

The background features three thick, wavy lines in red, blue, and green, flowing from the top left towards the bottom right. The lines are layered, with the red line on top, the blue line in the middle, and the green line on the bottom. They have a slight white outline, making them stand out against the white background.

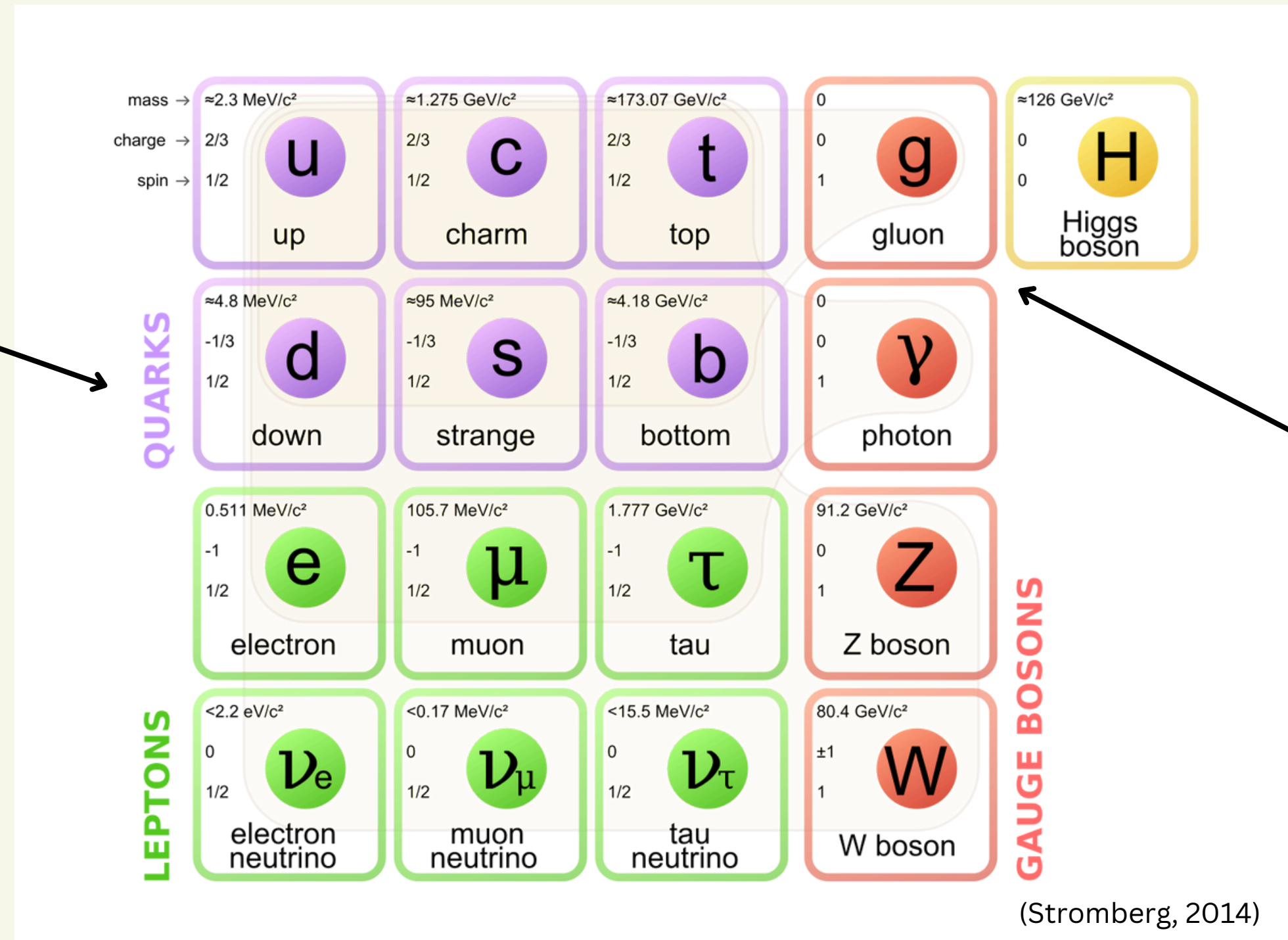
# Applying Group Theory to Hadronisation

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Supervisor: Peter Skands

# Colour Carrying Particles

Quarks carry a colour charge of 1.



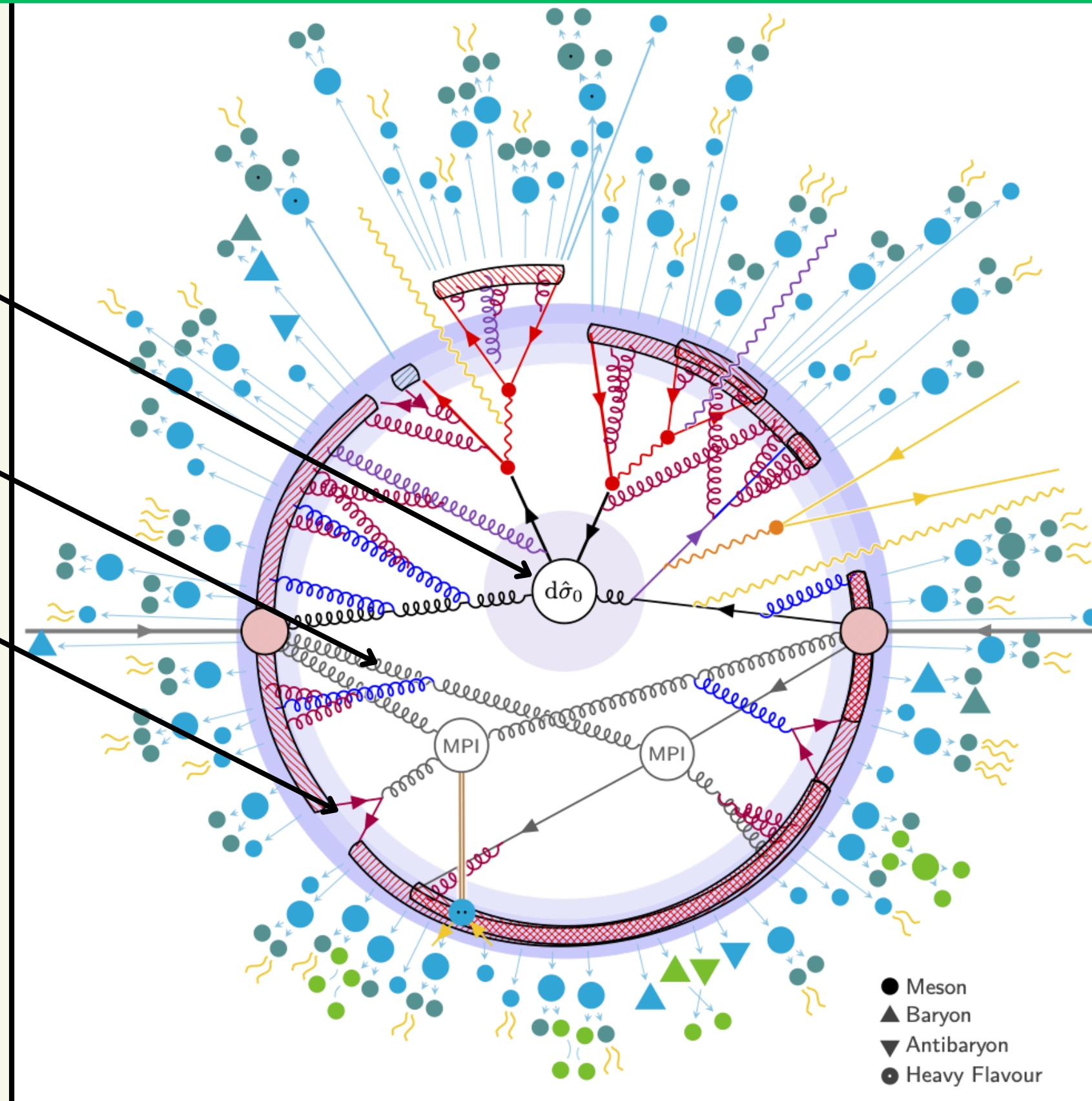
Gluons carry one colour and one anti-colour charge.

