. Work is proceeding on verifying these correspondences through calculation.

All these twistor diagram representations of the Feynman diagrams fit into the skeleton diagram picture (A.P.H in TMP). Thus the twistor diagrams are crossing symmetric in the same sense as the Feynman diagrams. Only the choice of boundary lines - and hence the region of integration - differs between the channels.

L.O'D.

A.P.H.