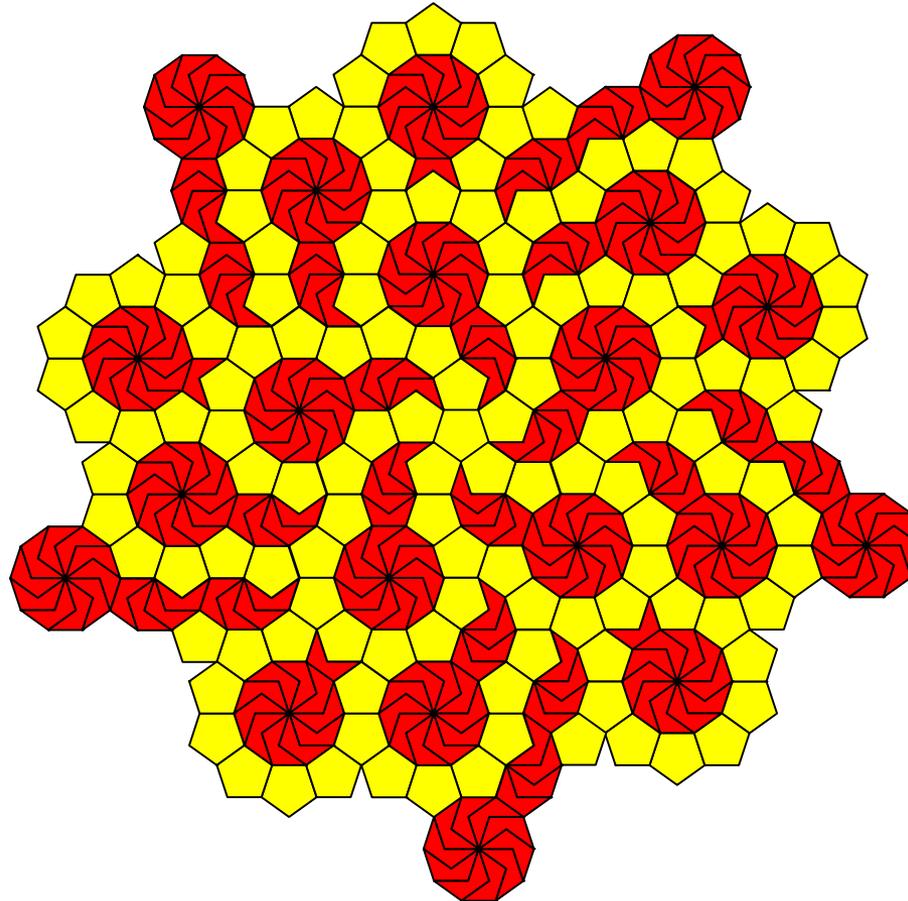


Halbreguläre Figuren

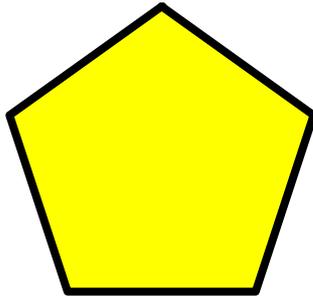


Hans Walser

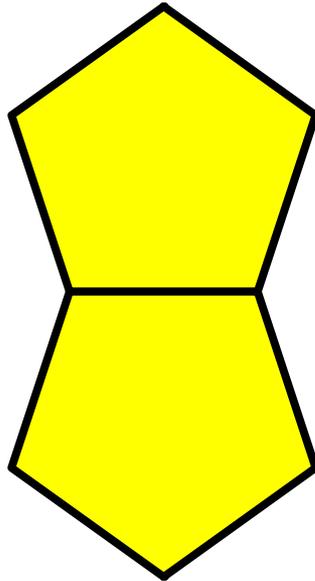
www.walser-h-m.ch/hans/Vortraege/20240208

In der Ebene

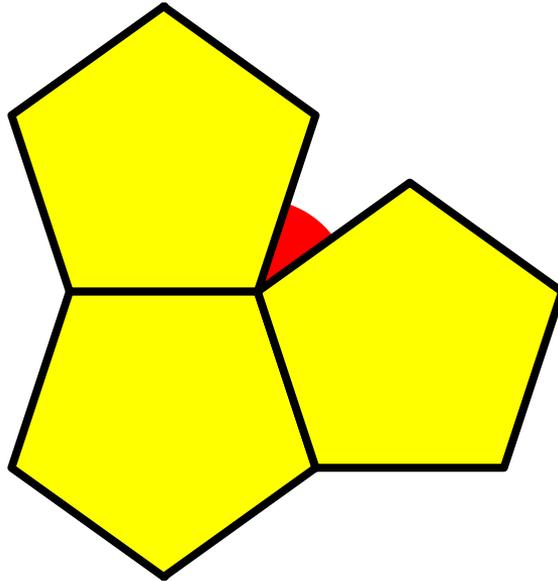
Parkett mit regulären Fünfecken?



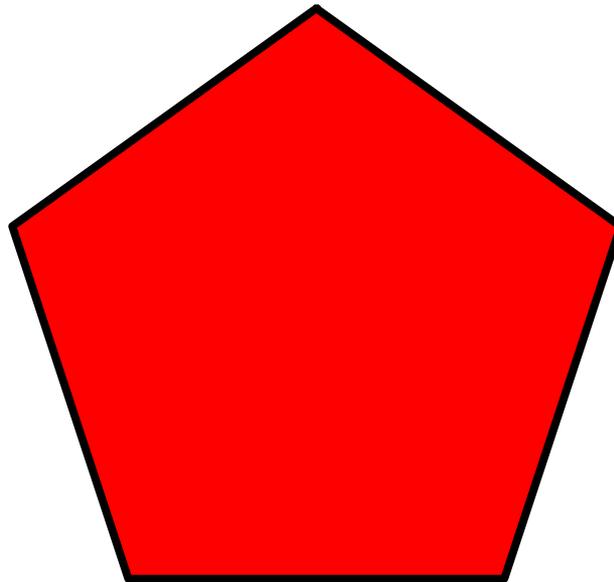
Parkett mit regulären Fünfecken?



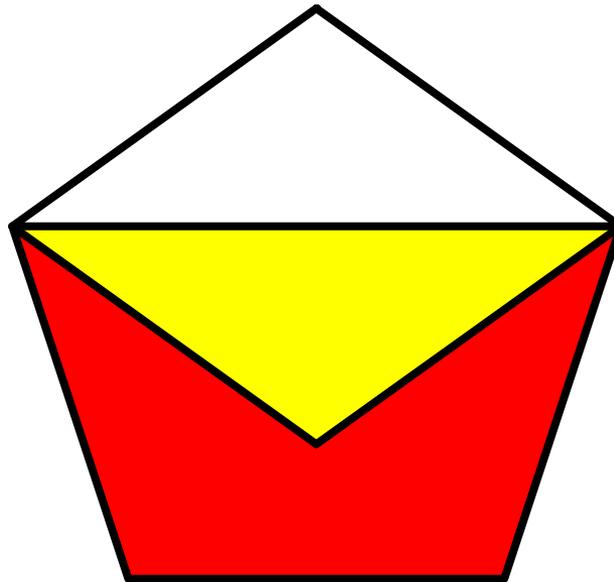
Parkett mit regulären Fünfecken **unmöglich**.



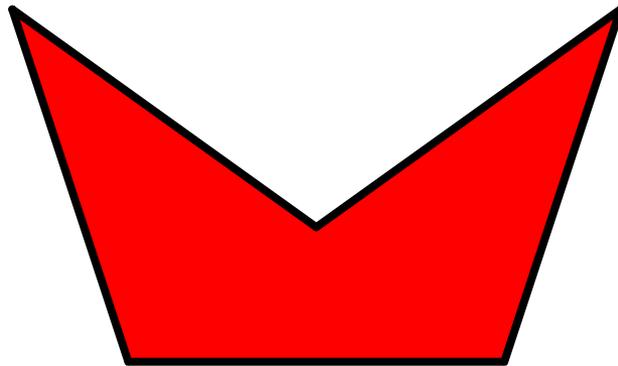
Reguläres Fünfeck



Reguläres Fünfeck



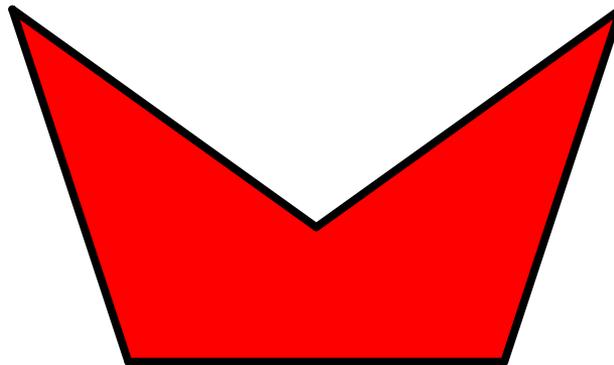
Halbreguläres Fünfeck



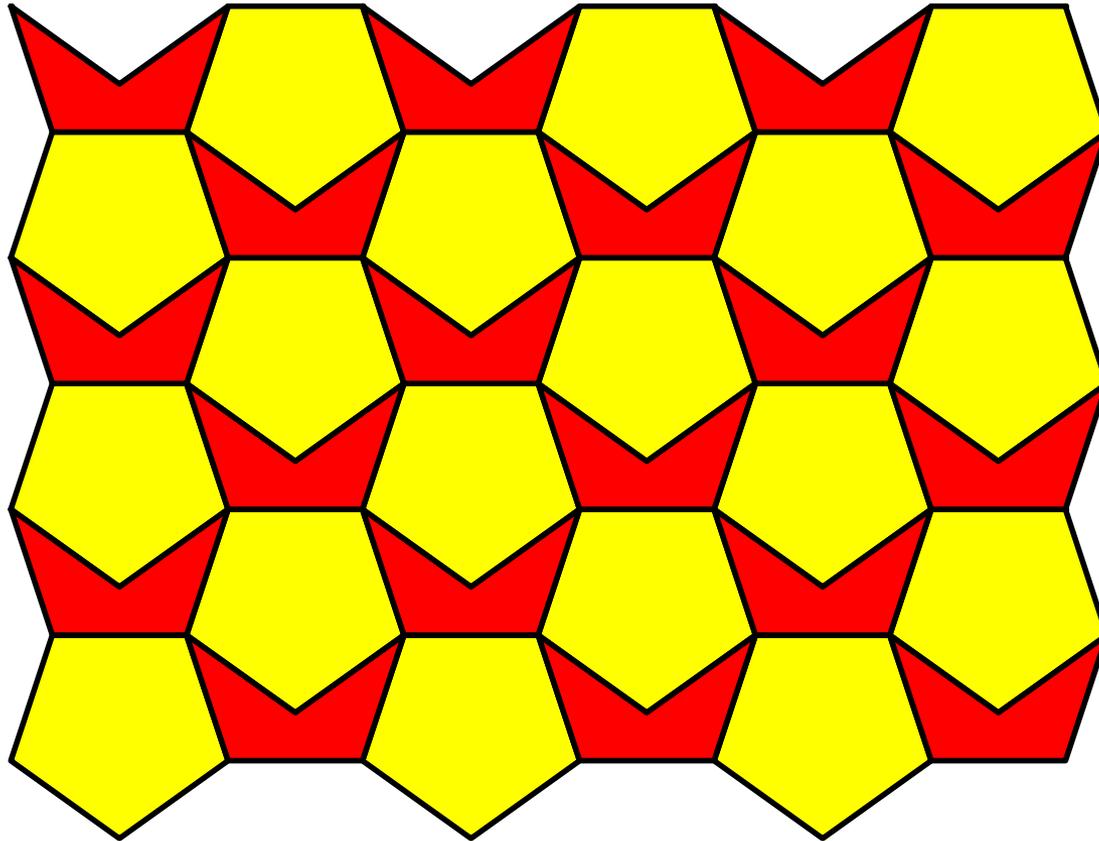
Halbreguläres Fünfeck

Gleiche Seiten

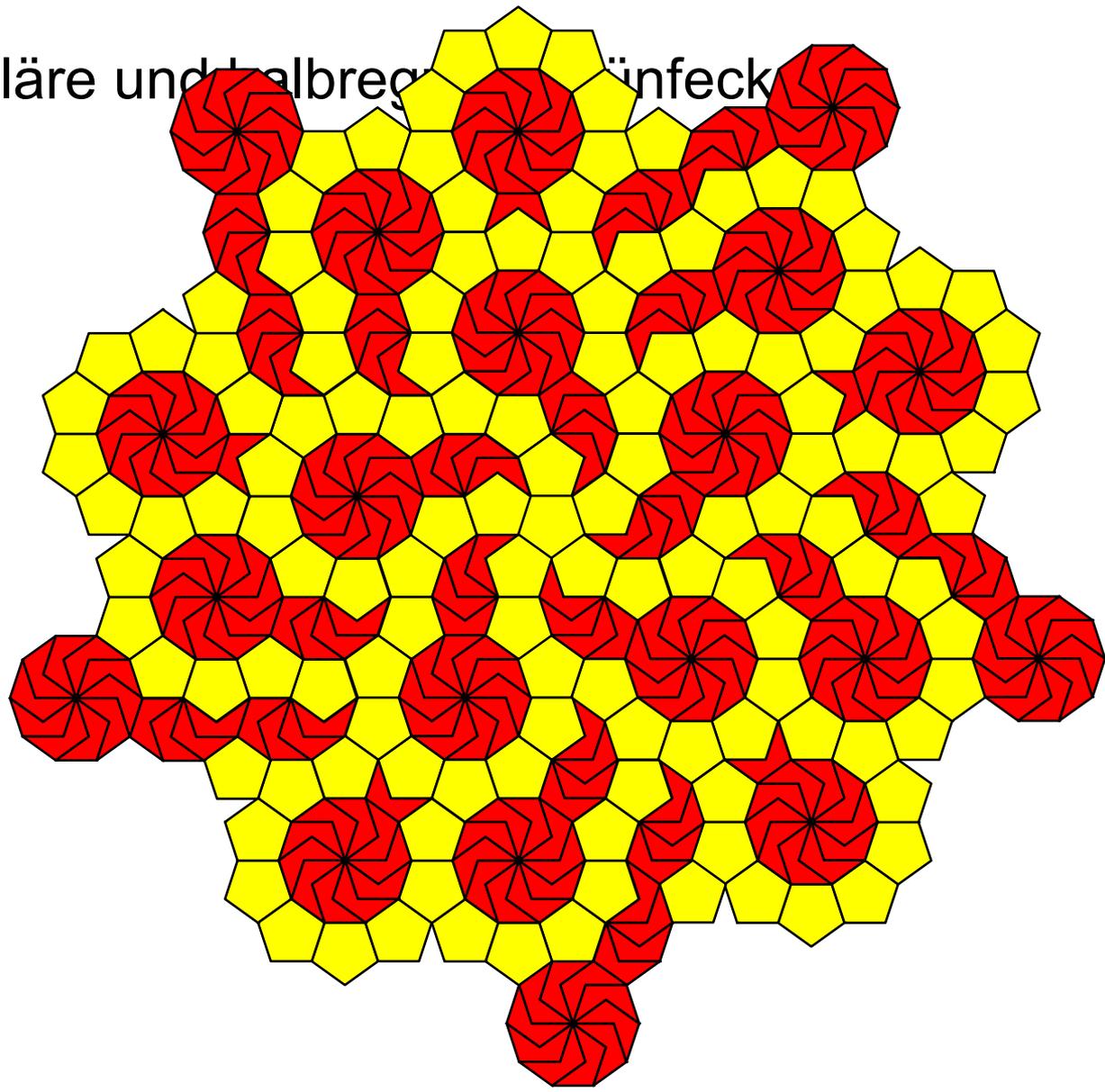
Ungleiche Winkel (108° , 36° , 252° , 36° , 108°)

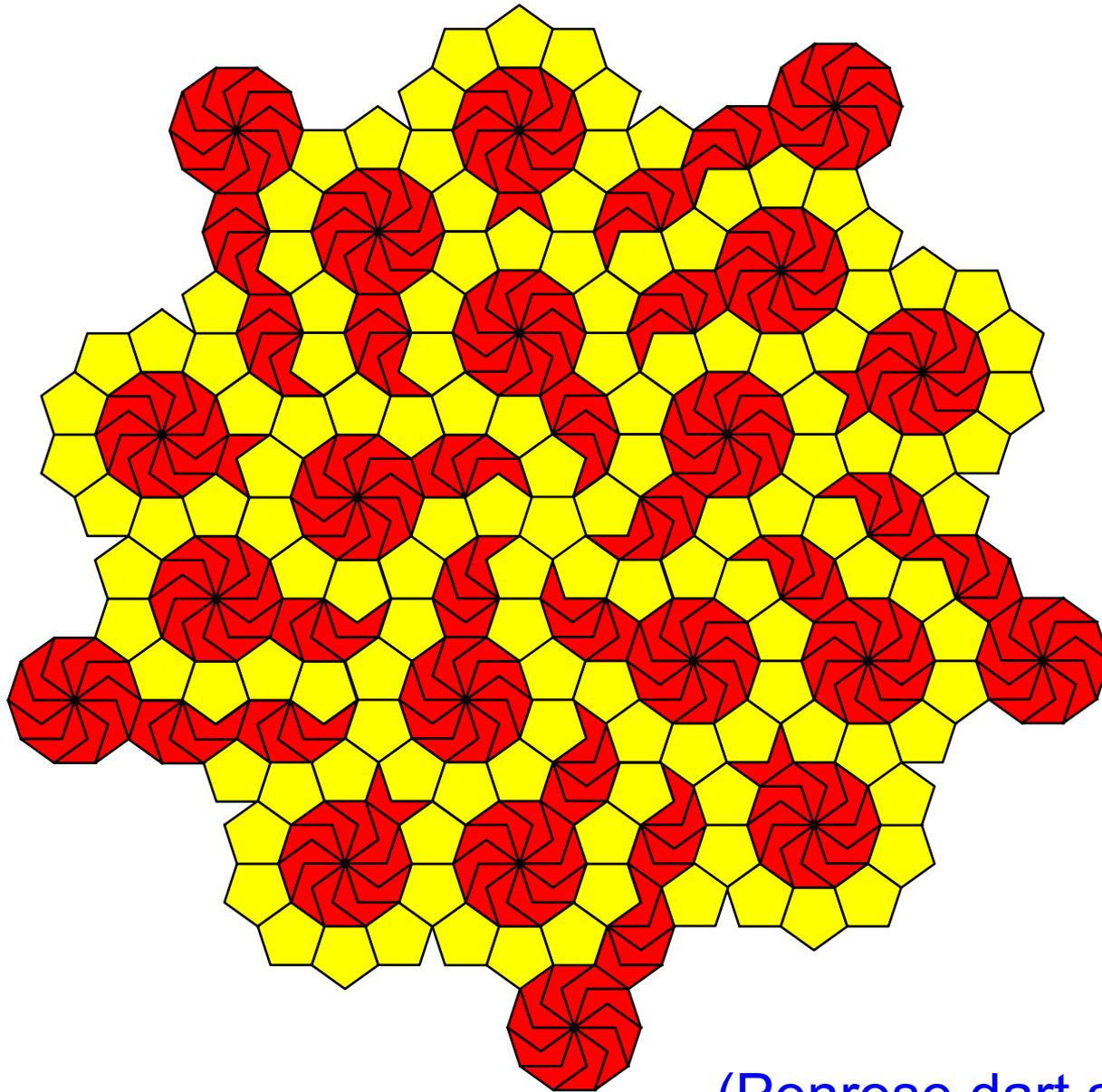


Reguläre und halbreguläre Fünfecke



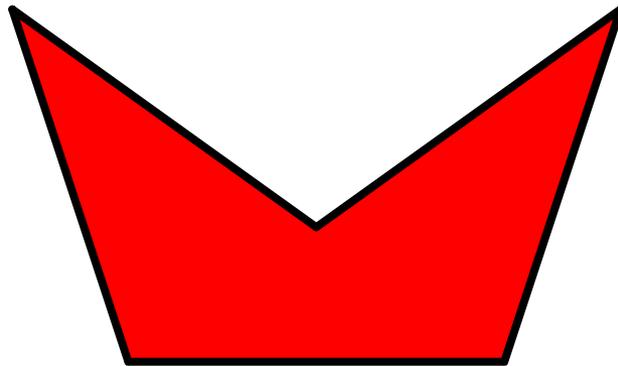
Reguläre und halbrege



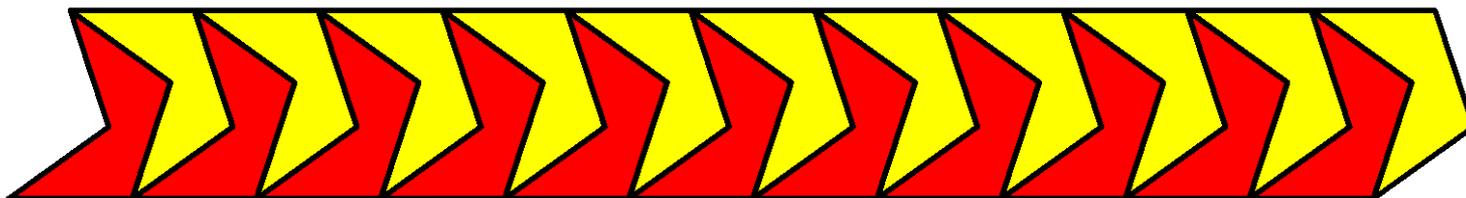


(Penrose dart and kite)

Ausschließlich halbreguläre Fünfecke?