# Hadronisation

Particles colliding

Parton Shower

Colour Singlet formation



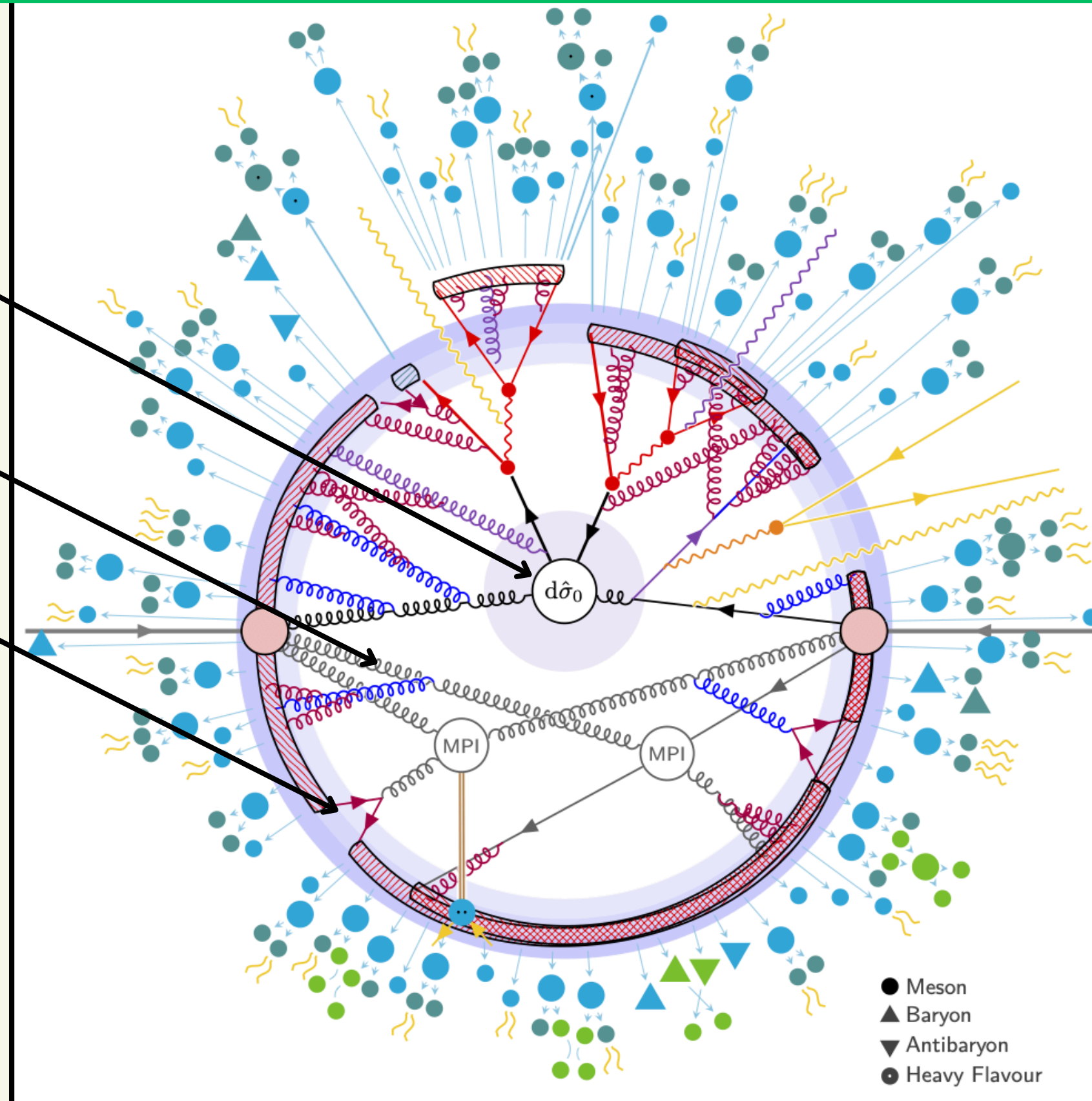
(Skands, 2022)

# Hadronisation

Particles colliding

Parton Shower

Colour Singlet formation



We need to model this!!

(Skands, 2022)

# Code

## Leading Colour:

Does not account for multicolour screening effects.

Equivalent to using an infinite amount of colours.

Does not accurately reflect SU(3)

## Colour Reconnection:

Randomly assigns additional colour information

Aims to stochastically approximate the exact values

“Simplified SU(3)”

# My Project

Interactions between colour fields.

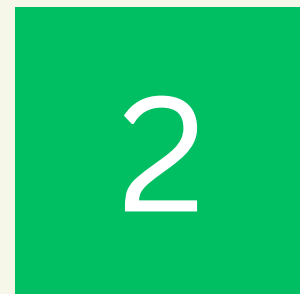
How well does the **Colour Reconnection**  
code model **SU(3)**?

Group that describes colour algebra.

