Discussion regarding Lauren William's Amplituhedron day talk

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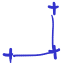
Combinatorial forms of positroids.

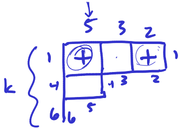
coloops

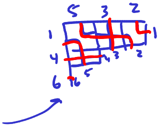
decorated permutations $2\ 5\ \underline{3}\ \overline{4}\ 1\ \overline{6}$

loop

J diagram







pipe dream

Grassmann necklace

$$I_{i+1} = \begin{cases} (I_i \setminus \{i\}) \cup \{j\} & i \in I_i \\ I_i & i \notin I_i \end{cases}$$

$I_1 = 146$
$I_2 = 246$
$I_3 = 456$
$I_4 = 456$
$I_5 = 146$
$I_6 = 145$

More combinatorial forms of positroids.

positroid as a matroid defn by bases

I_i are bases

more

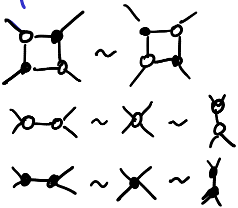
k-sets T st $\forall i$

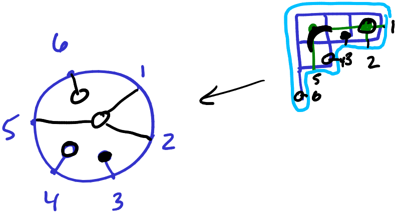
$$I_i \leq_i T$$

$i<i+1<\dots<n<1<\dots<i-1$

plabic graph

up to





$$\begin{array}{c|cccccc} & 1 & 2 & 3 & 4 & 5 & 6 \\ \hline 1 & 1 & a_1 & 0 & 0 & -a_1 a_2 & 0 \\ 4 & 0 & 0 & 0 & 1 & 0 & 0 \\ 6 & 0 & 0 & 0 & 0 & 0 & 1 \end{array}$$

Where does T-duality come from?

- Duality is in the sense of an equivalence of theories (string theories or QFTs esp. conformal field theories).
- Prototypically ~~it~~ T-duality inverts the radius (of space-time, or of the torus fibres of a bundle whose total space is space-time, . . .).
- In any case it is a transformation of the underlying space (and associated data) that give the same physics.
- People most often say T stands for *target space* (see point 3), alternately *torus* (see point 2) and others.
- It is important in string theory because in the 90s people realized certain string theories were related by T-duality.
- Precise versions are studied as pure differential geometry, etc.
- From the path integral, rewrite to integrate over auxiliary fields, then integrate the other way.

T-duality and the amplituhedron.

Williams and collaborators defined a combinatorial T-duality and proved many interesting properties of it, as we've just heard about. Why is this T-duality?

- In the Grassmannian context, T-duality maps between twistors and momentum twistors.
- One manifestation is the amplitude/Wilson loop duality.
- It maps between BCFW cells, $4k$-dimensional cells of $\mathrm{Gr}^+_{k,n}$, conjecturally triangulating the amplituhedron $\mathcal{A}_{n,k,4}$ and $2n-4$-dimensional cells of $\mathrm{Gr}^+_{k+2,n}$ conjecturally triangulating the momentum amplituhedron $\mathcal{M}_{n,k,4}$.
- Moving from 4 to 2, $\mathcal{M}_{n,k,2}$ is a kind of dual of $\Delta_{k+1,n}$.
- The combinatorial T duality is the corresponding map of cells. (Need an extra shift $\sigma(\hat{\pi}(i)) = \pi(i-1) - 1$ to make the 4 case line up exactly).