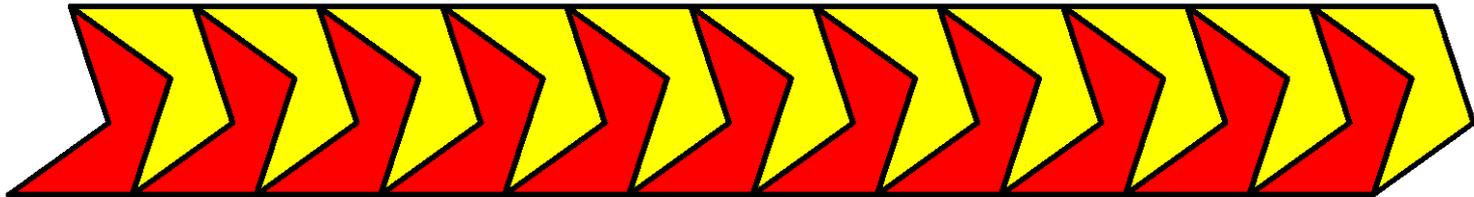


Bandornamente

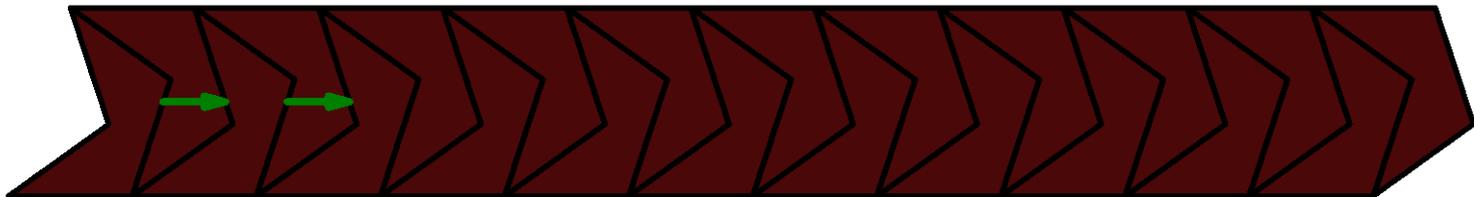


Bandornamente

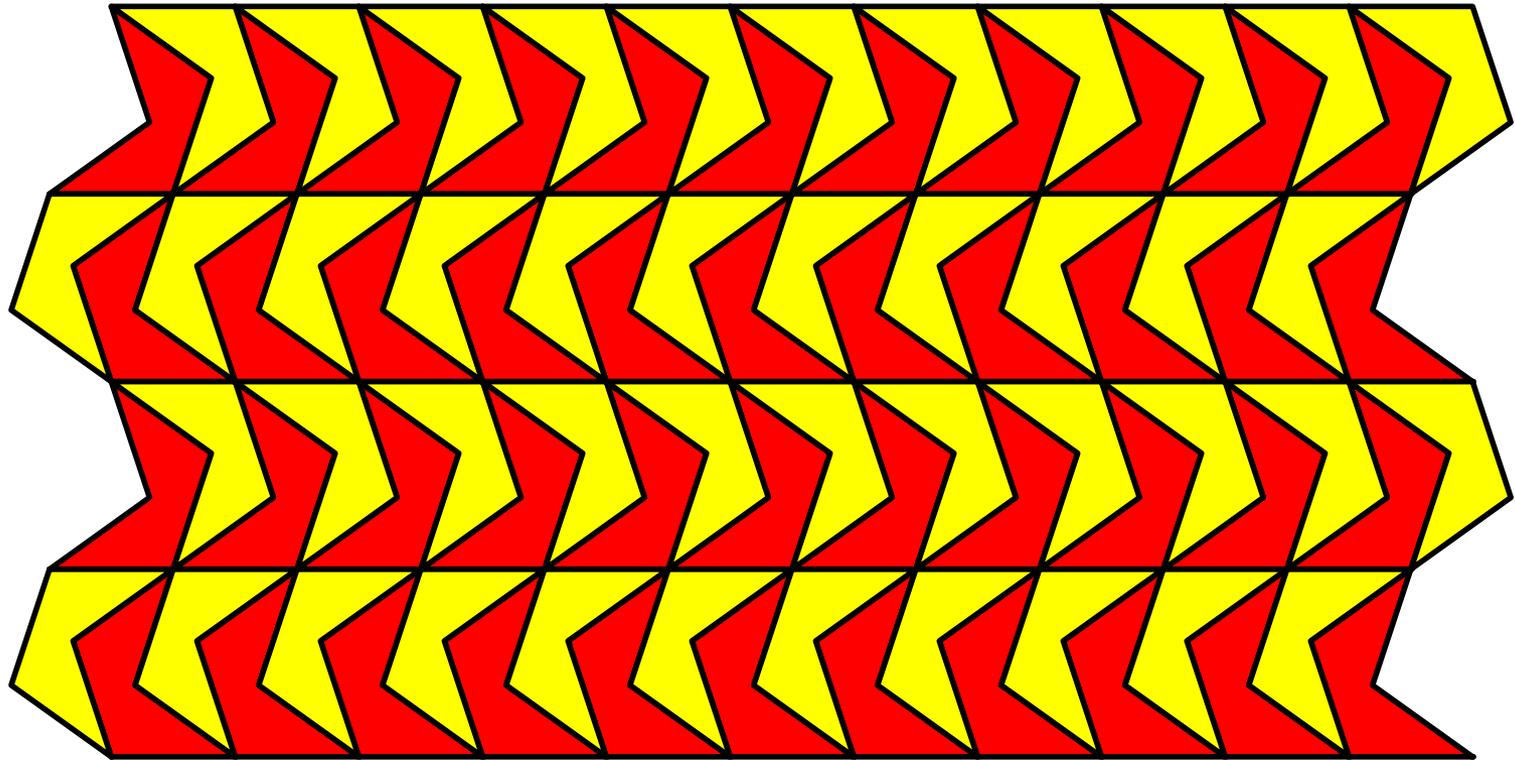
Nur Translationen



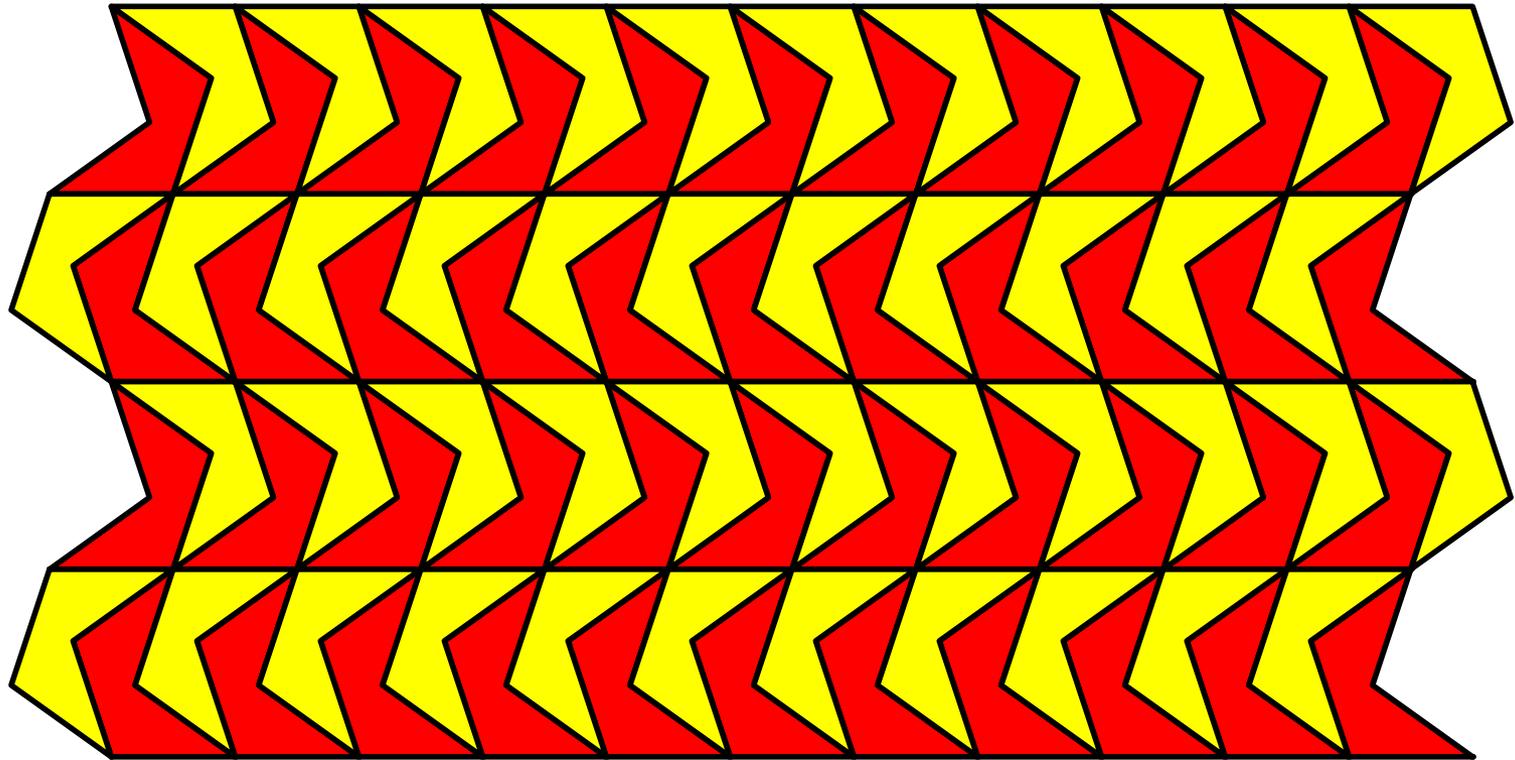
Translationen und Schubspiegelungen



Flächenornament

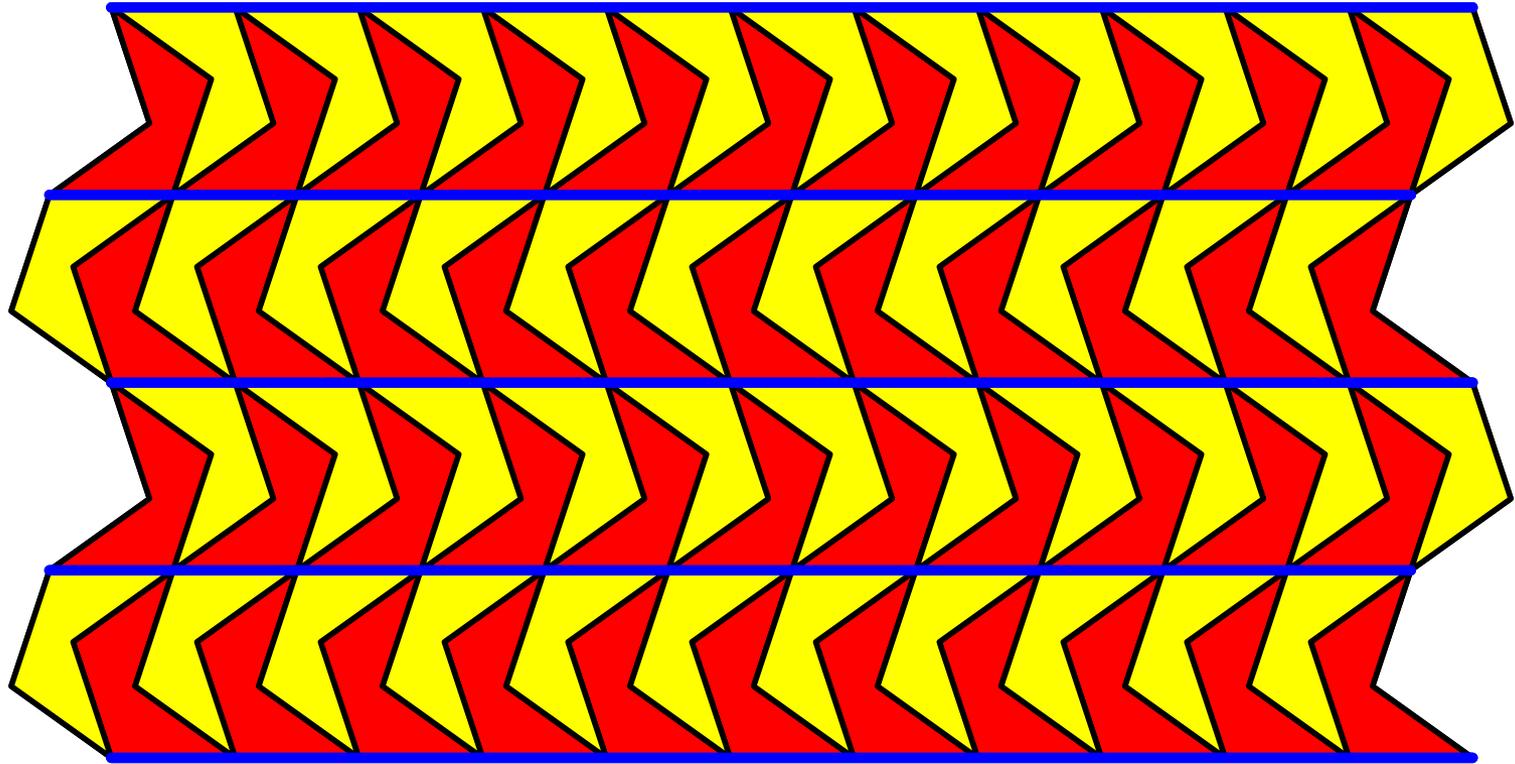


Flächenornament



Optische Täuschung?

Blaue Linien parallel?



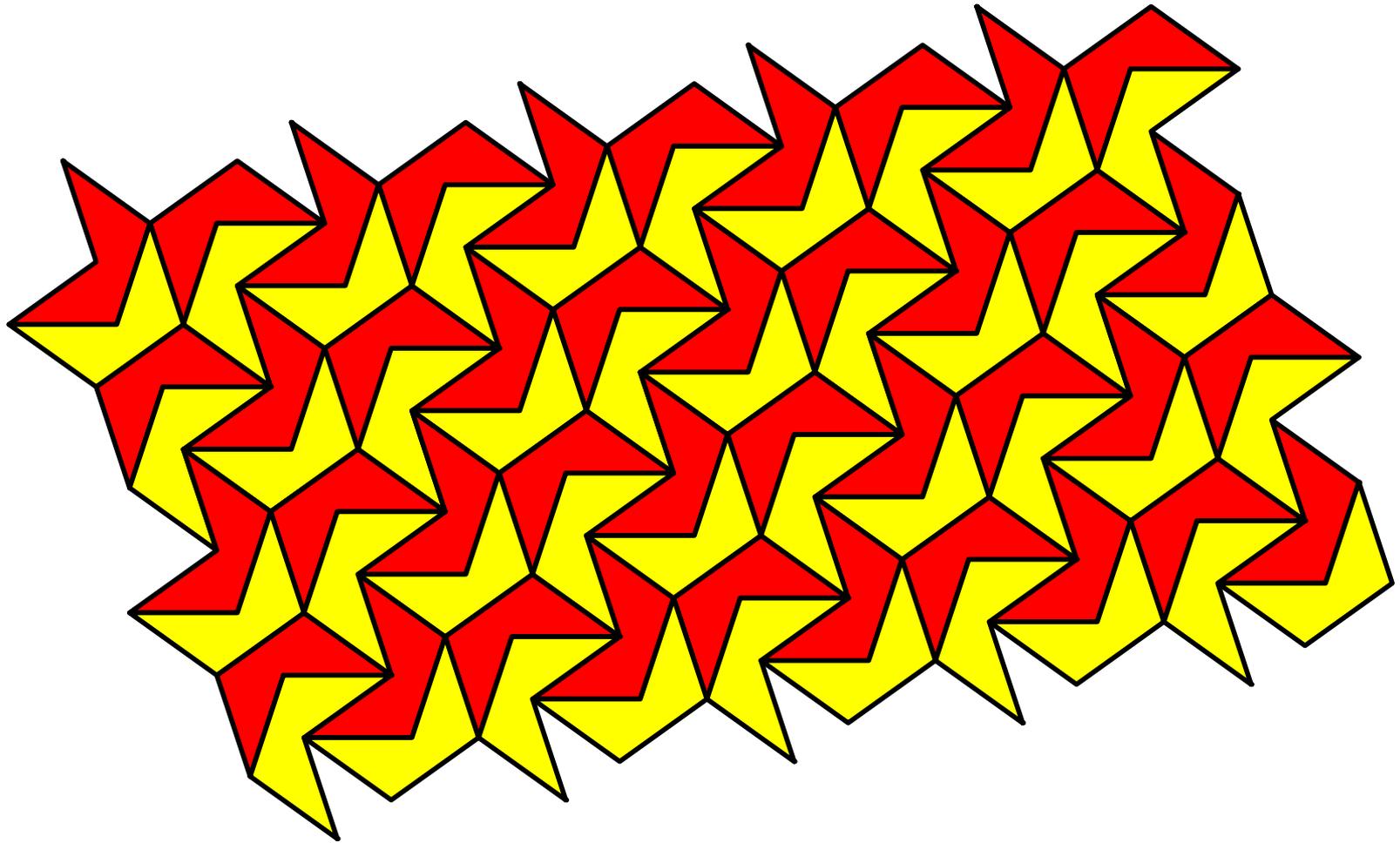
Optische Täuschung?