# Yong Tableaux

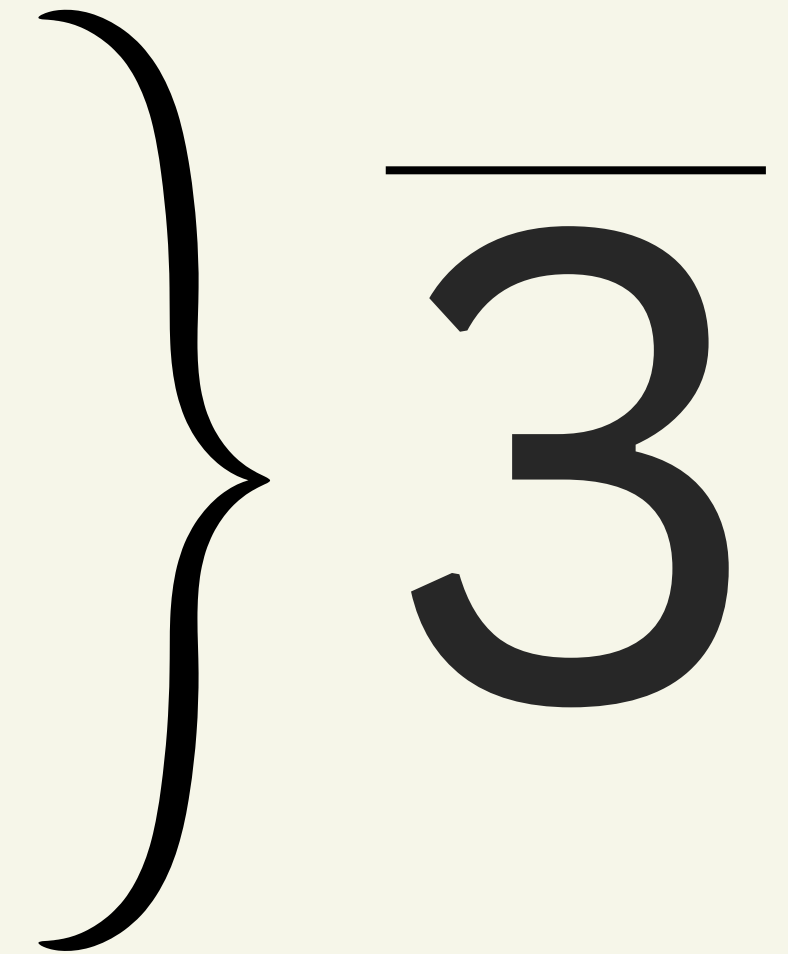
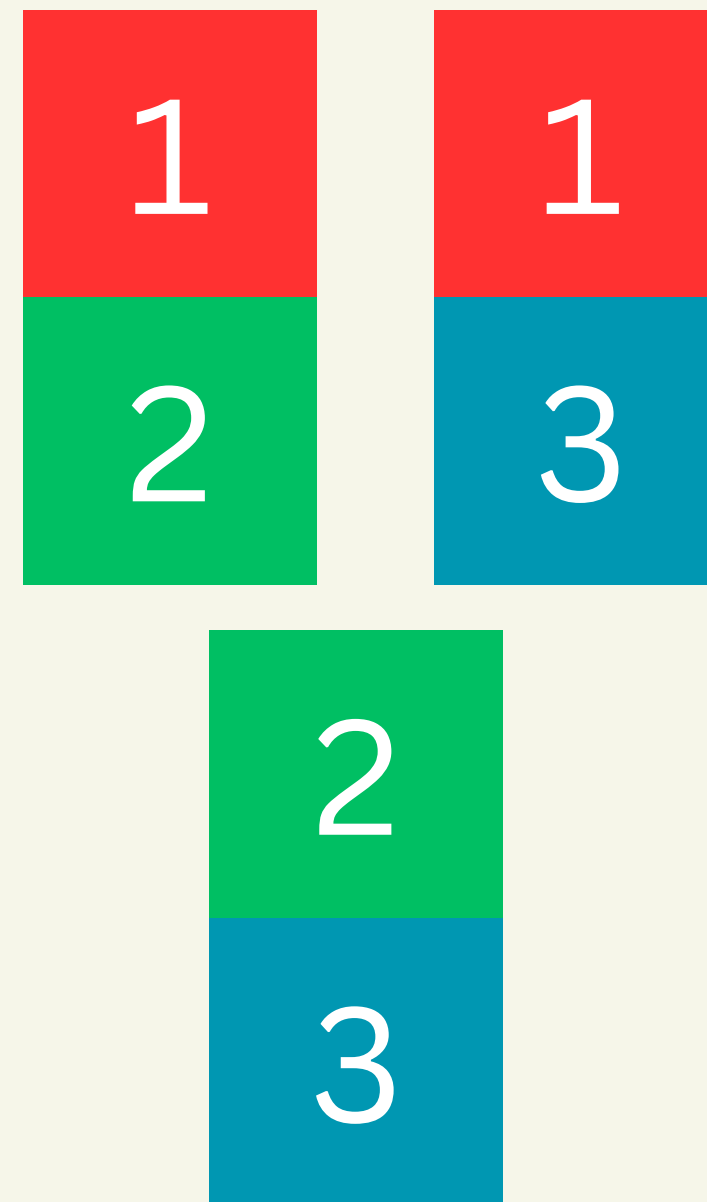
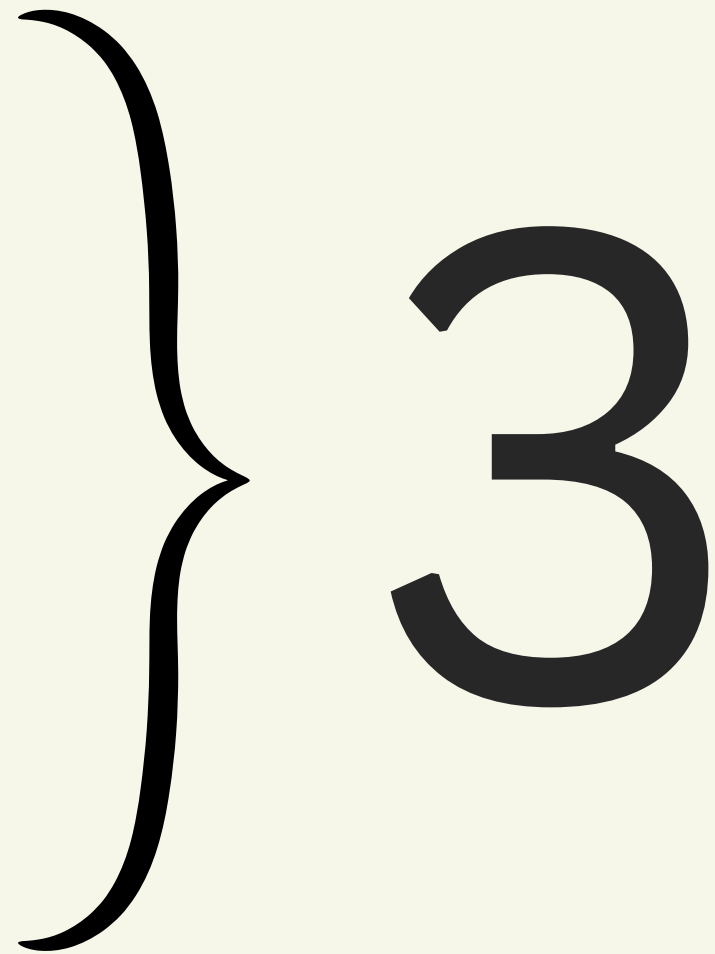
Mathematical system that determine the products of particle interactions, by representing colour as squares.

Numbers are used to distinguish the different colours.



# Naming Structures

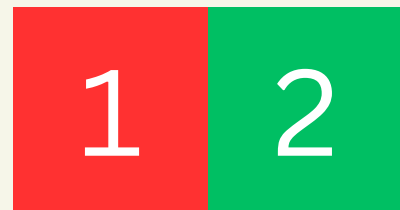
Based on the number of linearly independent arrangements.





