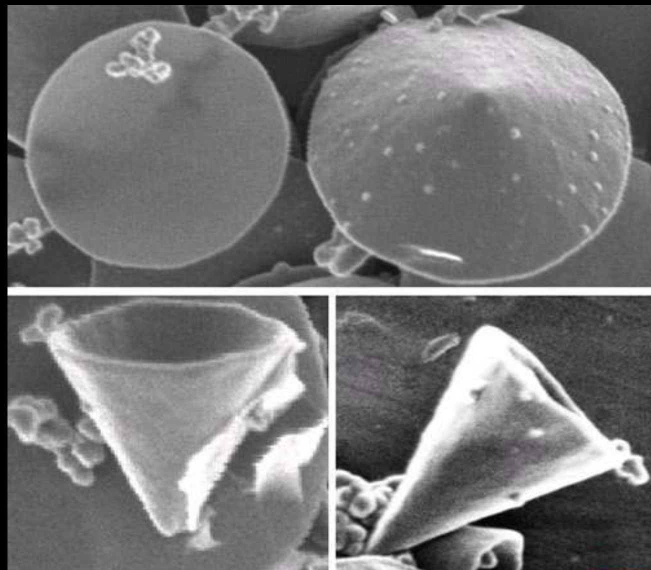

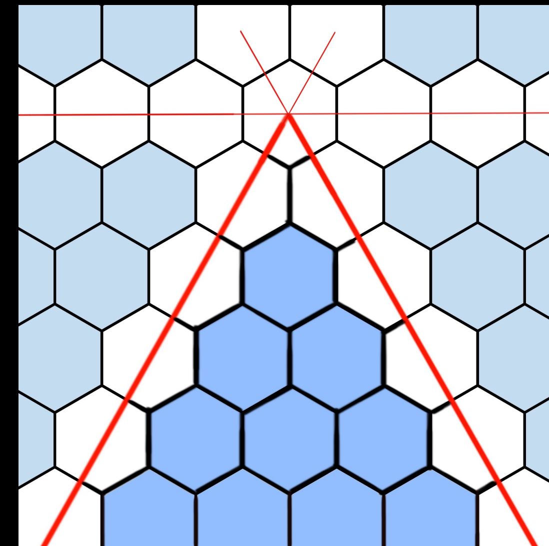

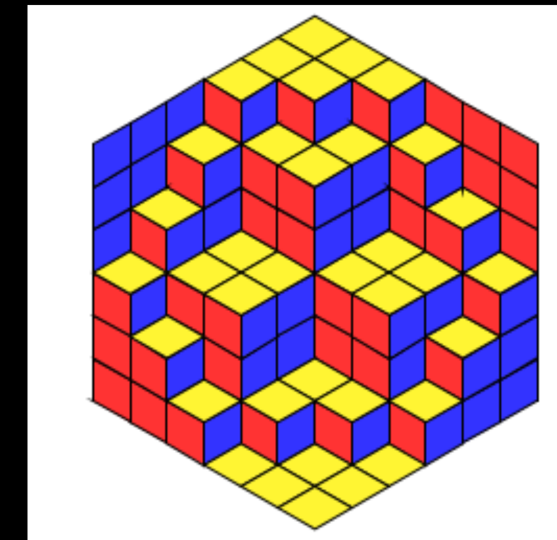

Graphene nanocones and Pascal matrices

A surprising connection with famous models in combinatorics (plane partitions, lozenge tilings, dense loops on cylinder)

$$\det H_n(e^{-i\theta}, e^{i\theta}) = e^{-i(n+1)\theta} \det(Q_n + e^{2i\theta})$$

$$H_2 = \left[\begin{array}{c|ccc|ccccc}
x+y & 0 & 1 & & & & & & \\
\hline
0 & 0 & 1 & y & 0 & 1 & & & \\
1 & 1 & 0 & 1 & 0 & & 0 & & \\
 & x & 1 & 0 & 0 & & & 1 & \\
\hline
 & 0 & 0 & 0 & 0 & 1 & & & y \\
 & 1 & & & 1 & 0 & 1 & & \\
 & & 0 & & & 1 & 0 & 1 & \\
 & & & 1 & & & 1 & 0 & 1 \\
 & & & & x & & & 1 & 0
\end{array}\right]$$

Adjacency matrix of a nanocone (size n^2)

DETERMINANT?

$$Q_5 = \left[\begin{array}{ccc|cc}
1 & 1 & 1 & 1 & 1 \\
1 & 2 & 3 & 4 & 5 \\
1 & 3 & 6 & 10 & 15 \\
\hline
1 & 4 & 10 & 20 & 35 \\
1 & 5 & 15 & 35 & 70
\end{array}\right]$$

Pascal Matrix (size n)

n	$\theta = 0$	$\pi/6$	$\pi/3$	$\pi/2$	$\pi/4$
2	20	$3^2\sqrt{3}$	7	0	$8\sqrt{2}$
3	132	10^2	42	2^4	70
4	1452	$25^2\sqrt{3}$	429	0	$526\sqrt{2}$
5	26741	140^2	7436	7^4	13167
6	826540	$588^2\sqrt{3}$	218348	0	$280772\sqrt{2}$

L.G. Molinari, arXiv:2206.14428