Blaue Linien parallel? – ja

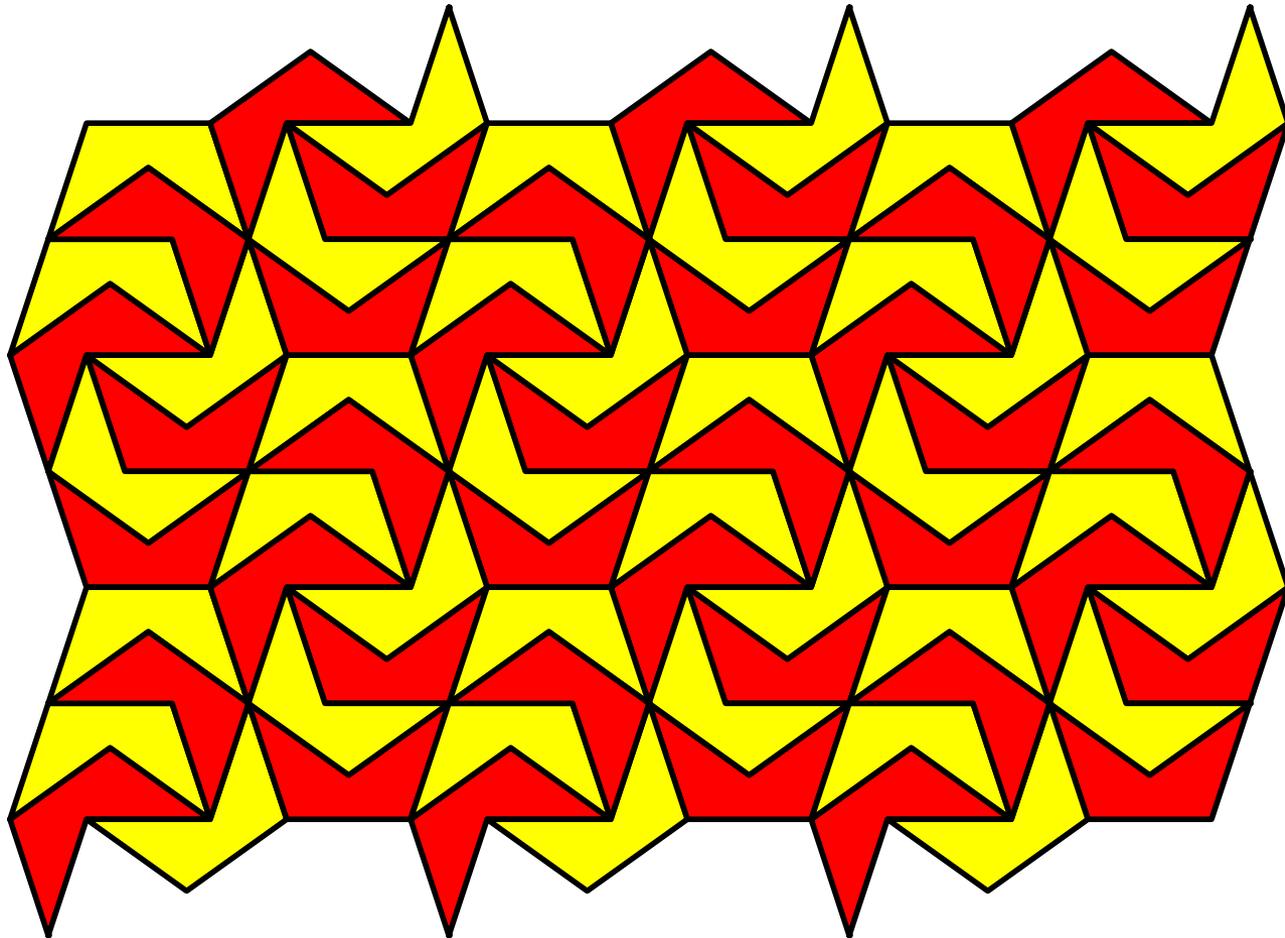


Optische Täuschung?

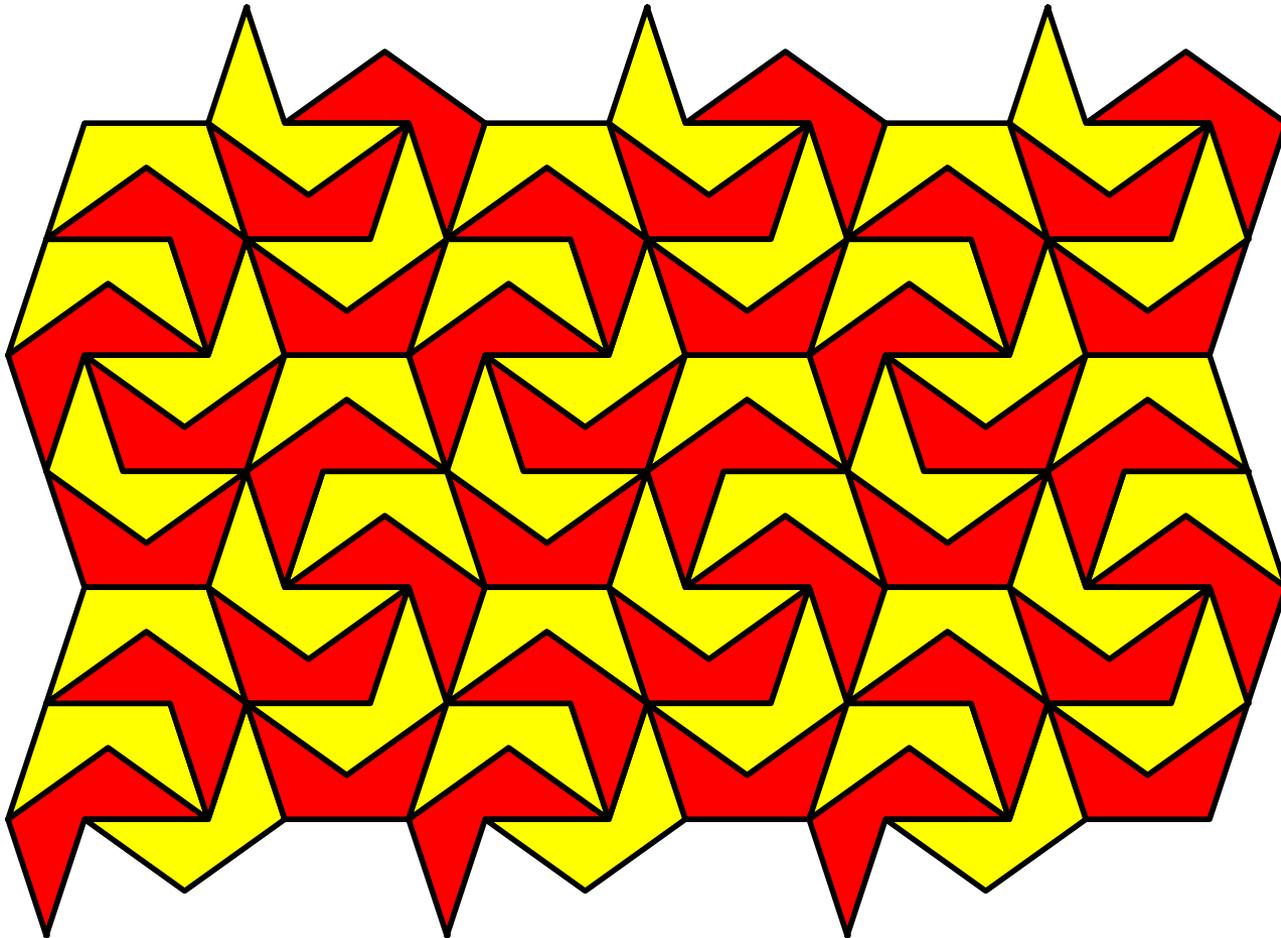
Flächenornament

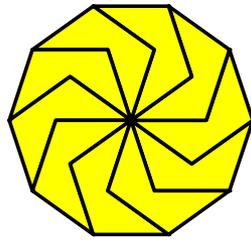


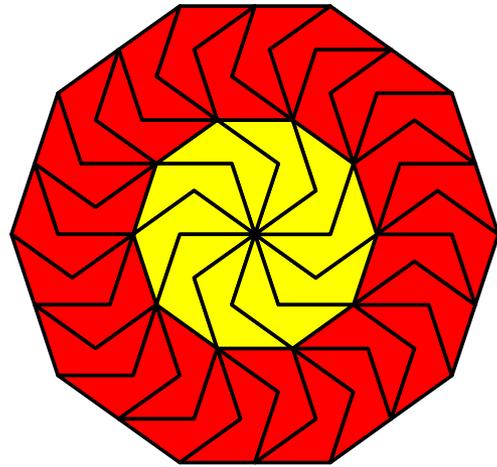
Flächenornament

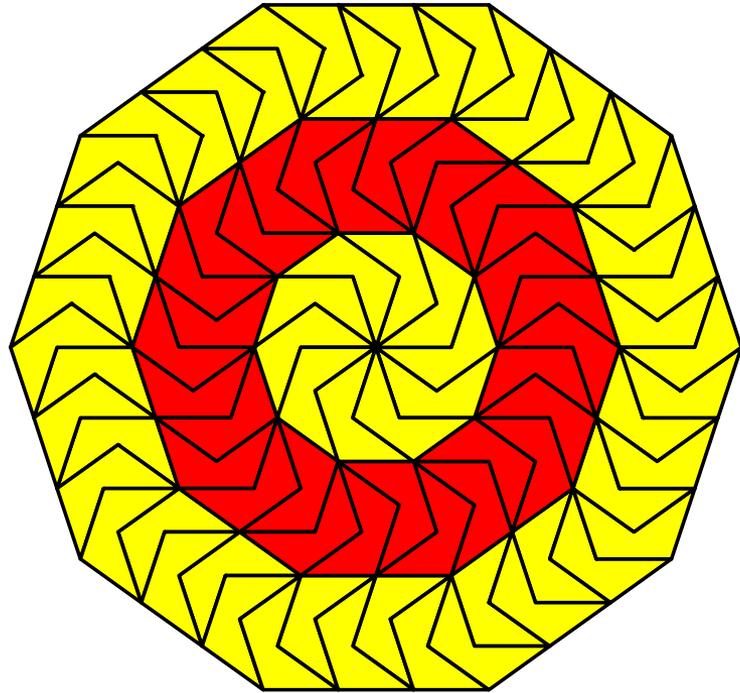


Flächenornament

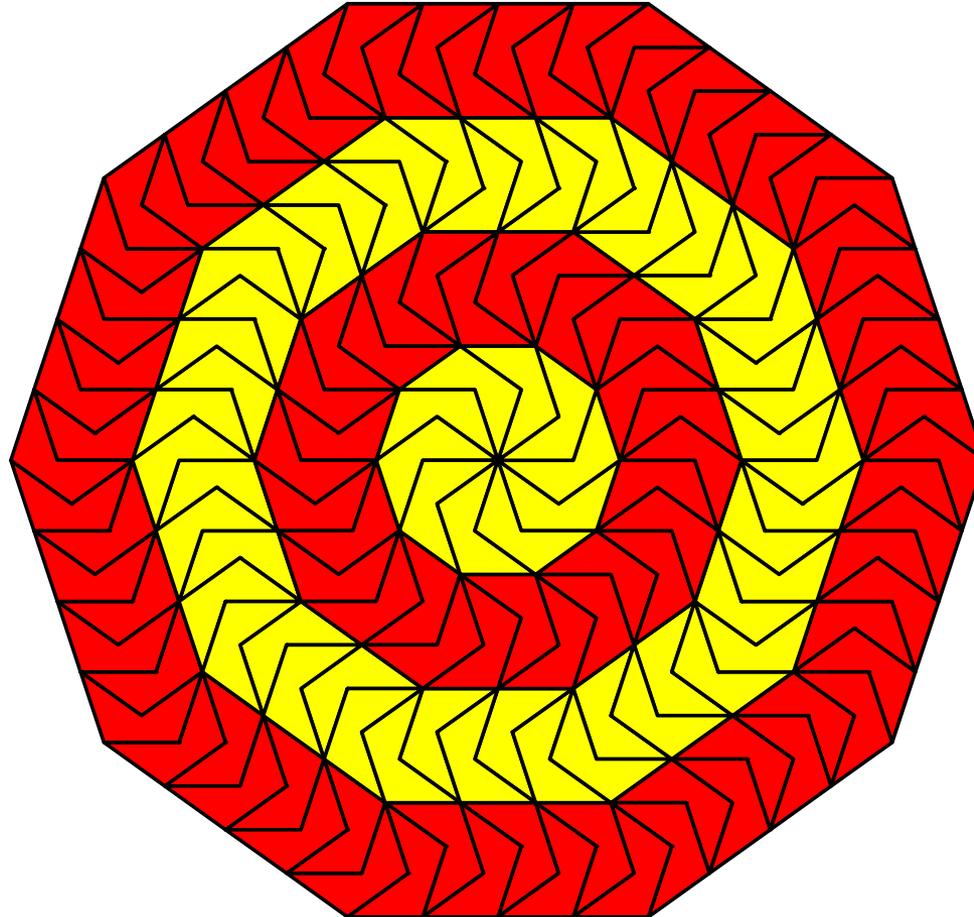




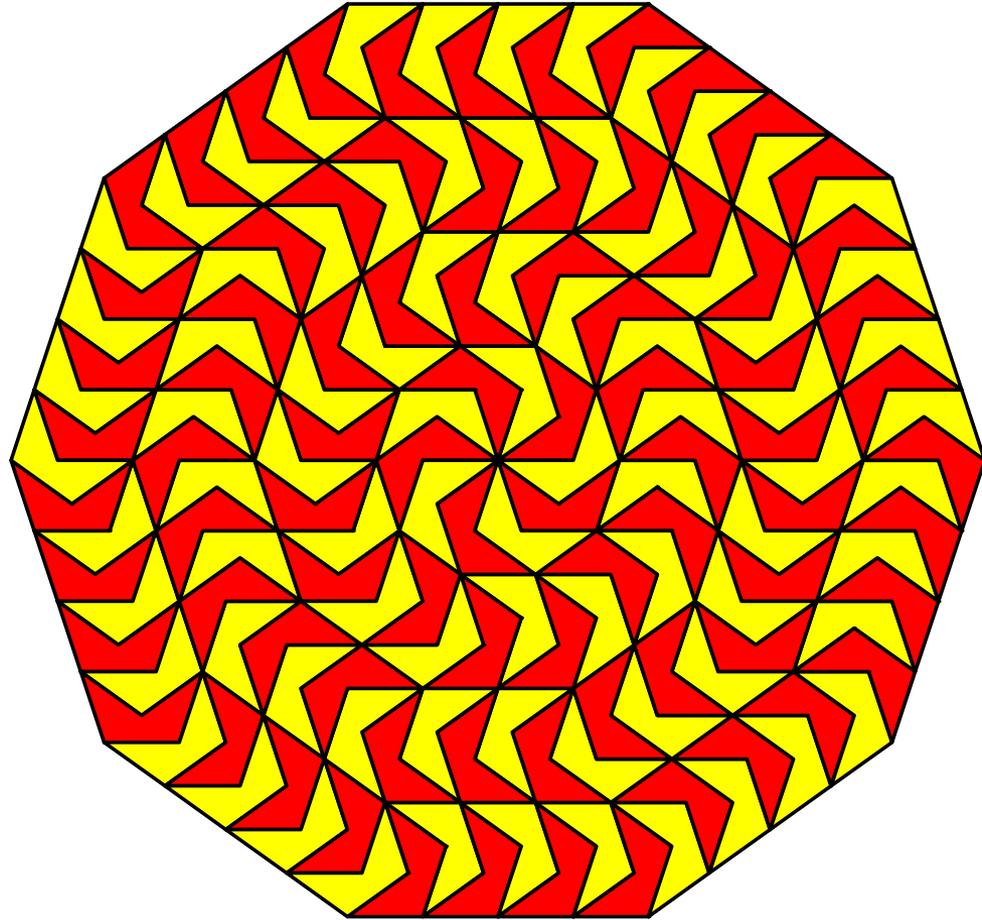




Kein Flächenornament

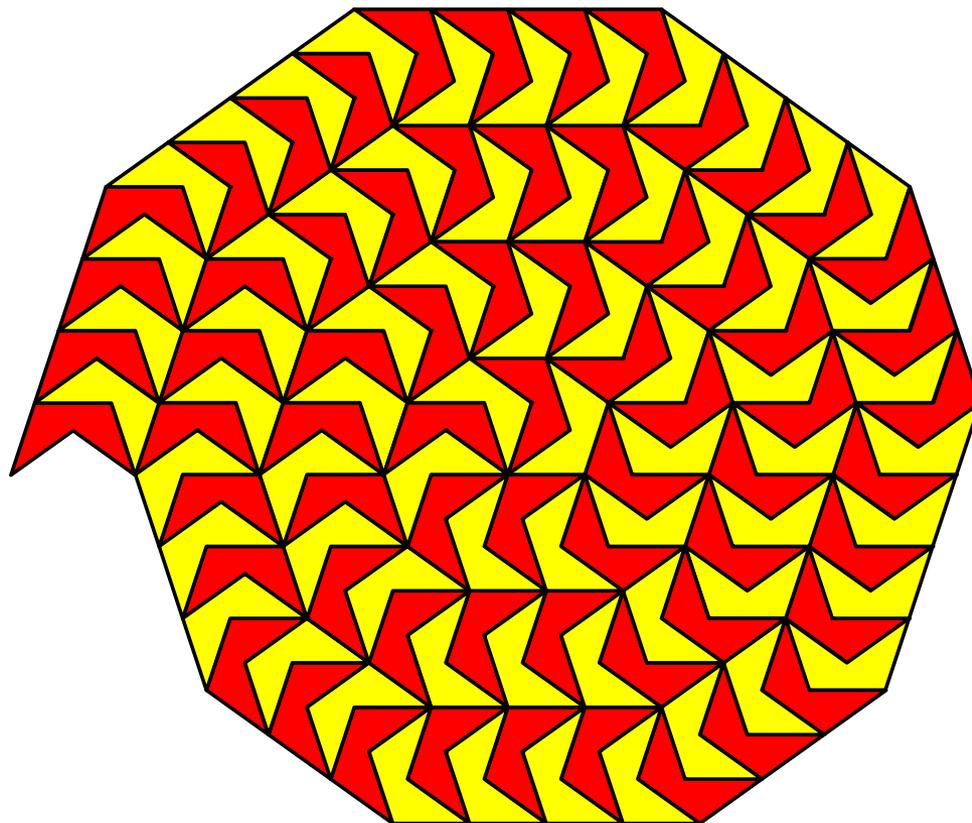


Keine Translationssymmetrie.
Aber zehnteilige Drehsymmetrie.