# Naming Structures

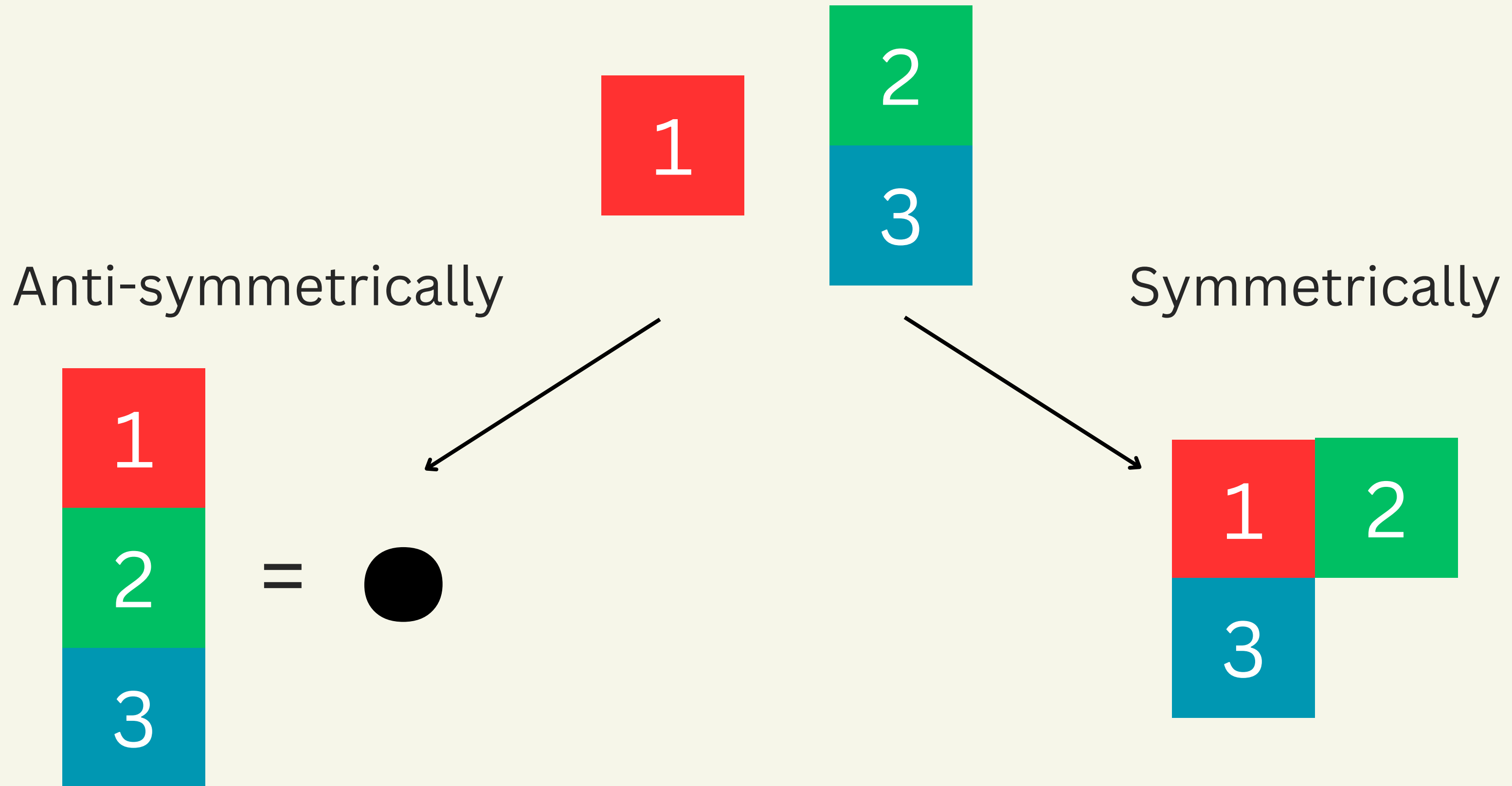
6 (Sextet)



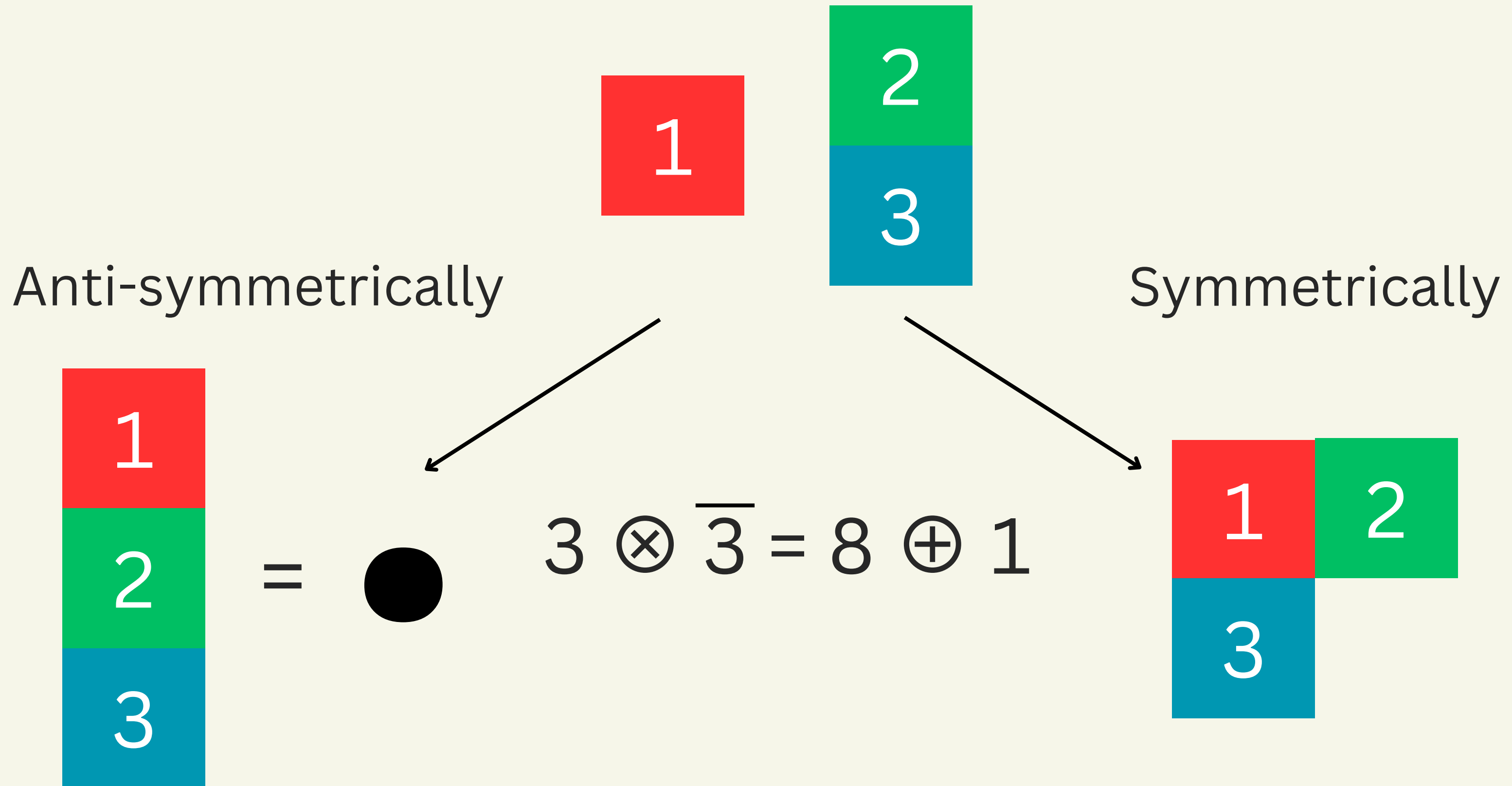
8 (Octet)