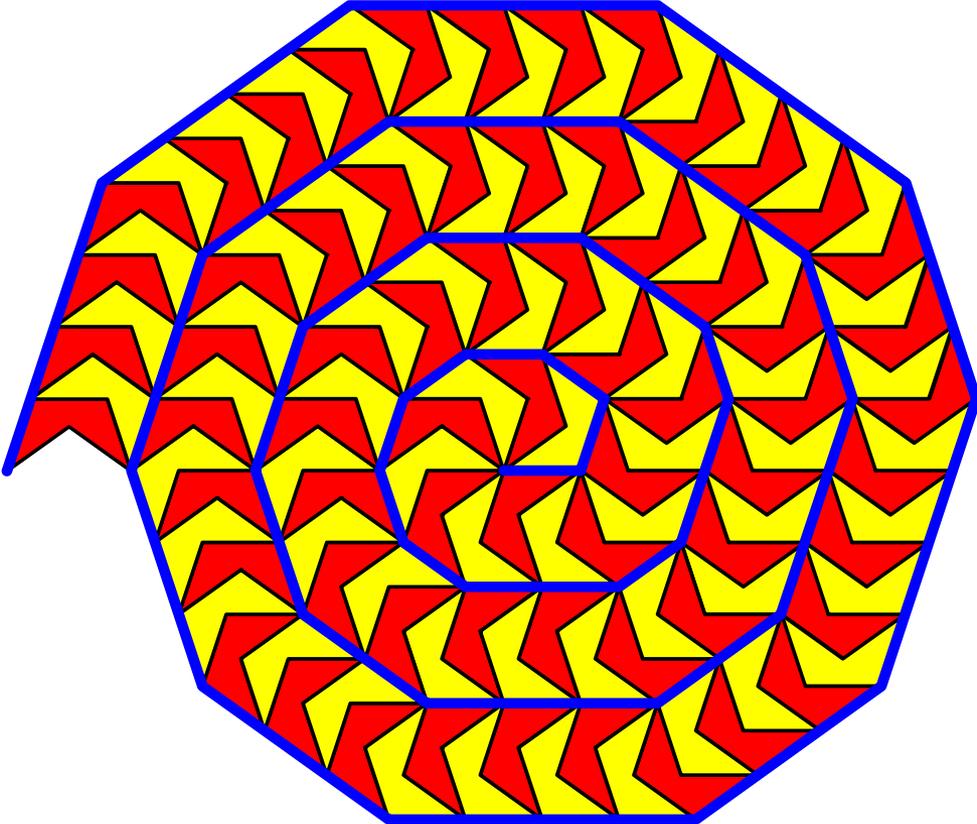


Fünfteilige Drehsymmetrie

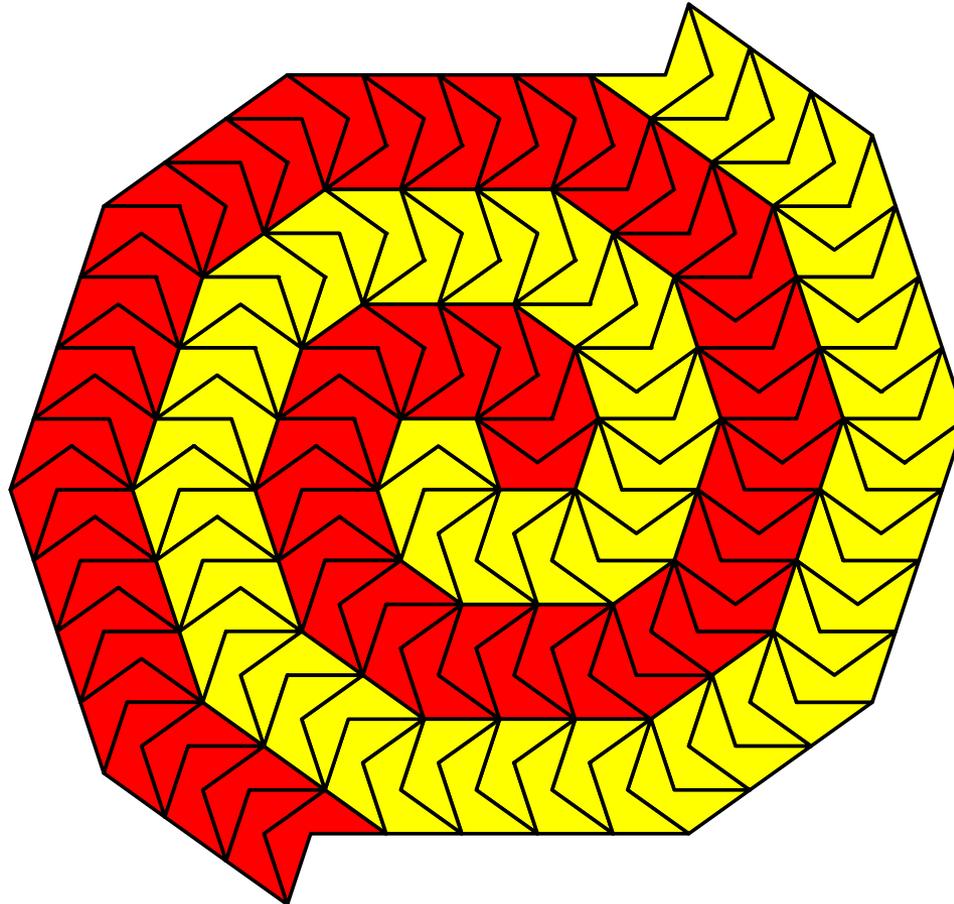
Muster ?



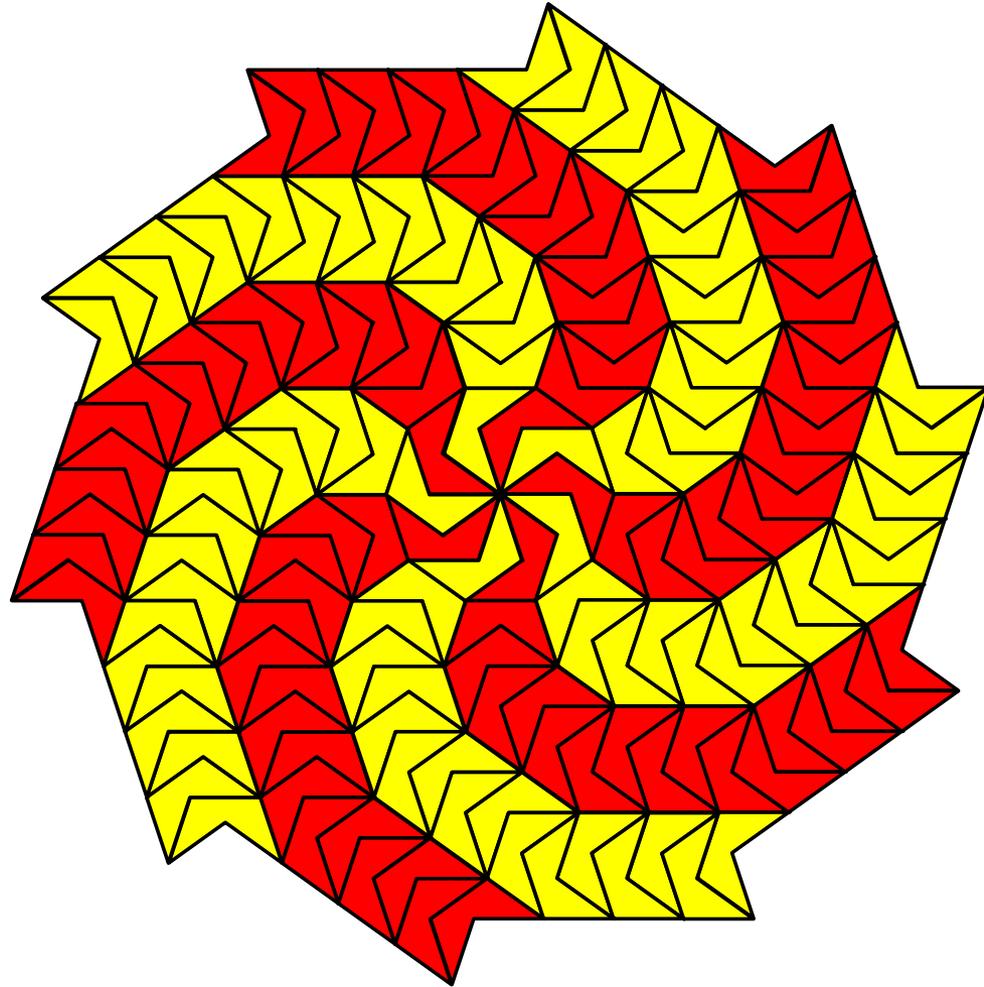
Archimedische Spirale



Doppelspirale



10 Spiralen

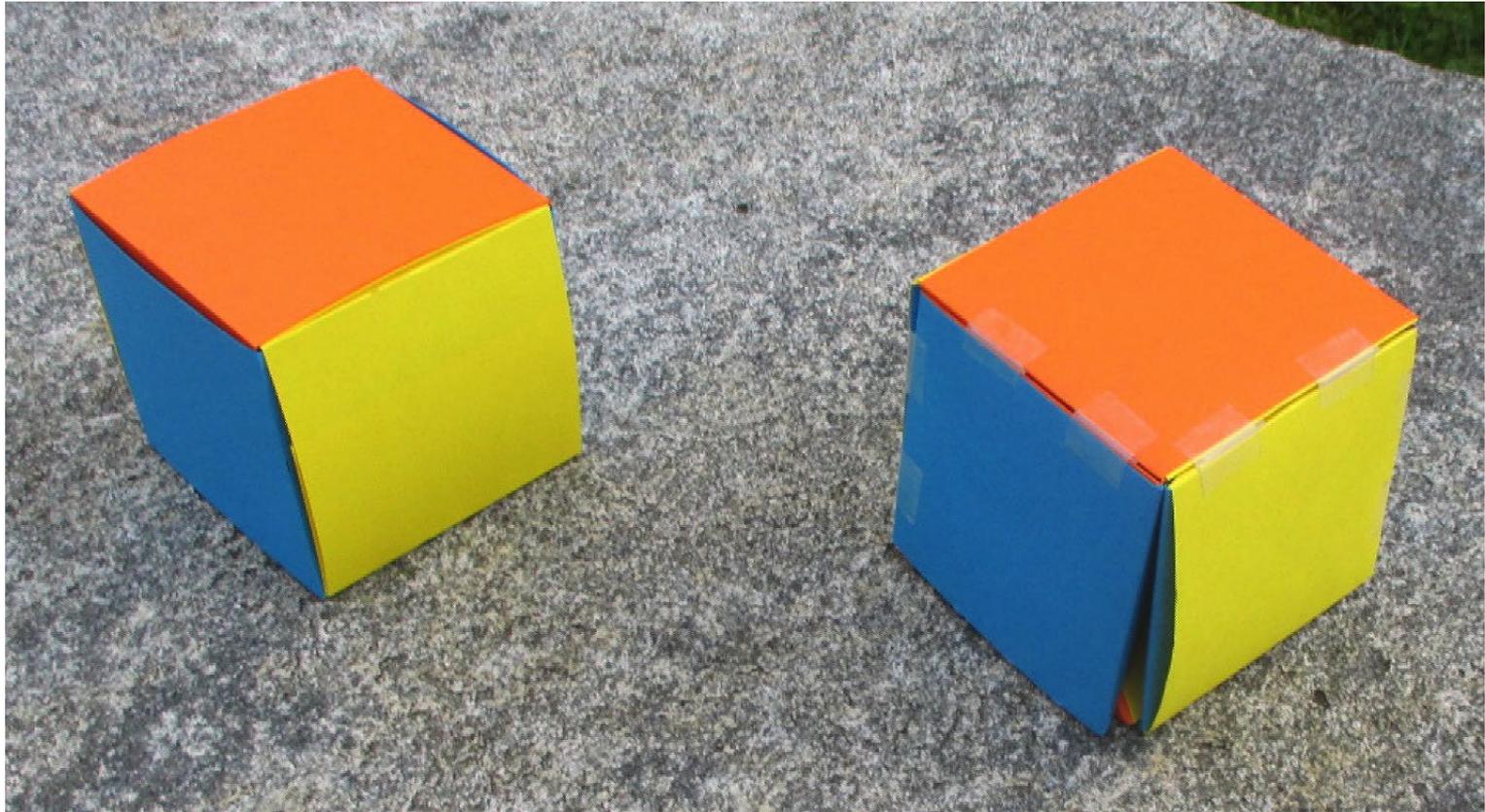


Im Raum

Im Raum: Ein alter Bekannter



Im Raum: Was steckt im Würfel?



Im Raum: Was steckt im Würfel?



Im Raum: Was steckt im Würfel?

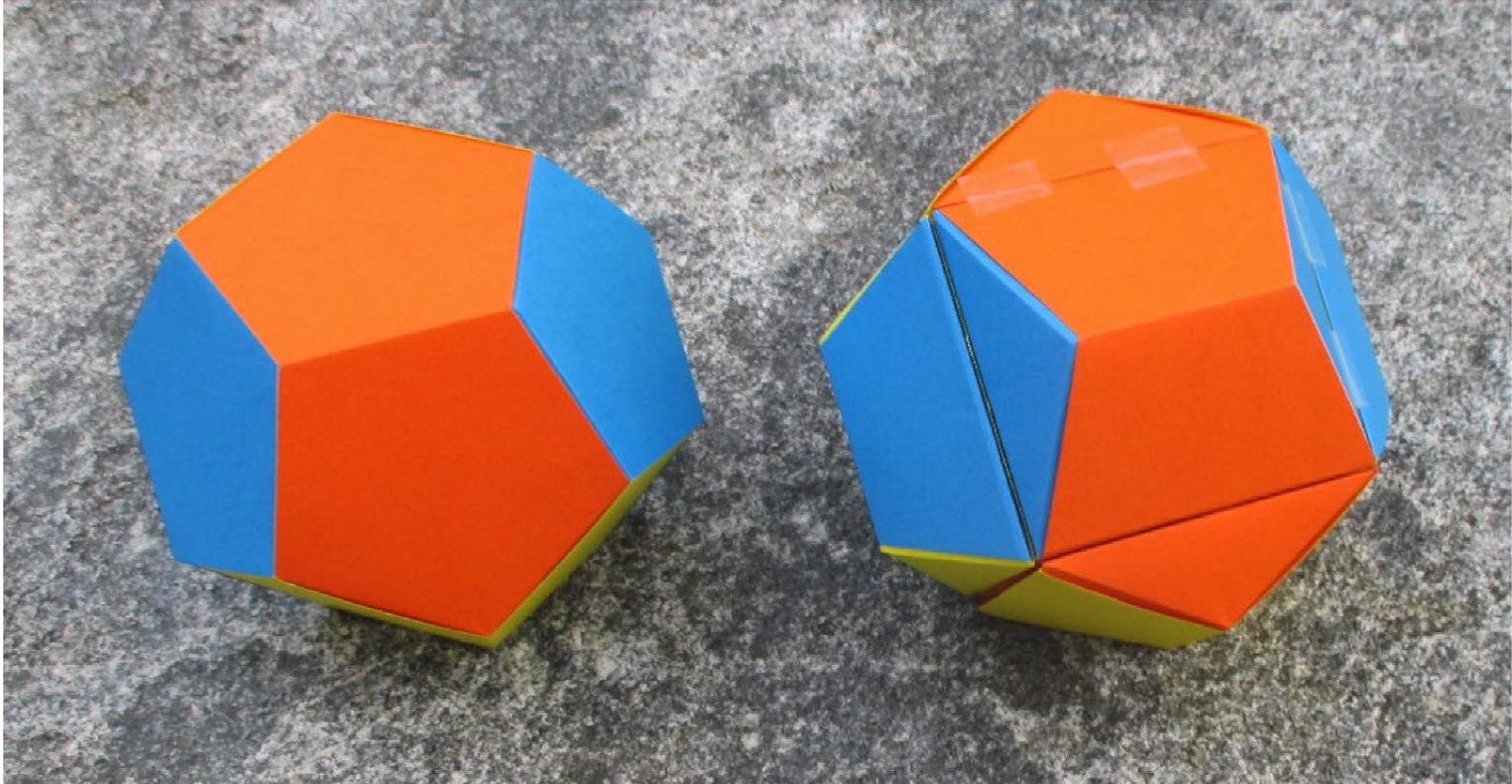


Im Raum: **Kemper-Stern**

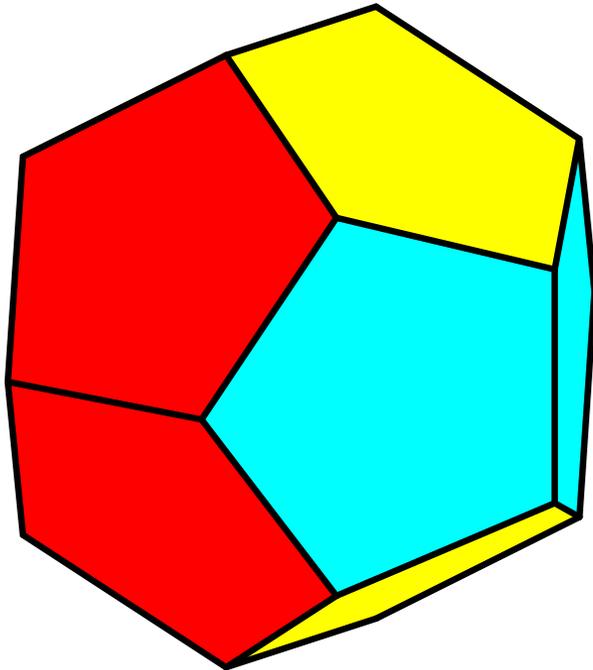


Carl Kemper, 1881-1957
Bildhauer und Architekt, Dornach

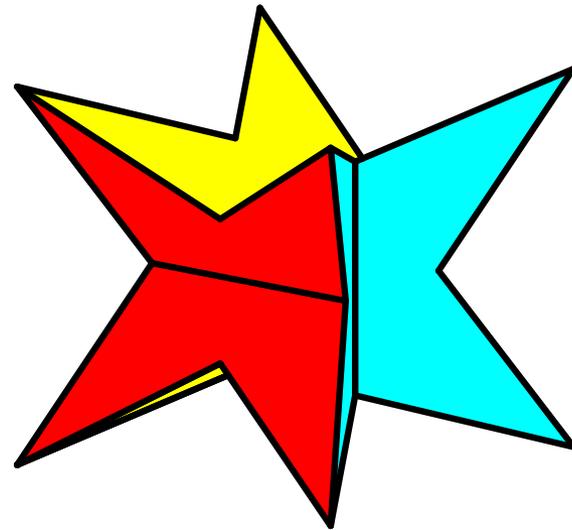
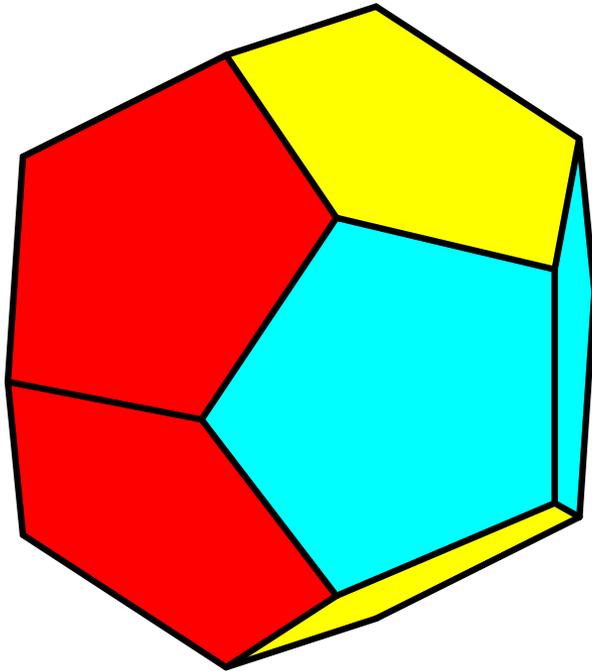
Im Raum: Was steckt im Dodekaeder?