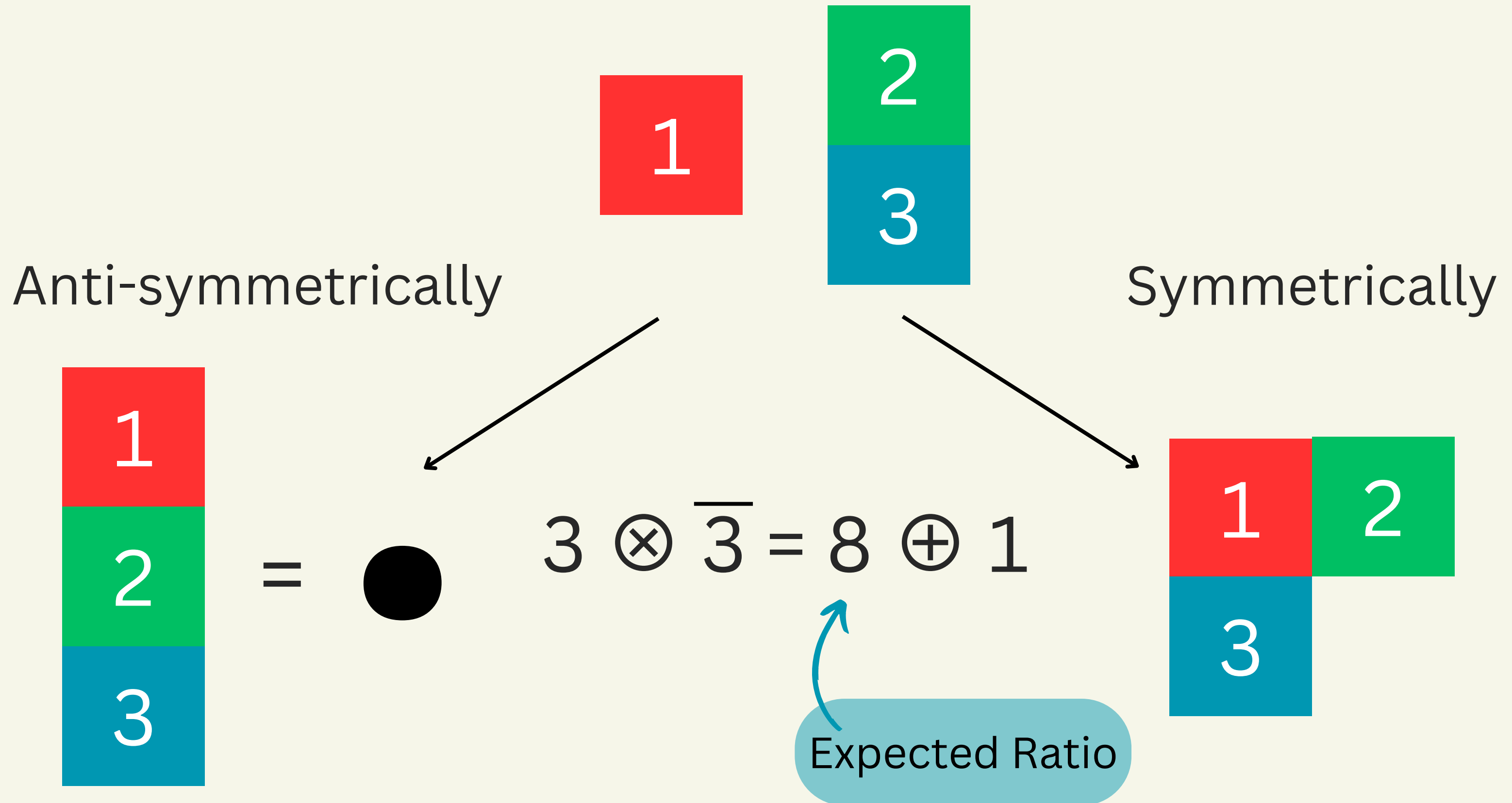
# Combining Structures



# Combining Structures

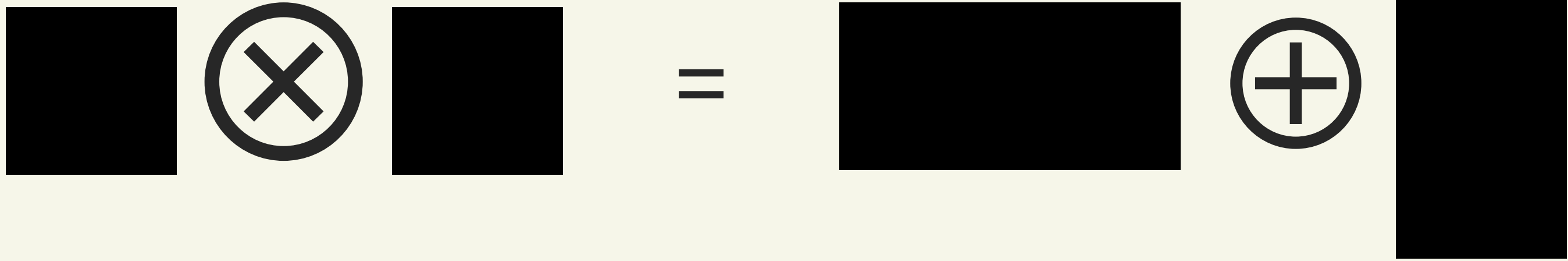


# Combining Structures

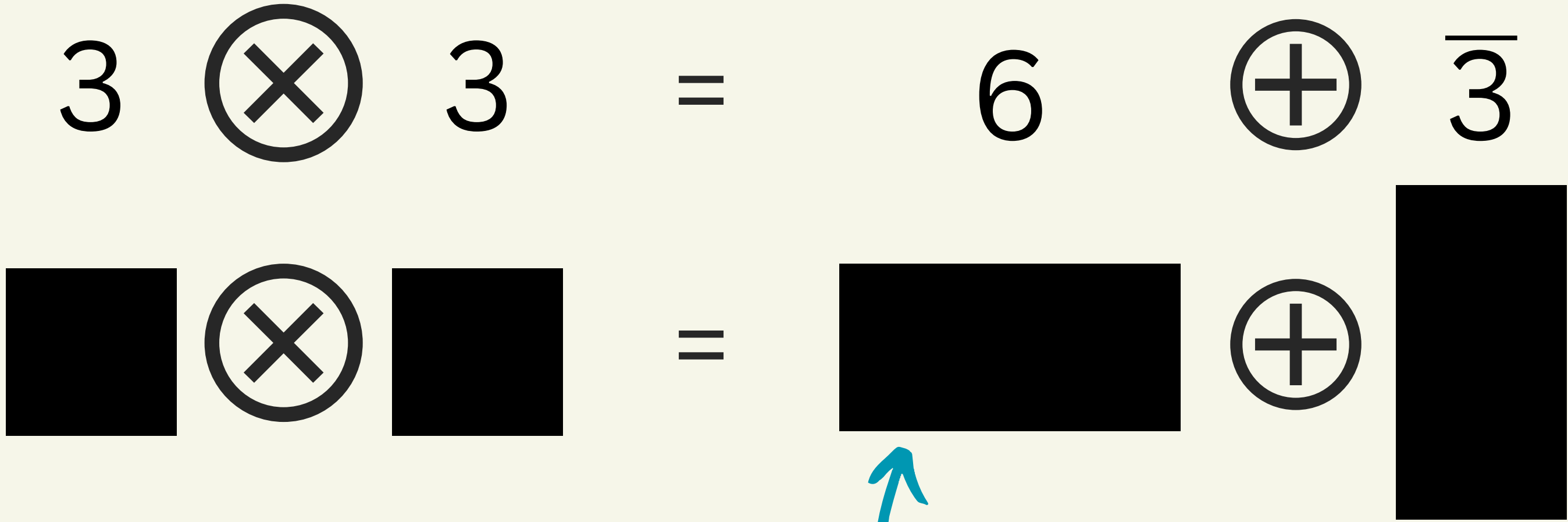


# Need for a Stochastic Model

$$3 \otimes 3 = 6 \oplus \bar{3}$$



# Need for a Stochastic Model



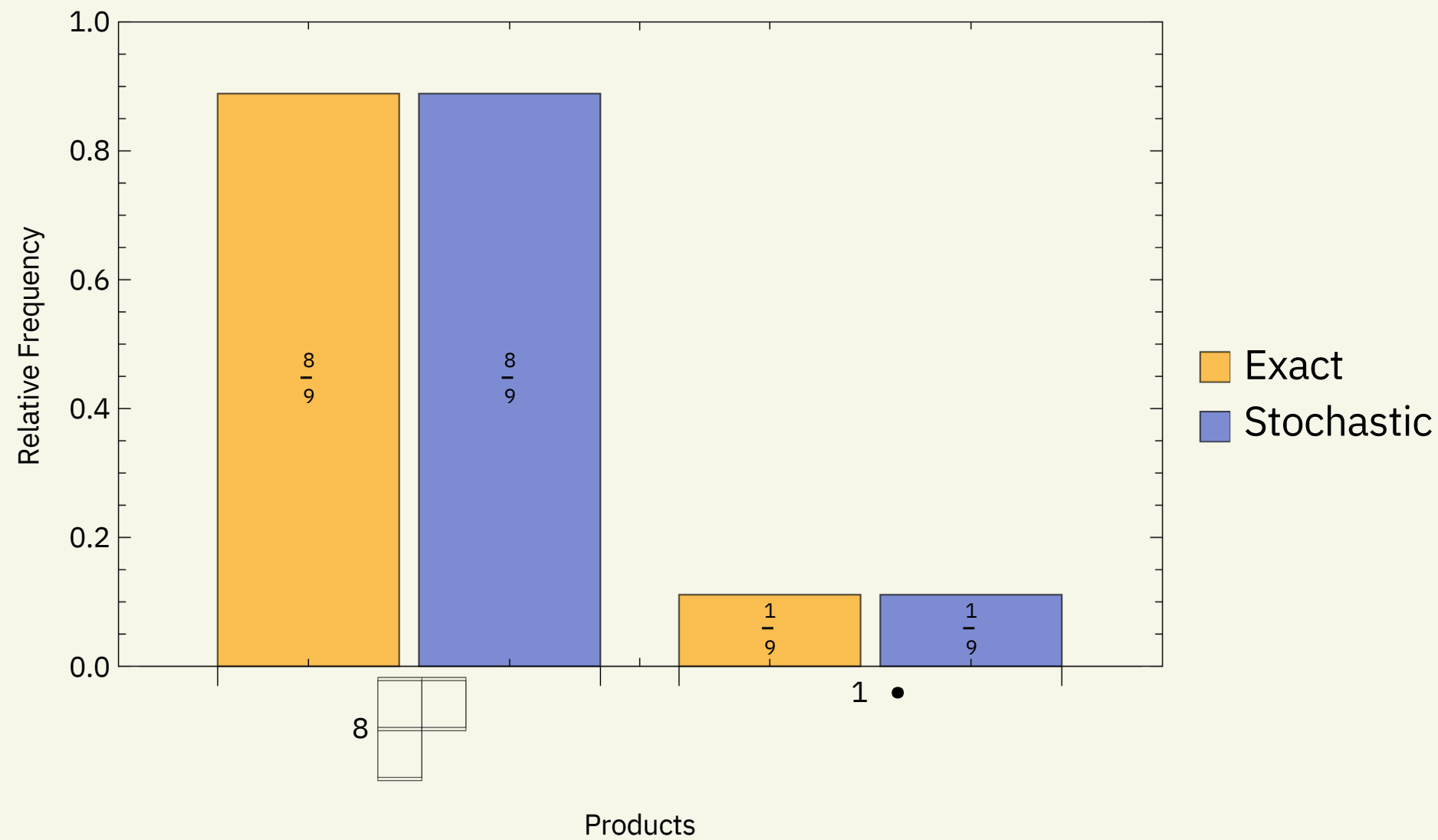
We don't know which product we get!