Dodekaeder

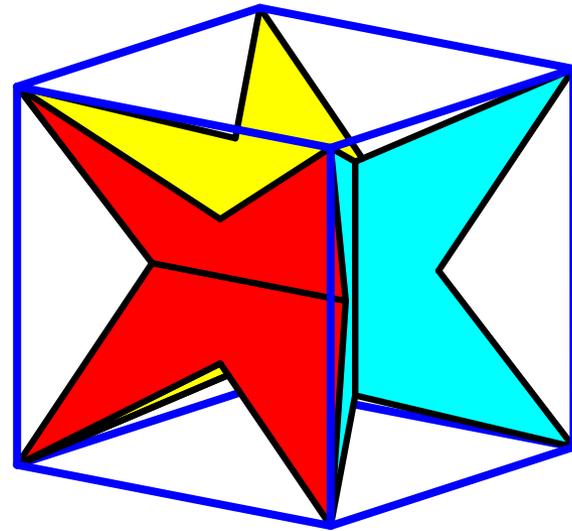
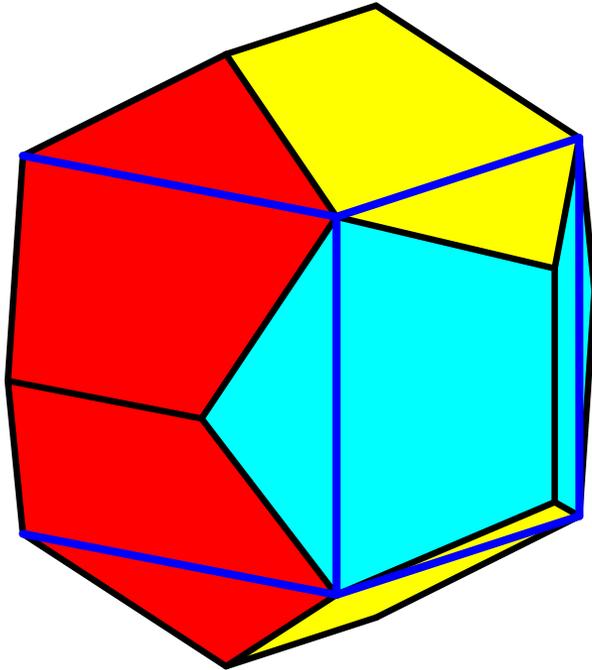


Dodekaeder — und halbreguläres Dodekaeder



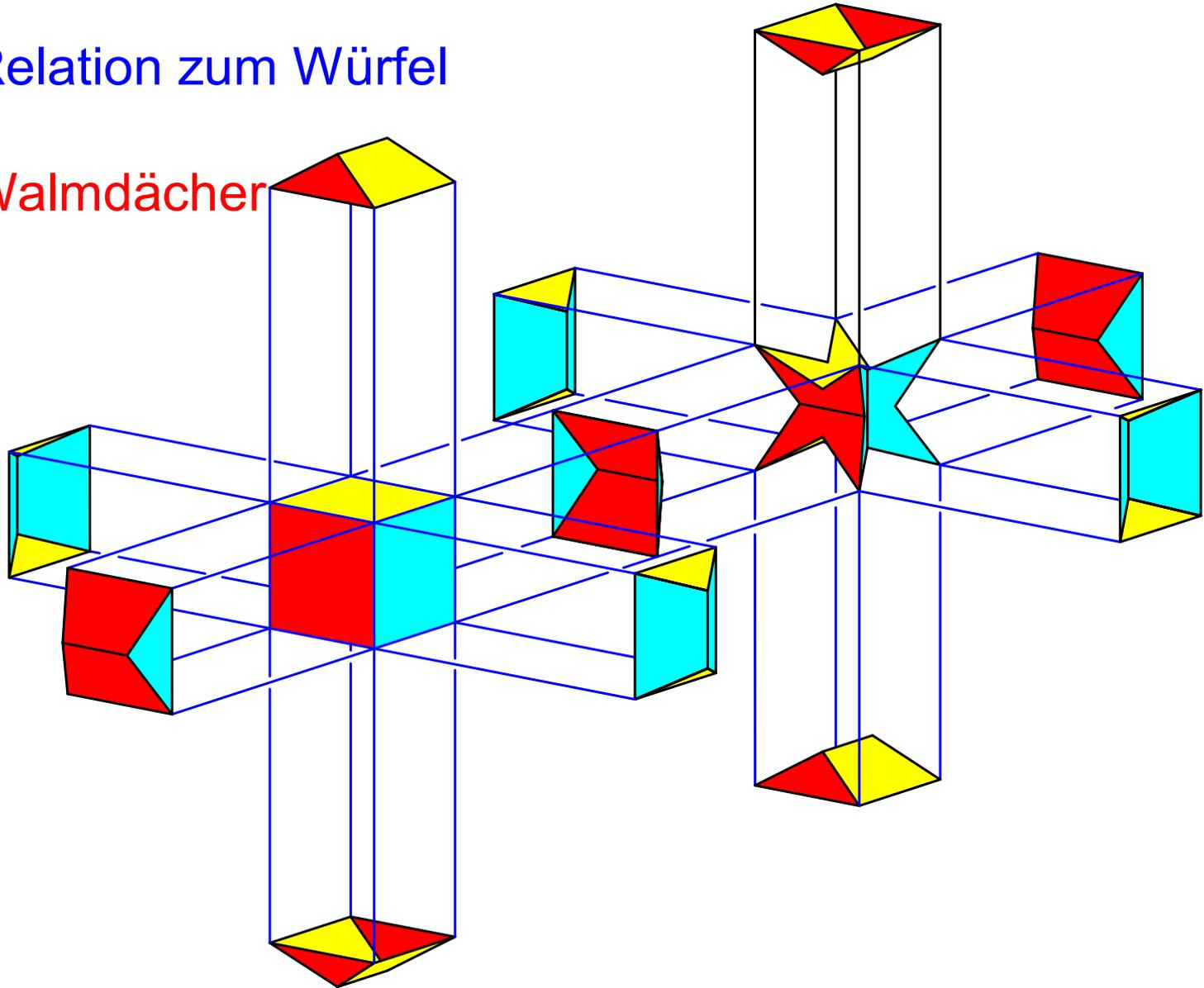
Relation zum Würfel

Walmdächer



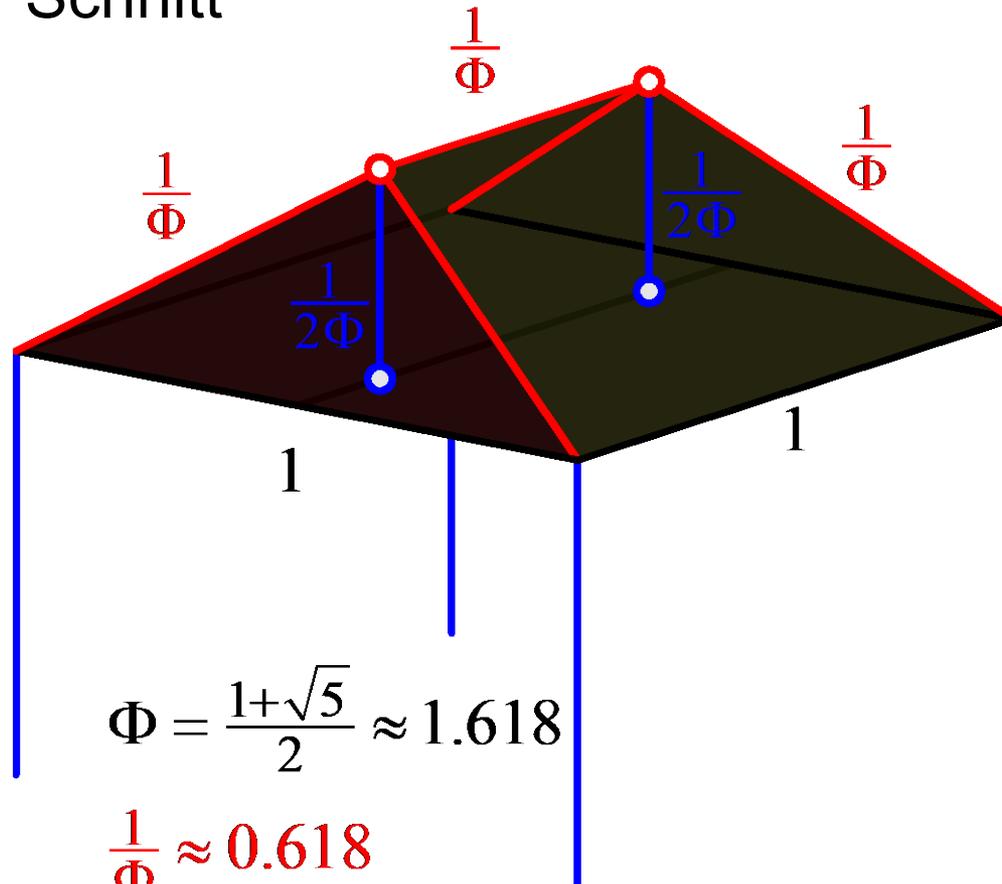
Relation zum Würfel

Walmdächer



Geometrie des Walmdaches

Goldener Schnitt

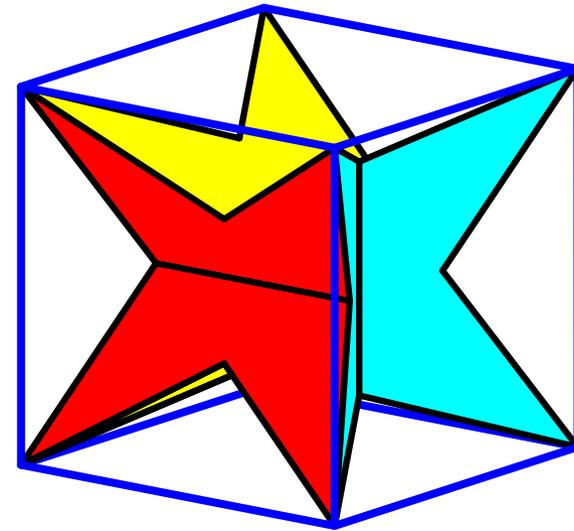
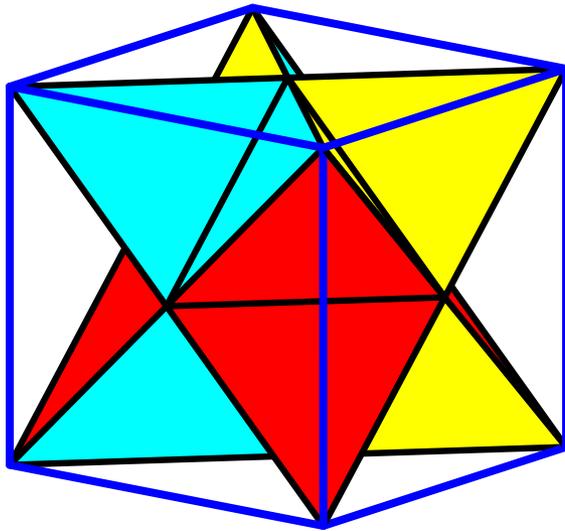


$$\Phi = \frac{1+\sqrt{5}}{2} \approx 1.618$$

$$\frac{1}{\Phi} \approx 0.618$$

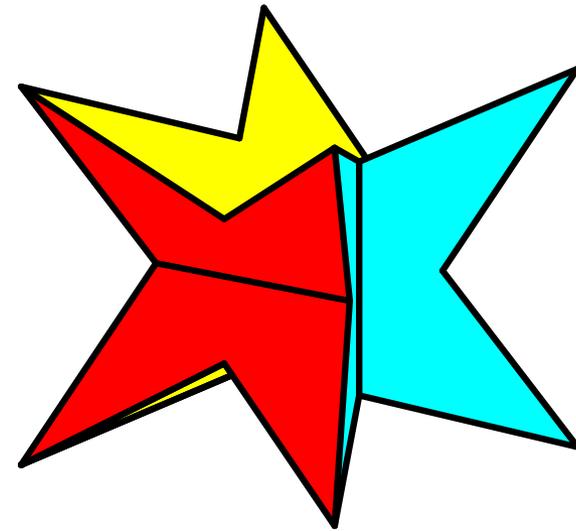
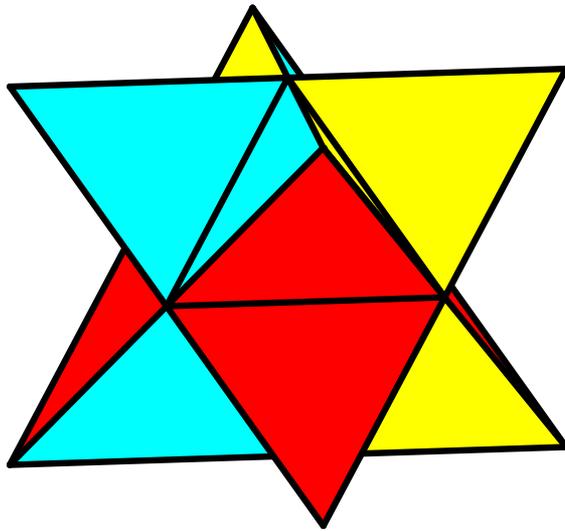
$$\frac{1}{2\Phi} \approx 0.309$$

Stella octangula und halbreguläres Dodekaeder



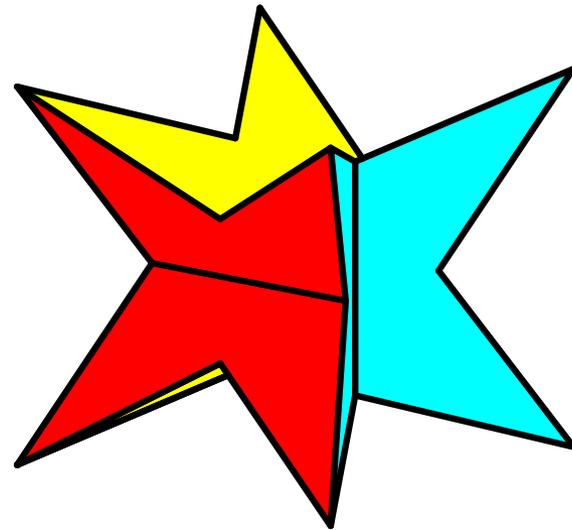
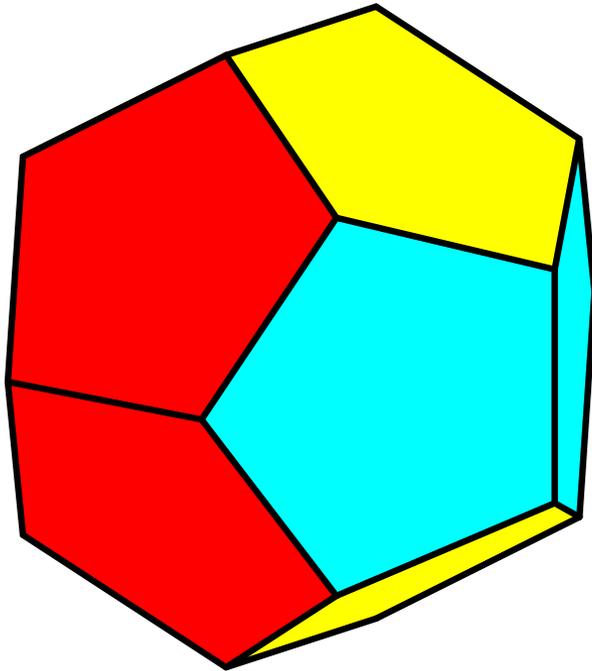
Johannes Kepler (1571-1630)

Stella octangula und halbreguläres Dodekaeder

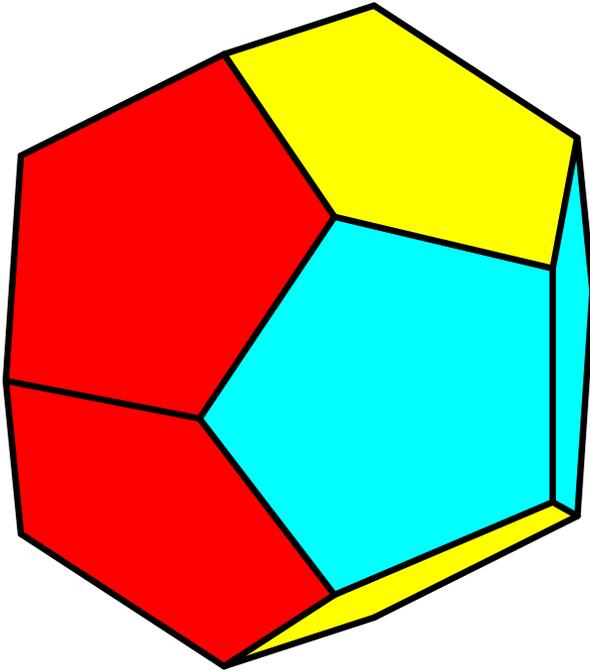


Johannes Kepler (1571-1630)