# Results

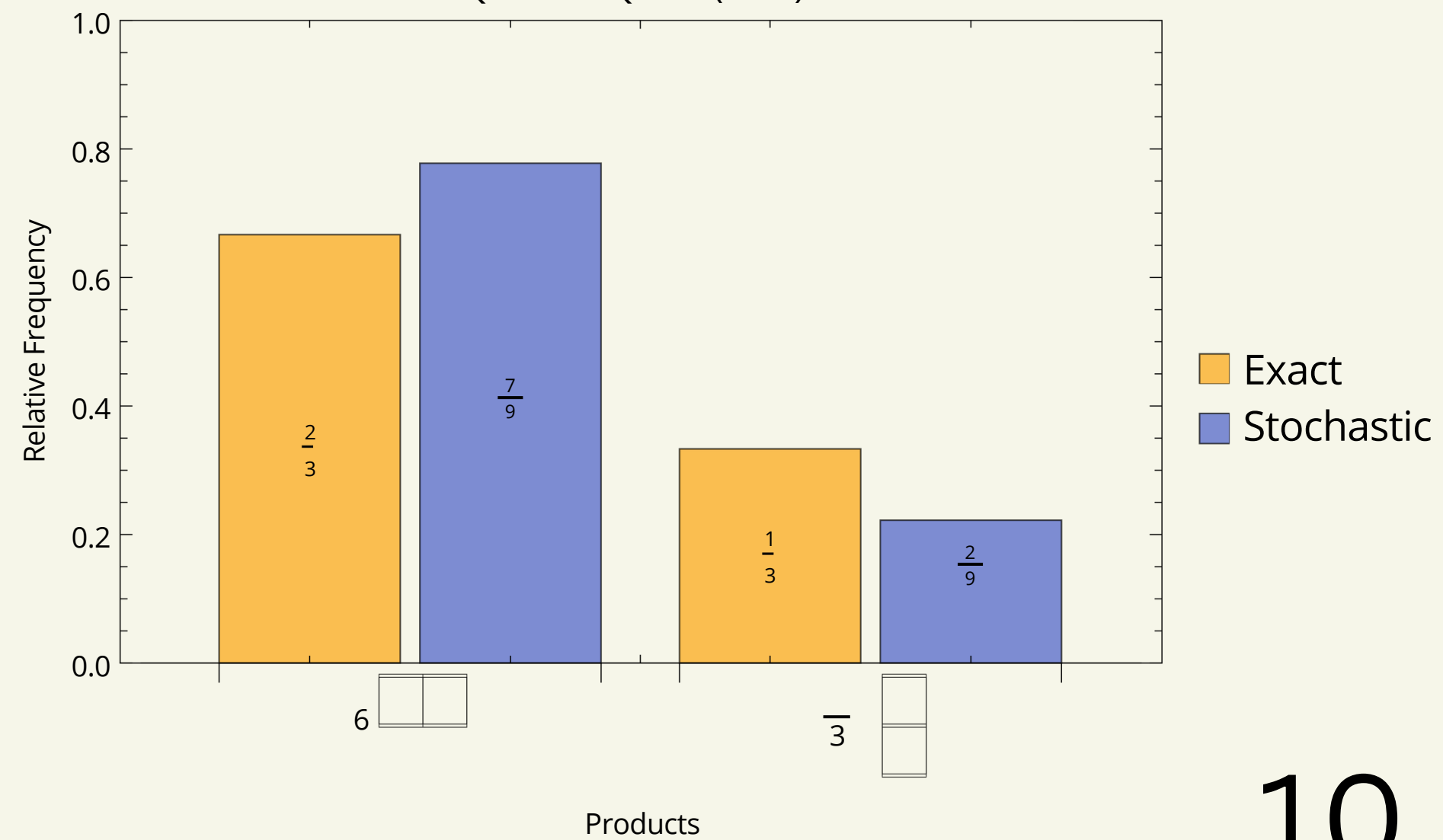
$$3 \otimes \bar{3} = 8 \oplus 1$$

$$3 \otimes 3 = 6 \oplus \bar{3}$$

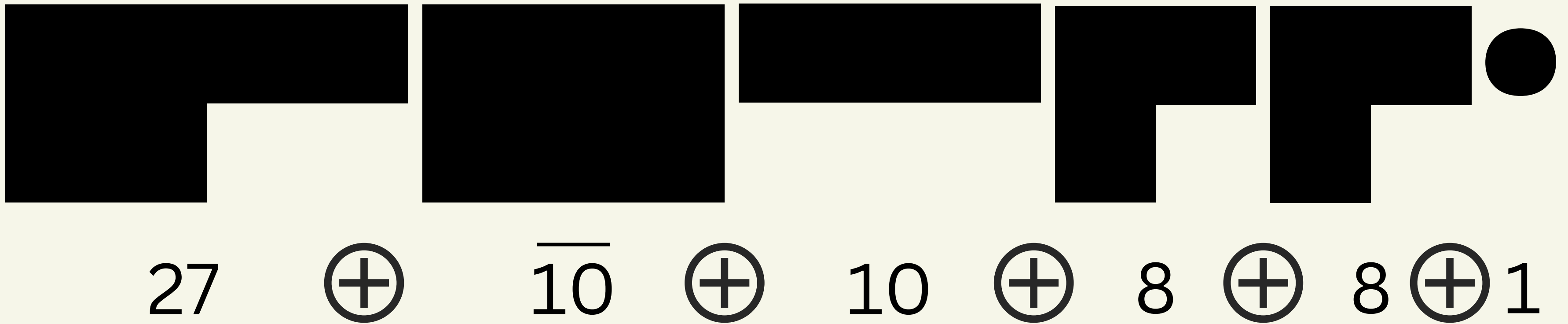
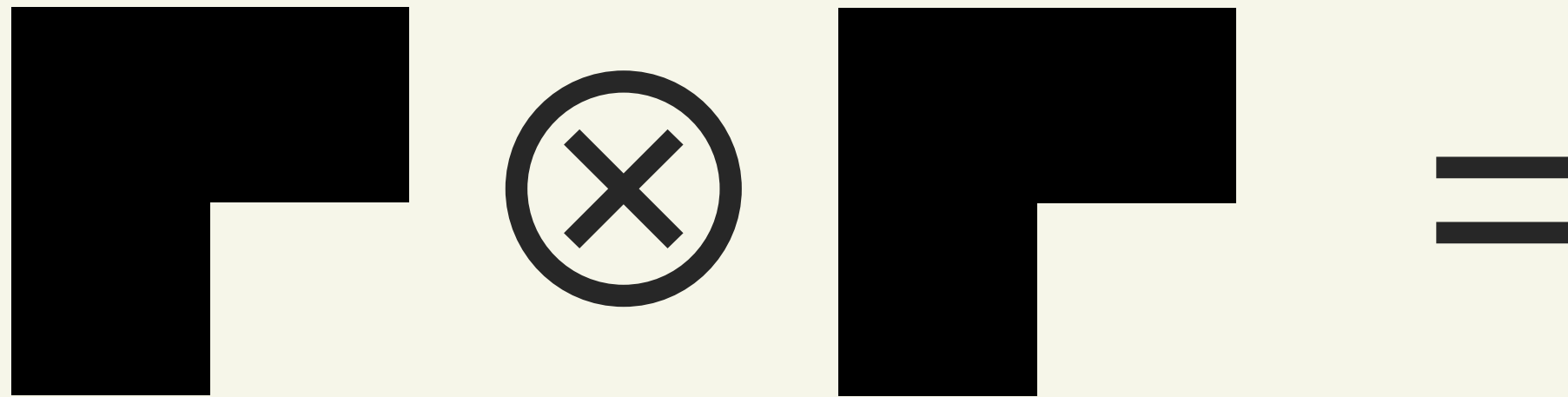
Quark  $\otimes$  Anti-Quark ( $3 \otimes \bar{3}$ )



Quark  $\otimes$  Quark ( $3 \otimes 3$ )