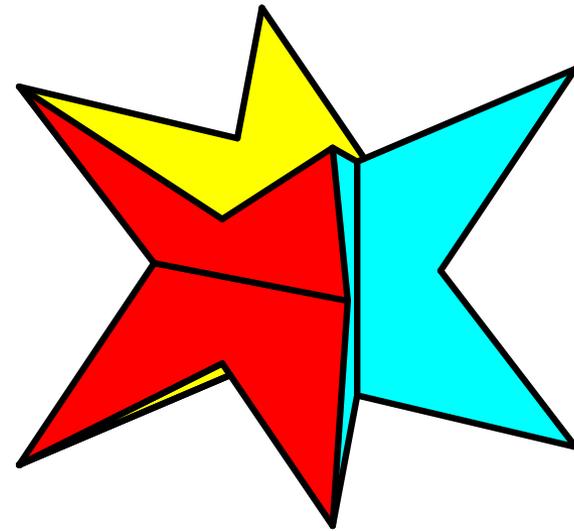
Dodekaeder und halbreguläres Dodekaeder



Symmetriegruppen

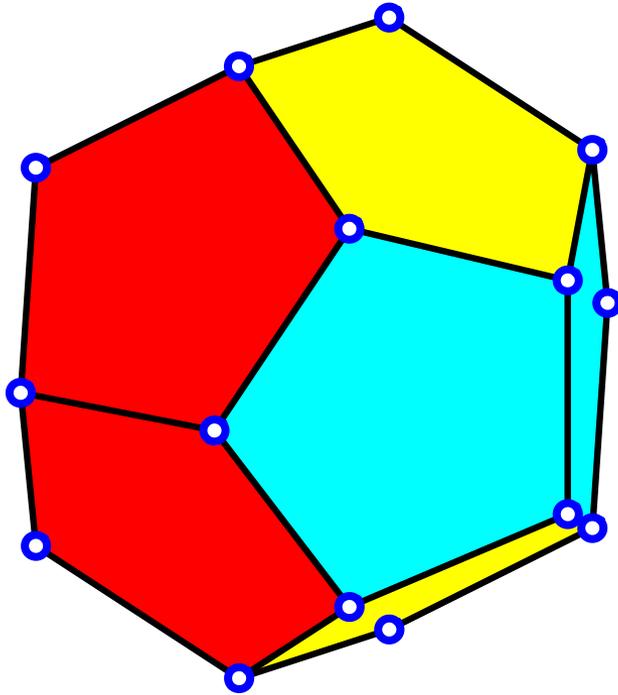


Symmetriegruppe von
Dodekaeder / Ikosaeder
 $A_4 \times Z_2$

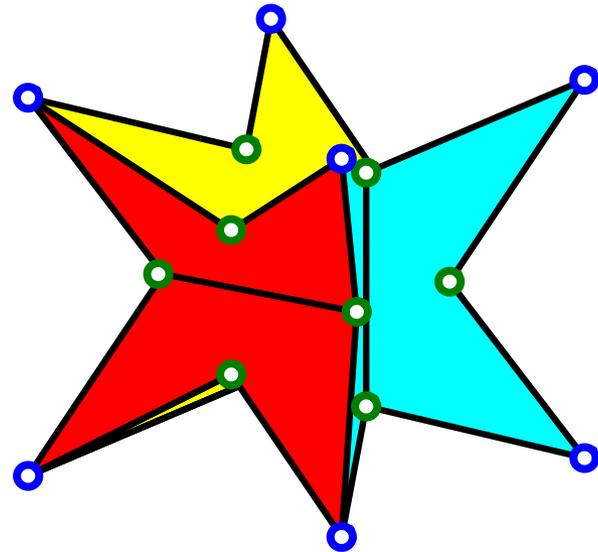


Symmetriegruppe des
Tetraeders
 S_4

Topologie



20 Ecken

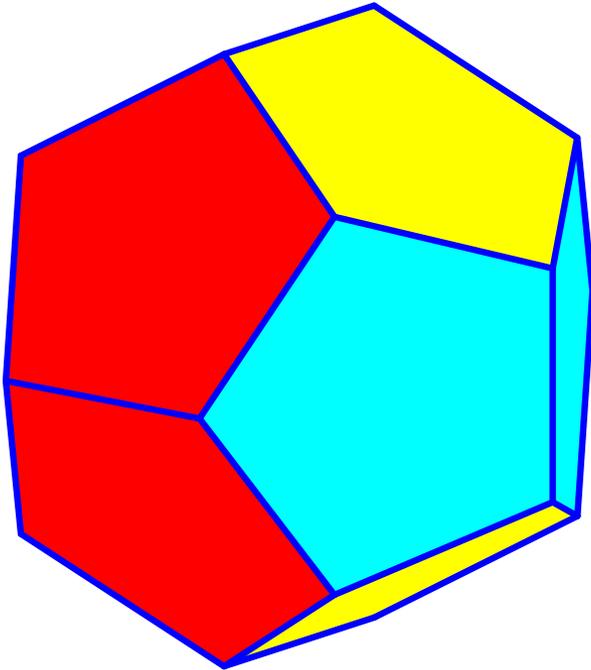


8 + 12 = 20 Ecken

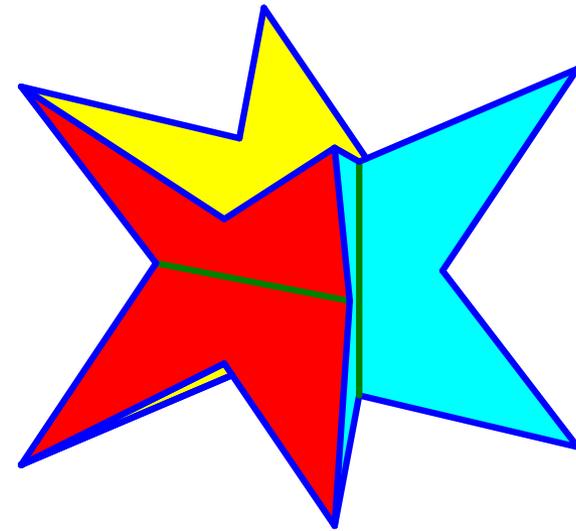
↑
konvex

↑
hyperbolisch

Topologie



20 Ecken
30 Kanten

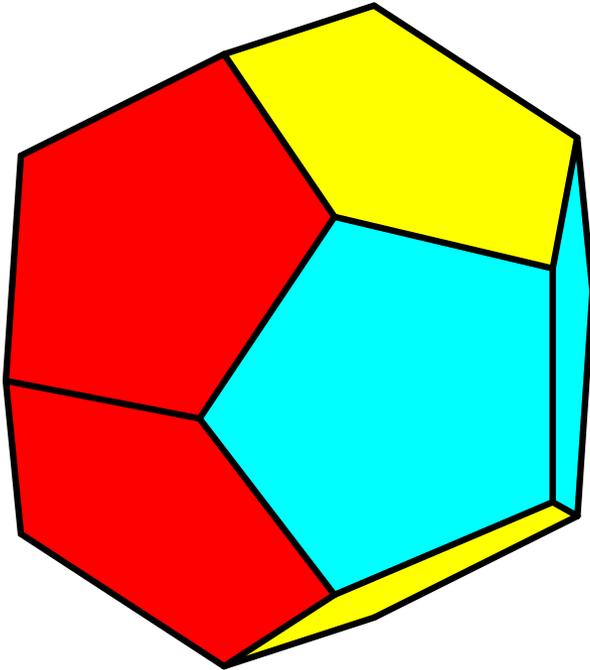


$8 + 12 = 20$ Ecken
 $24 + 6 = 30$ Kanten

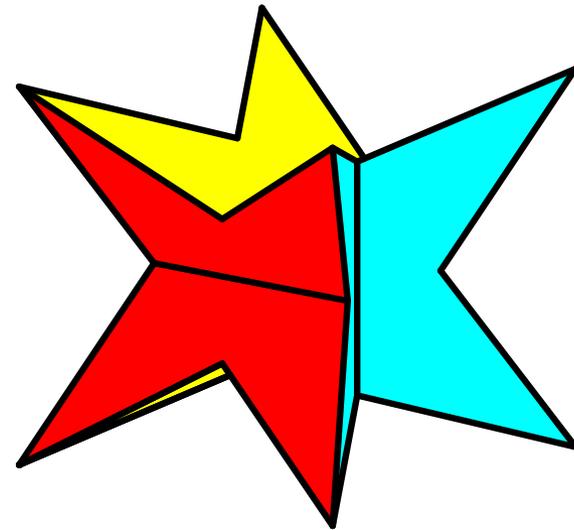
↑
konvex

↑
„Talsohlen“

Topologie

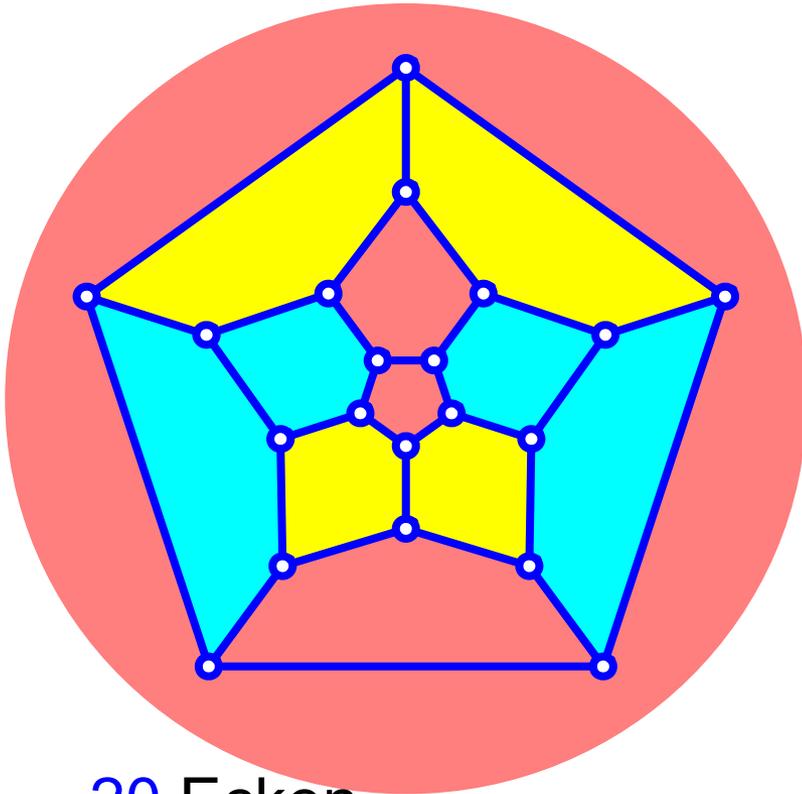


20 Ecken
30 Kanten
12 Flächen (regulär)

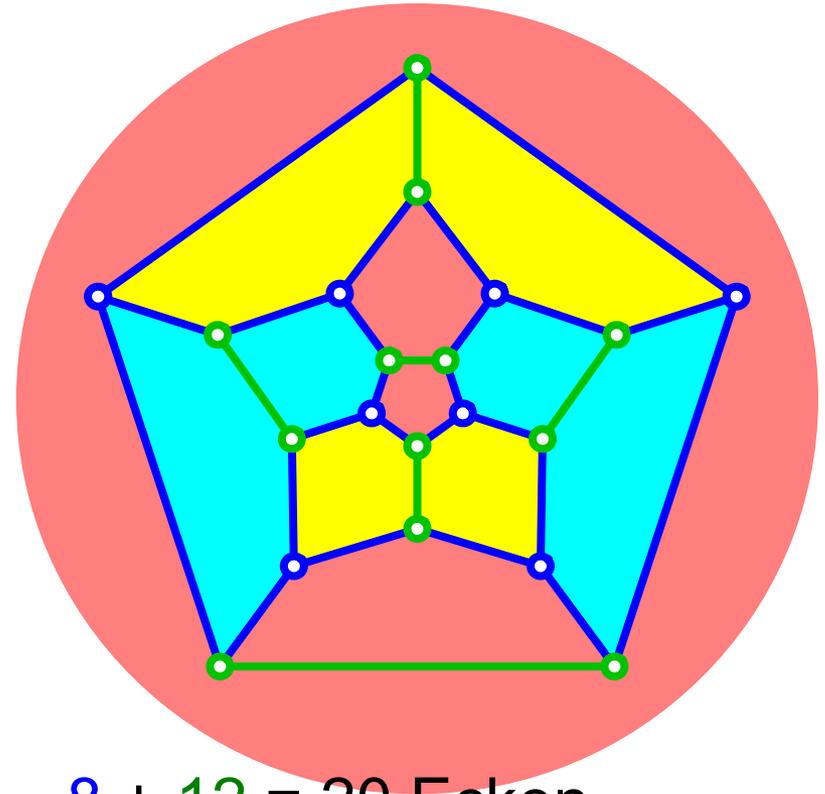


$8 + 12 = 20$ Ecken
 $24 + 6 = 30$ Kanten
12 Flächen (halbregulär)

Topologie



20 Ecken
30 Kanten
12 Flächen (regulär)

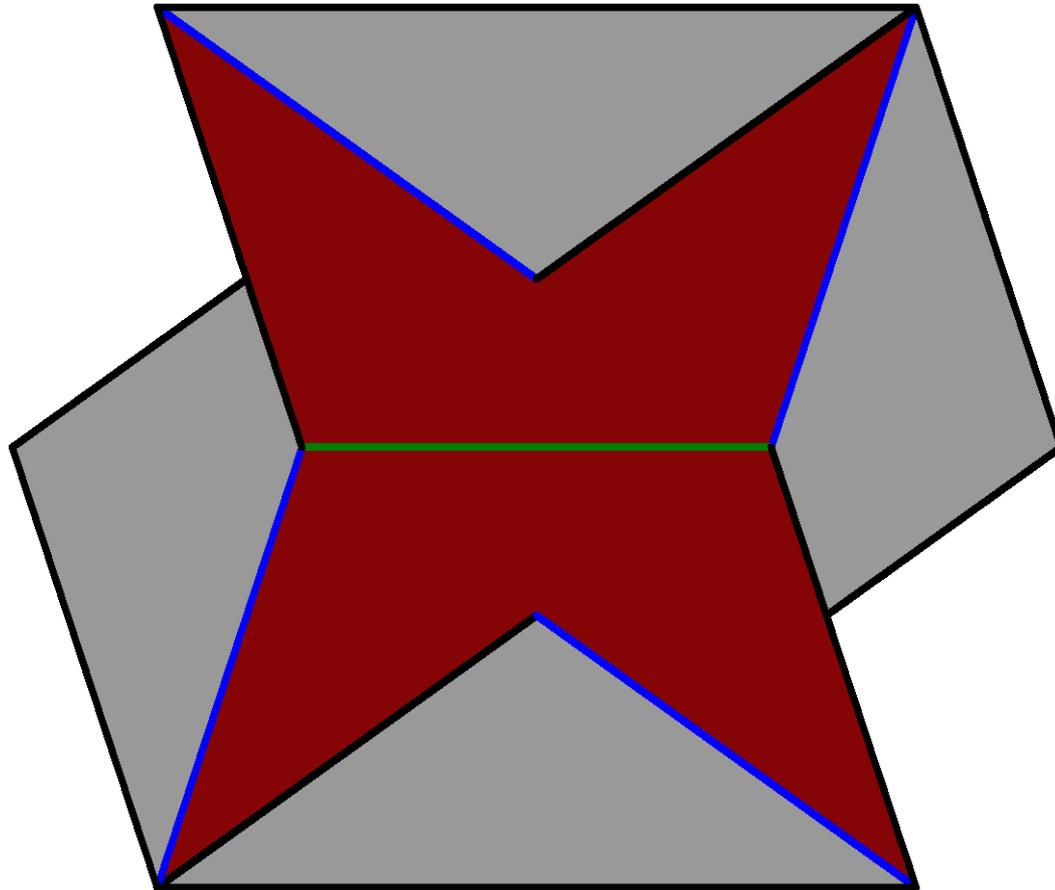


$8 + 12 = 20$ Ecken
 $24 + 6 = 30$ Kanten
12 Flächen (halbregulär)

Papiermodell ohne Leim



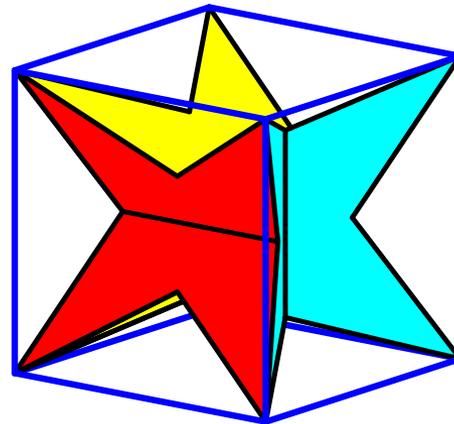
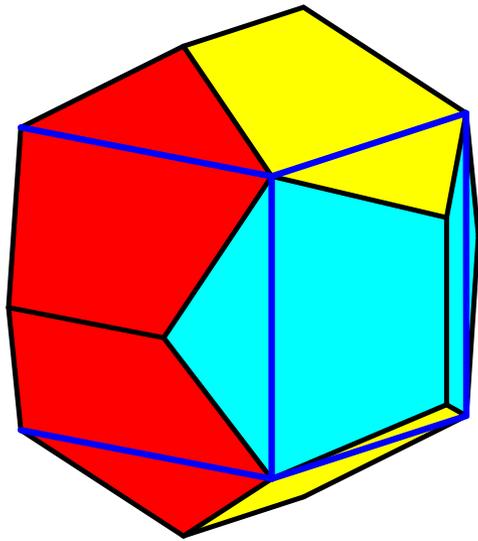
Schnittmuster für Doppelfläche



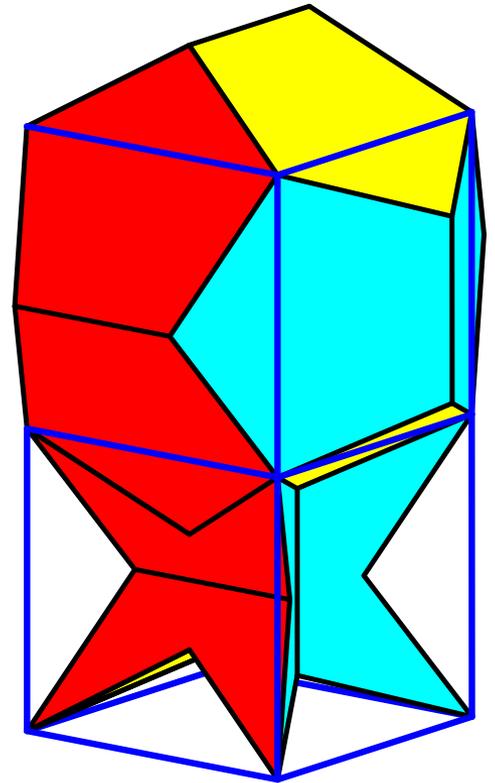
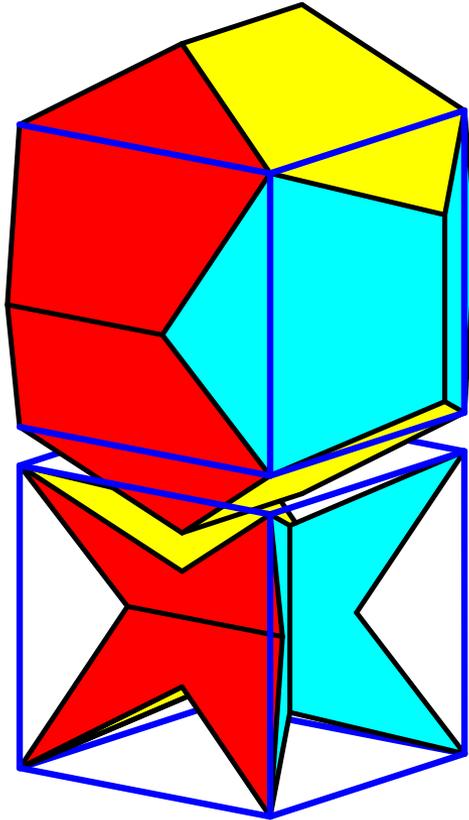
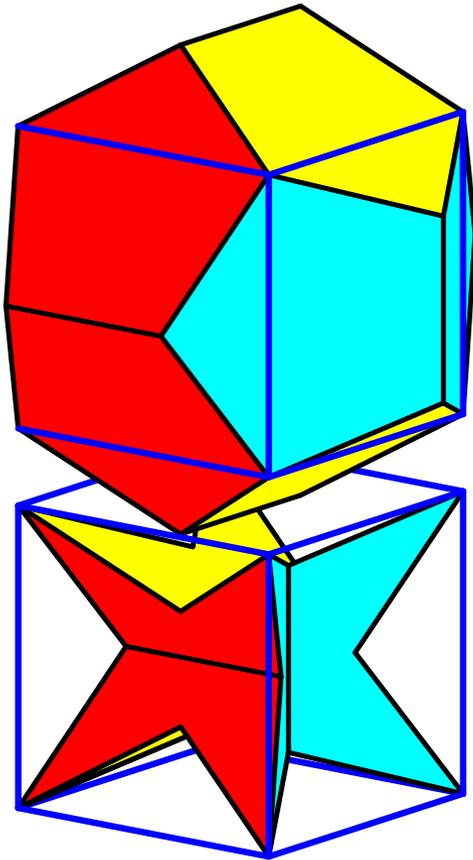
Schwarz: Schneiden
Grau: Einstecklasche

Blau: Bergfalt
Grün: Talfalt

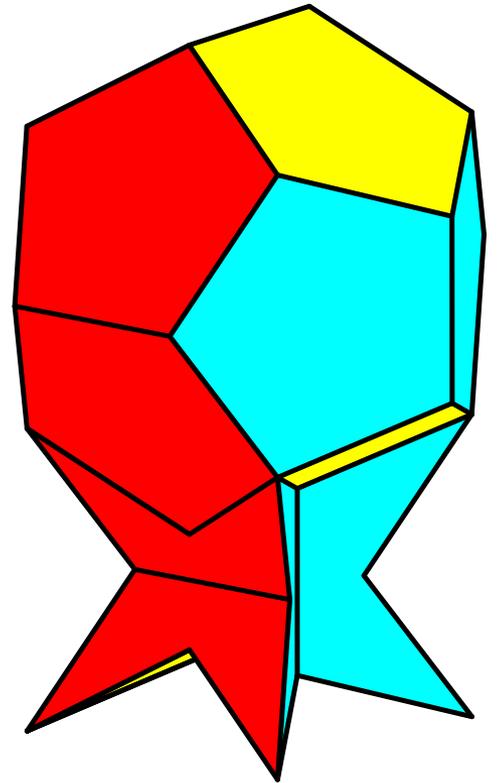
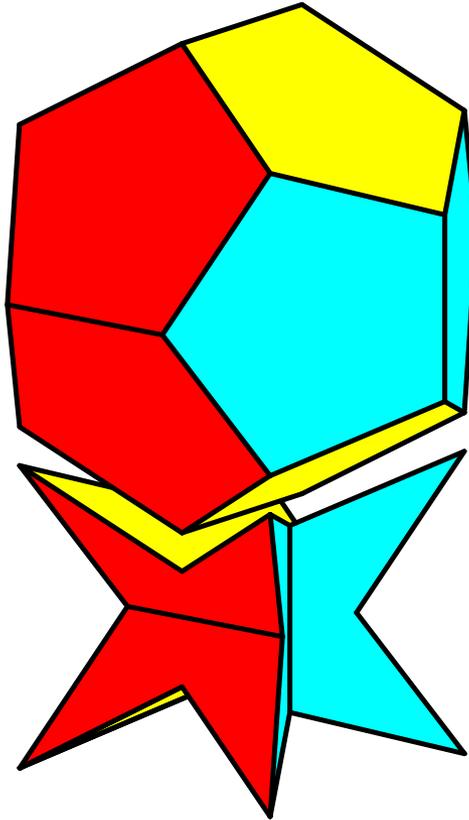
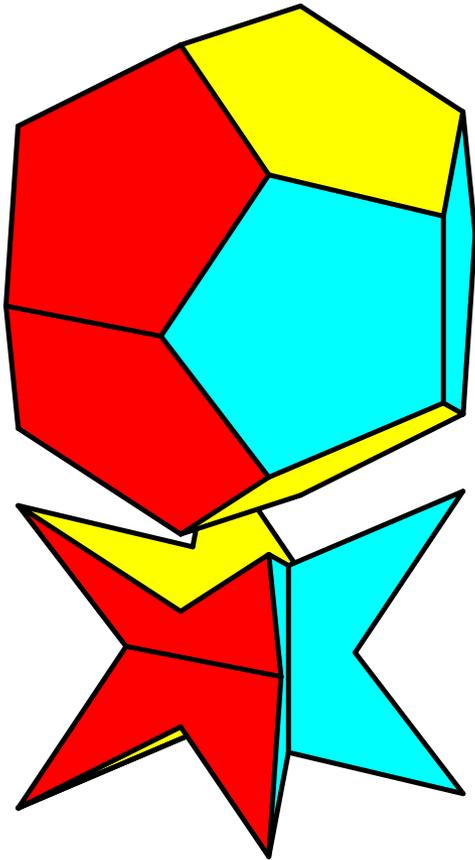
Relation zum Würfel



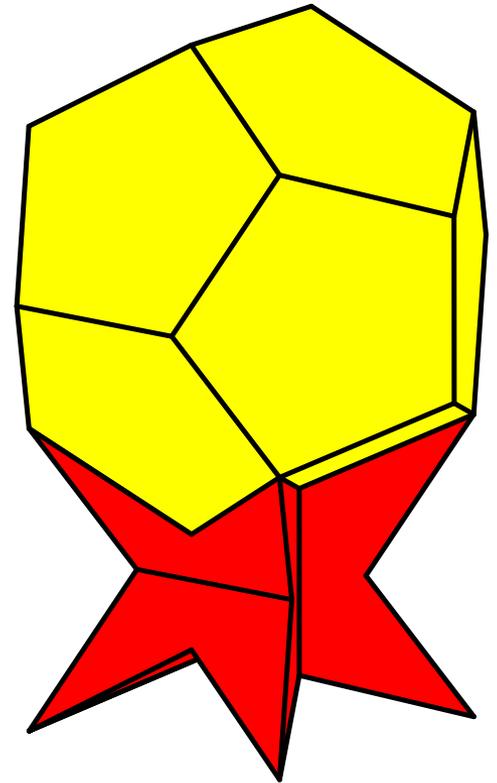
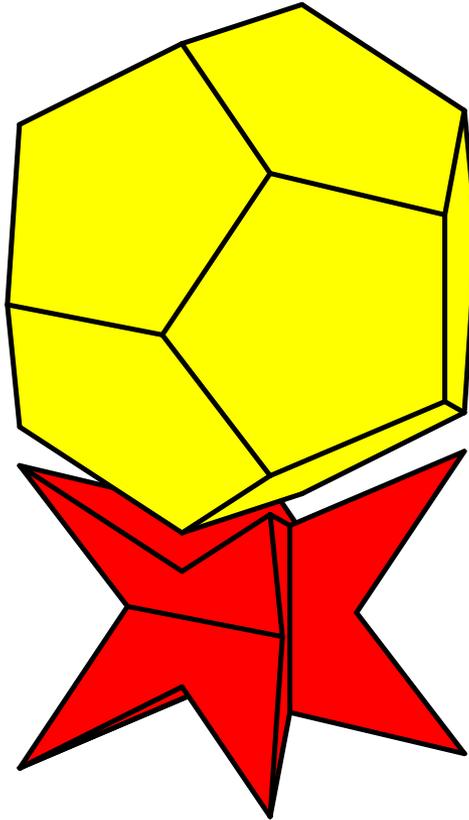
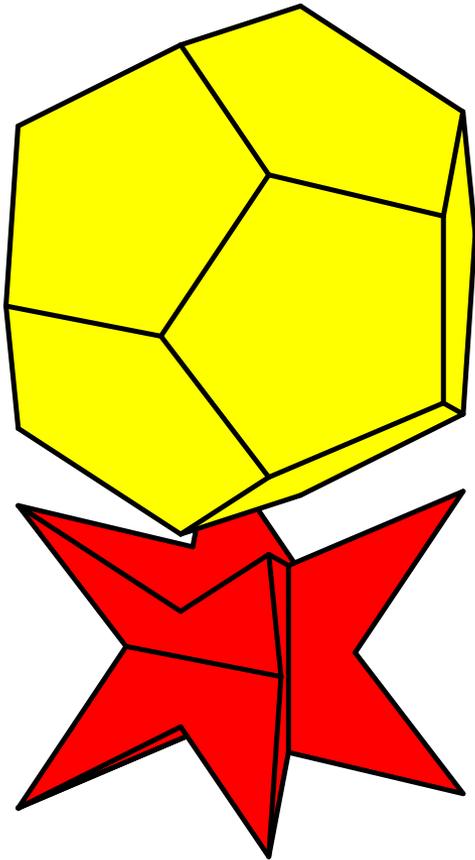
Relation zum Würfel



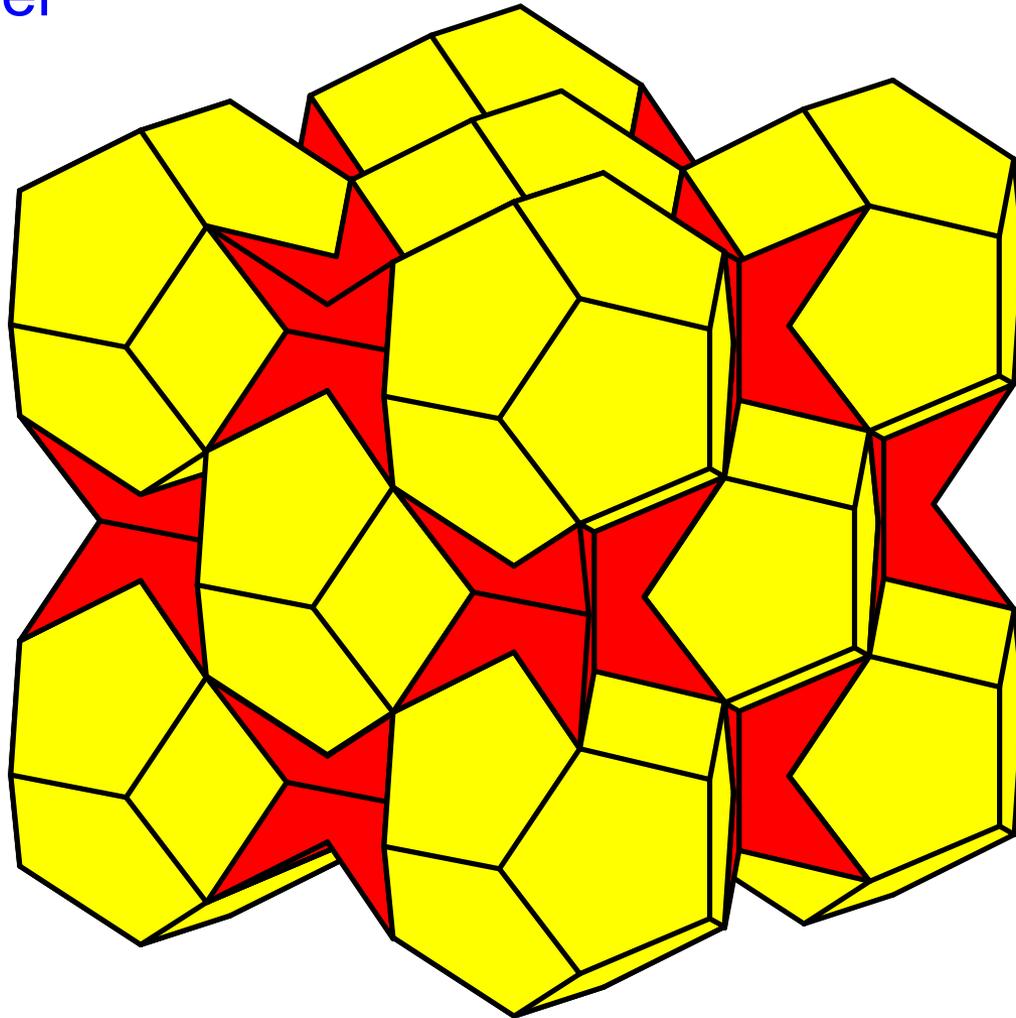
Relation zum Würfel



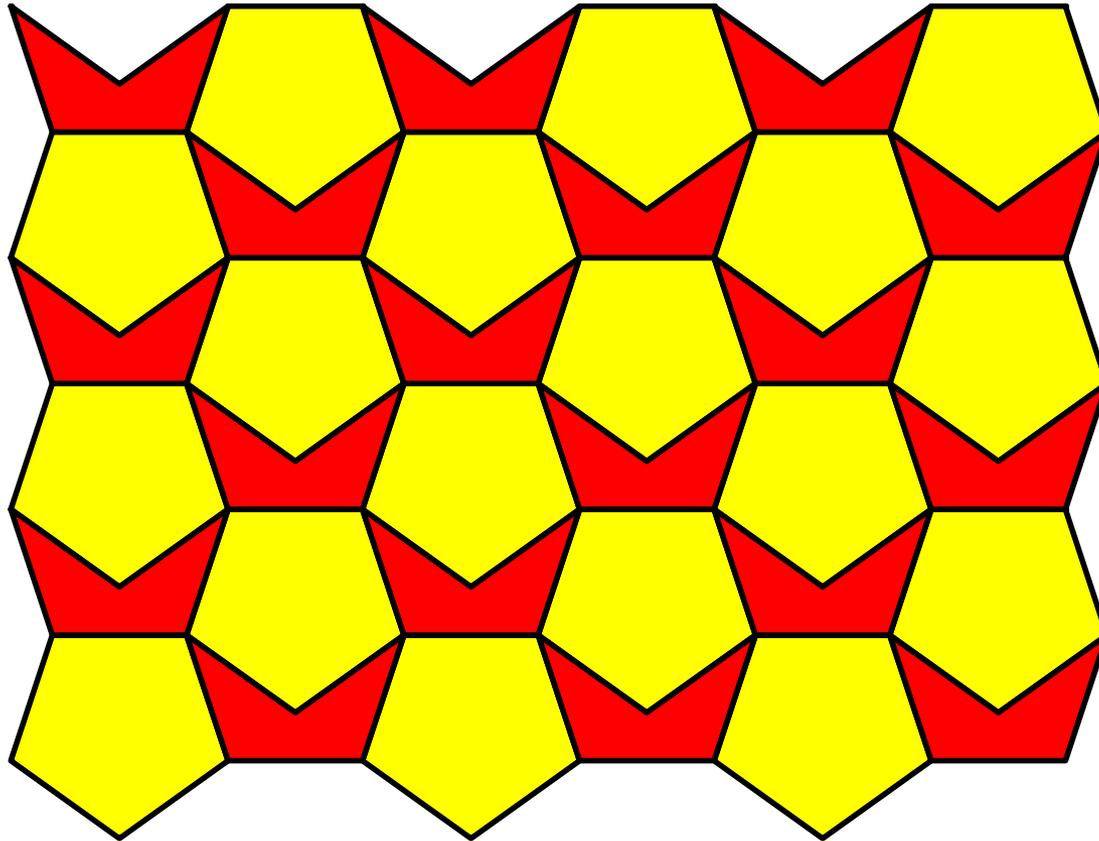
Ei und Eierbecher



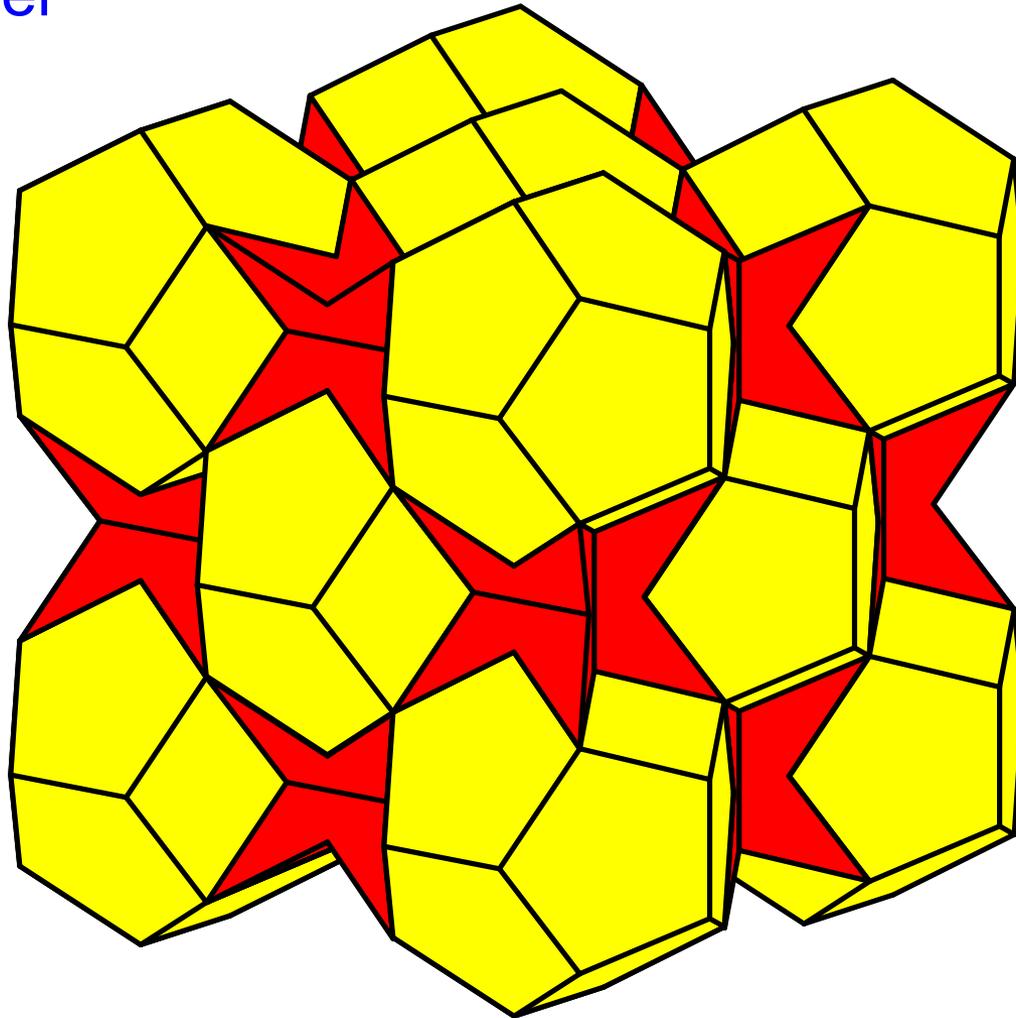
Raumfüller



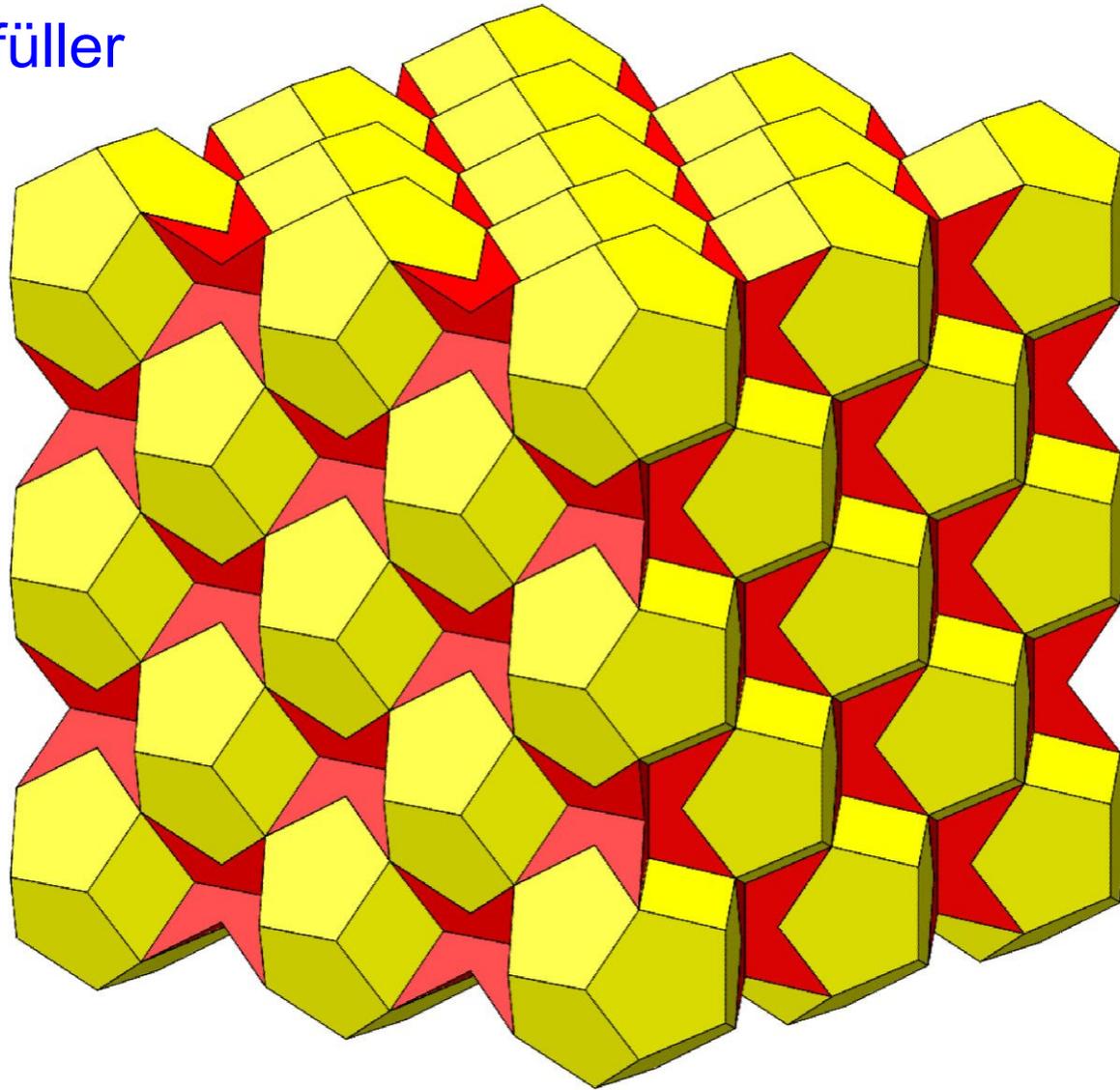
Erinnerung: Reguläre und halbreguläre Fünfecke