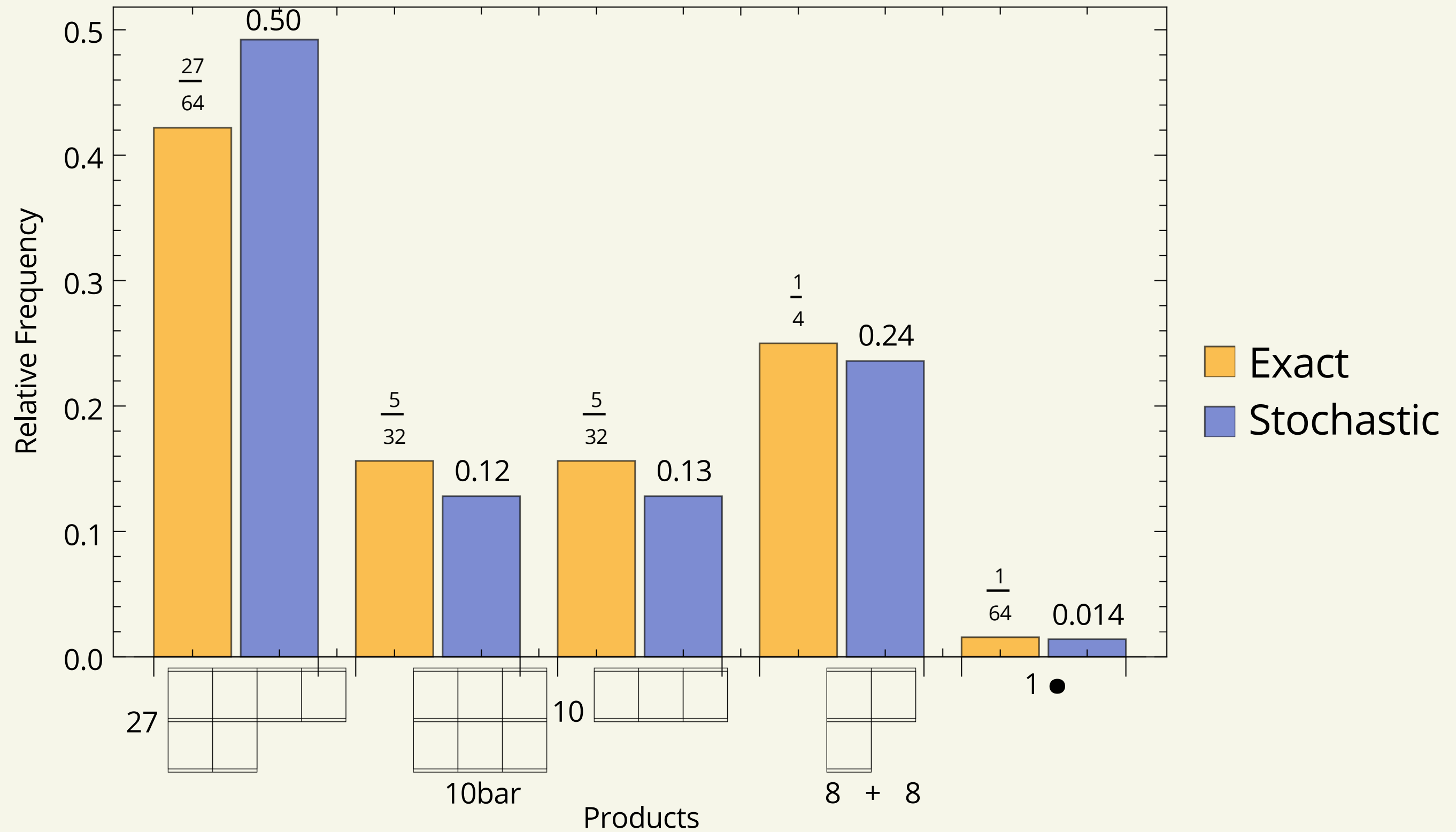
# Octet x Octet



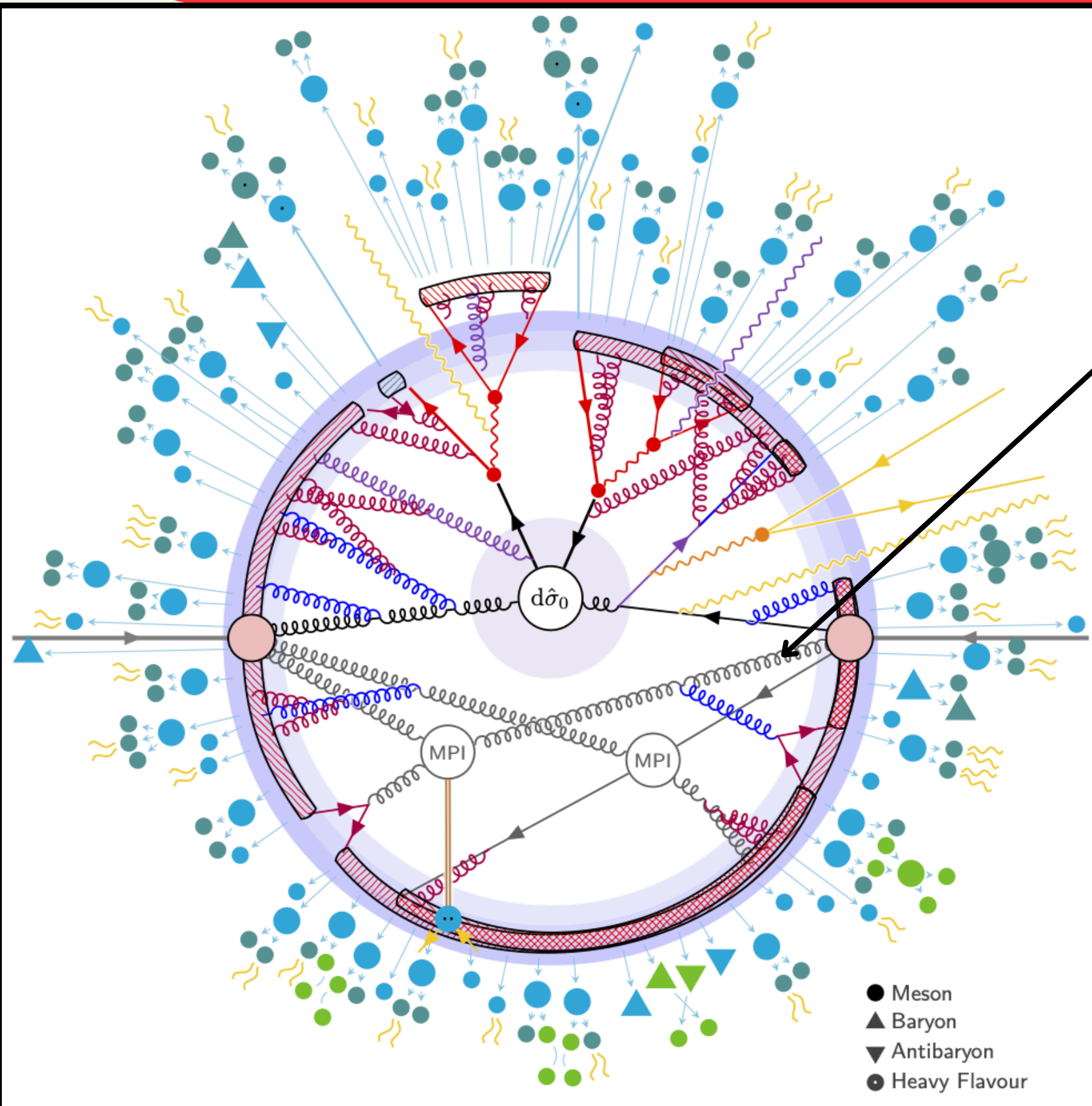


# Results

$8 \otimes 8$



# Future Research



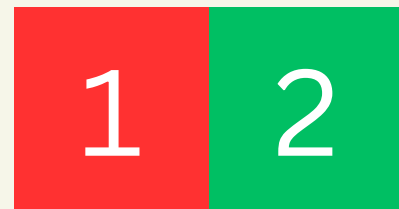
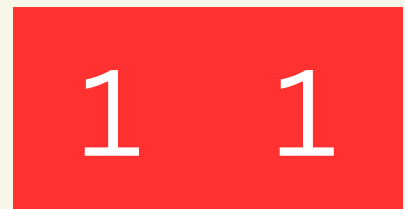
Code relies on approximations, so stochastic model is the best option at the moment.

In future research, efforts should be made to model this process more accurately, by using Young tableaux.

(Skands, 2022)

# Naming Structures

6 (Sextet)



$\bar{6}$  (Anti-Sextet)