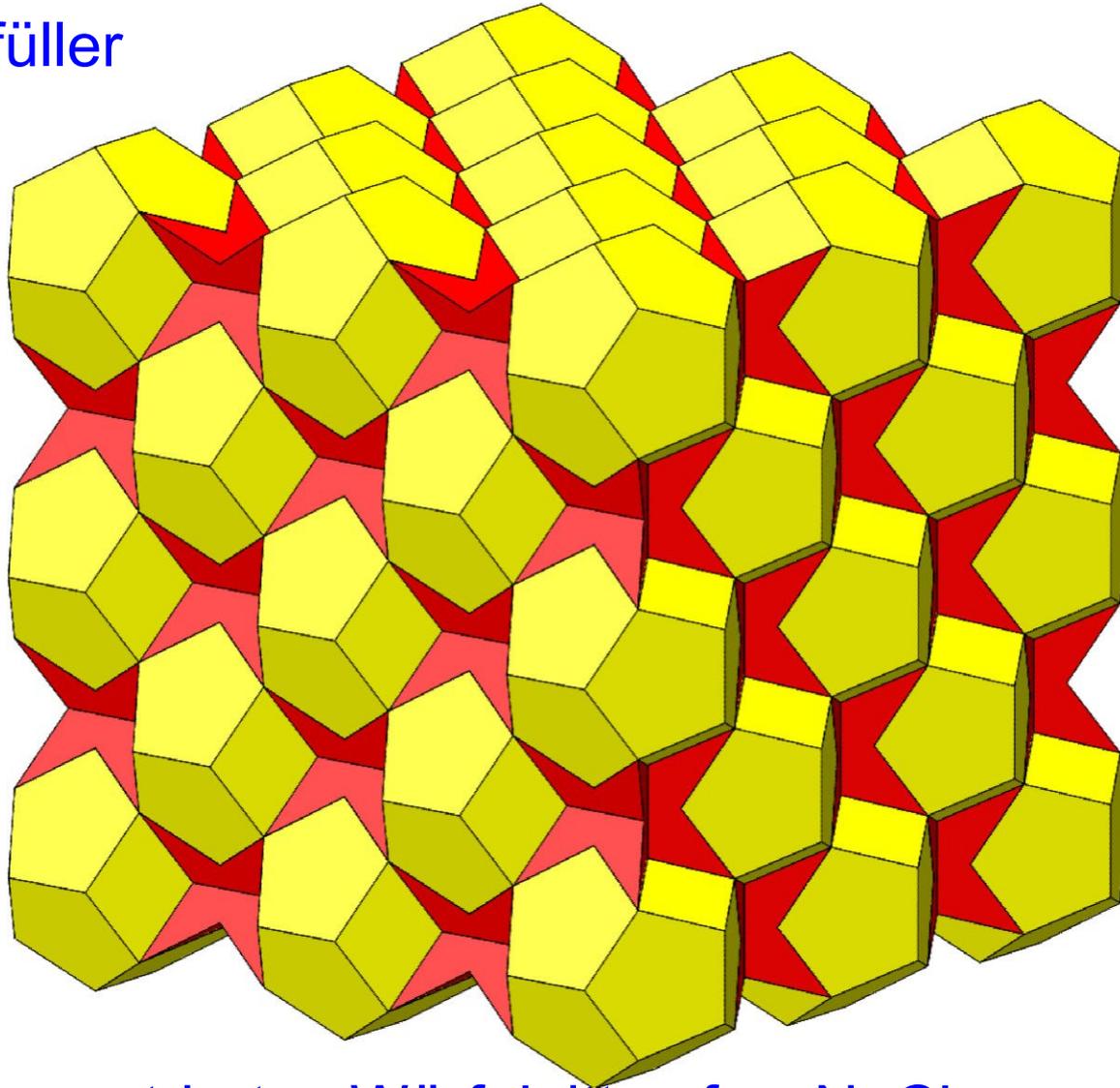
Raumfüller



Raumfüller

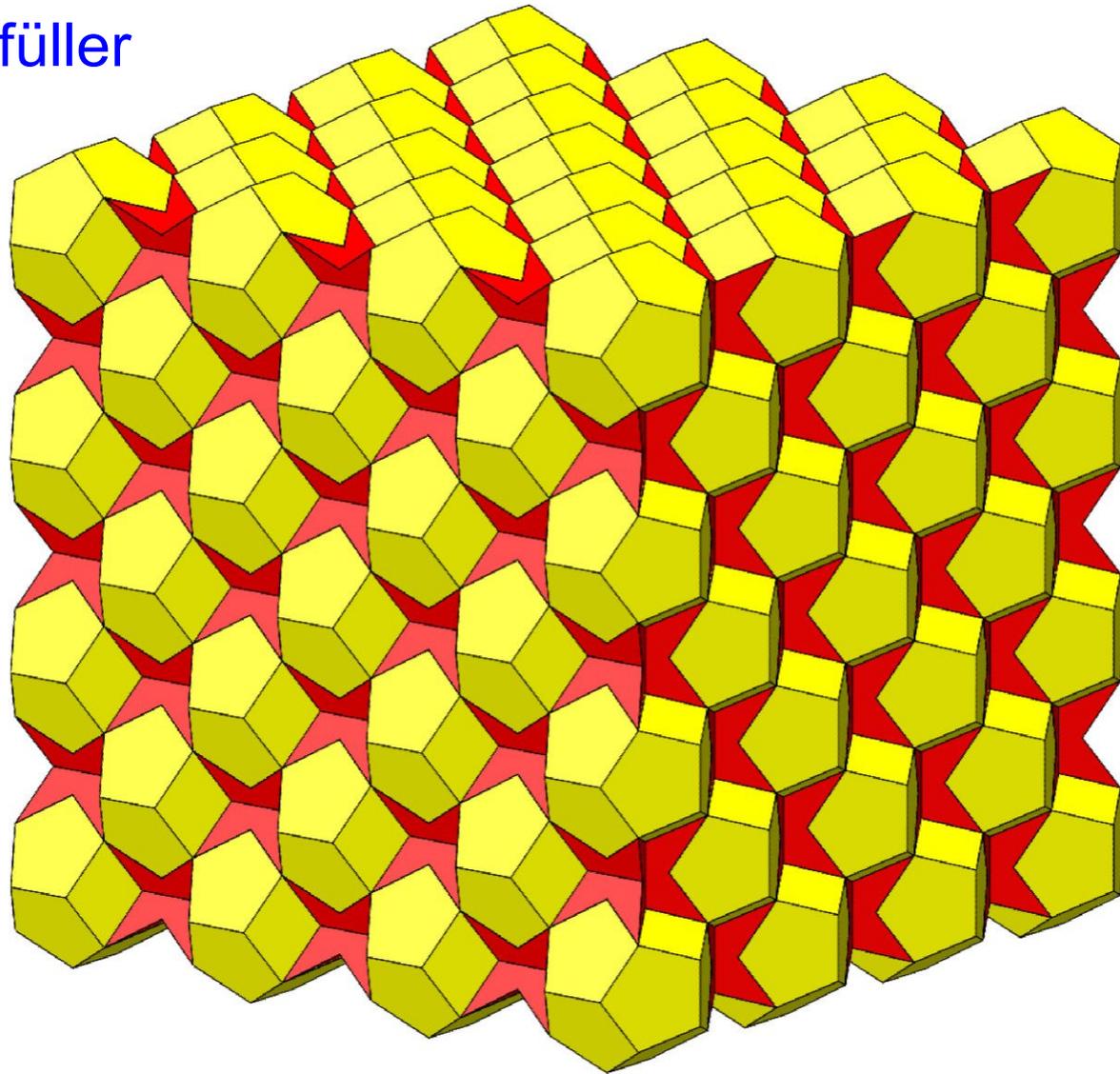


Raumfüller

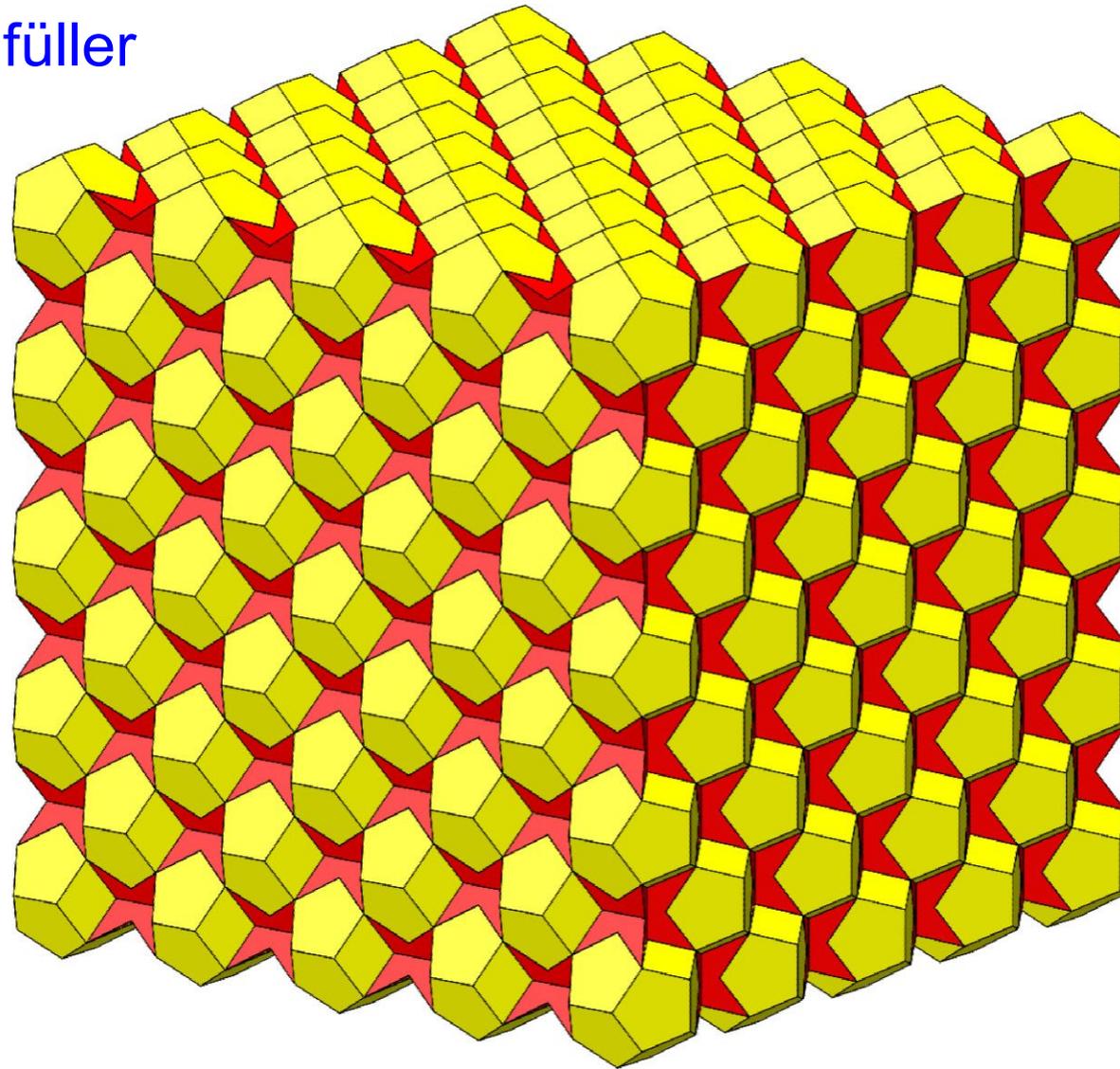


Flächenzentriertes Würfelgitter, fcc, NaCl

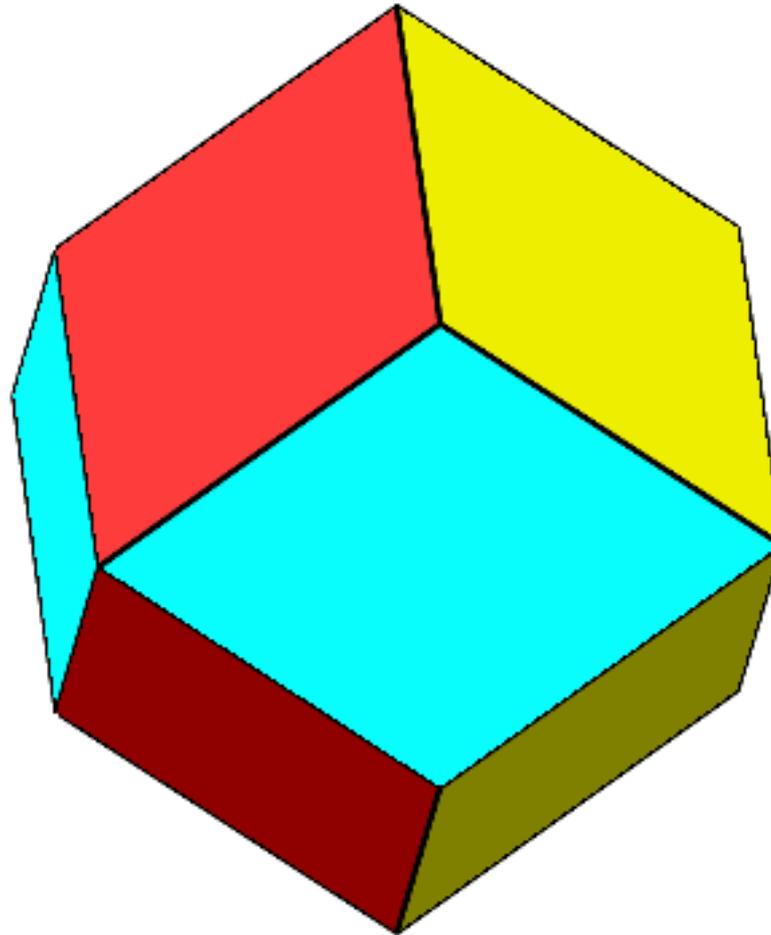
Raumfüller



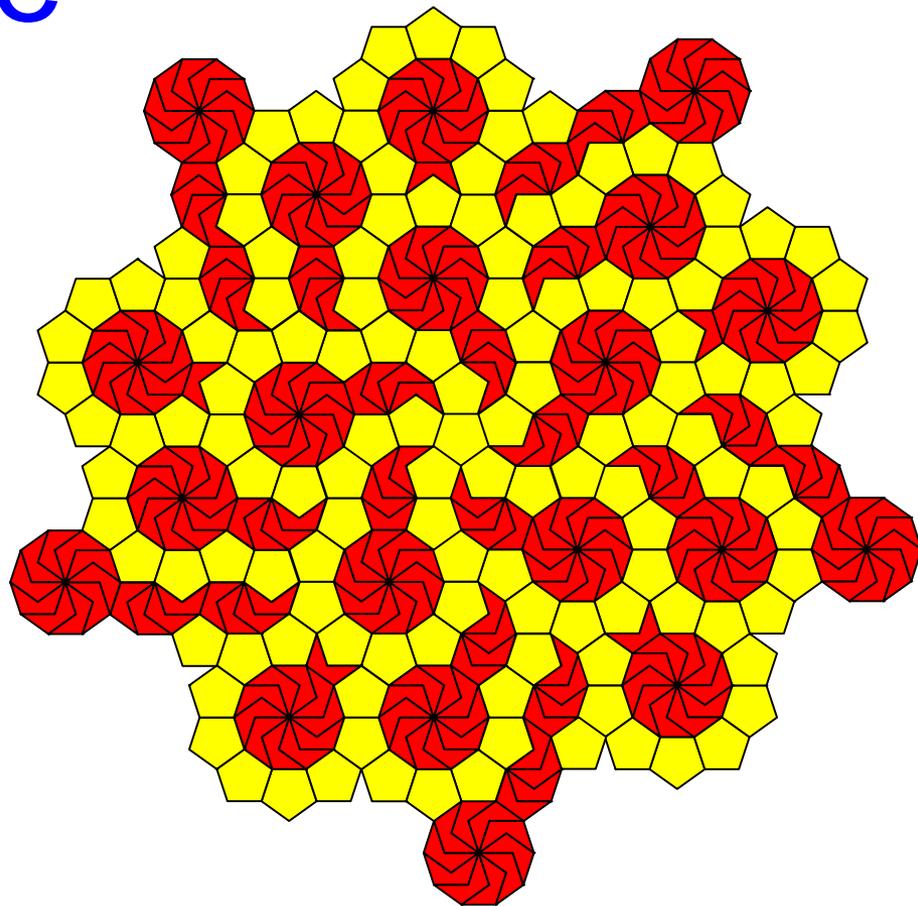
Raumfüller



Transformationen



Danke



www.walser-h-m.ch/hans/Vortraege/20240208