Transcomputation

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Agenda

- Rotation
- Angle
- Polar-transcomplex numbers

Rotation

Rotation

$$\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} x' \\ y' \end{bmatrix}$$

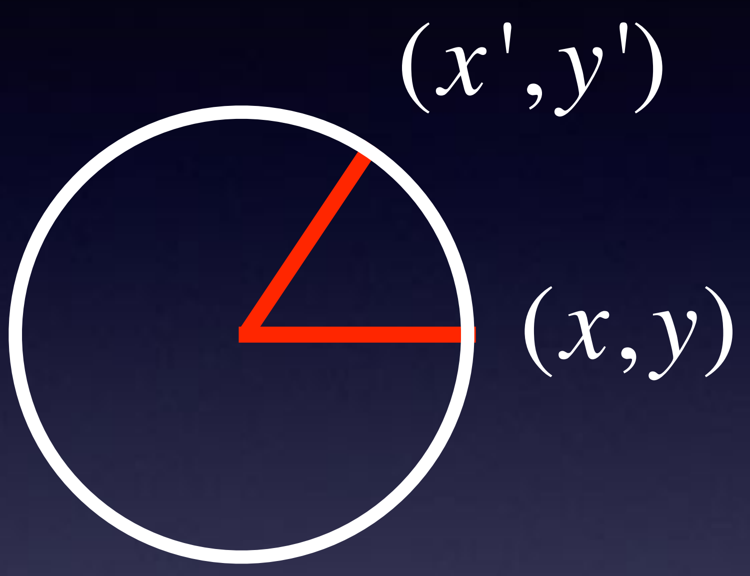
- A point (x,y) is rotated by the angle θ to the point (x',y') by the above matrix
- But we know $\sin\theta = \cos\theta = \Phi$ when $\theta \in \{-\infty, \infty, \Phi\}$
- So what does a non-finite rotation do?

Quiz

- You now know about transreal arithmetic and all transreal rotations so what kinds of software could you totalise?

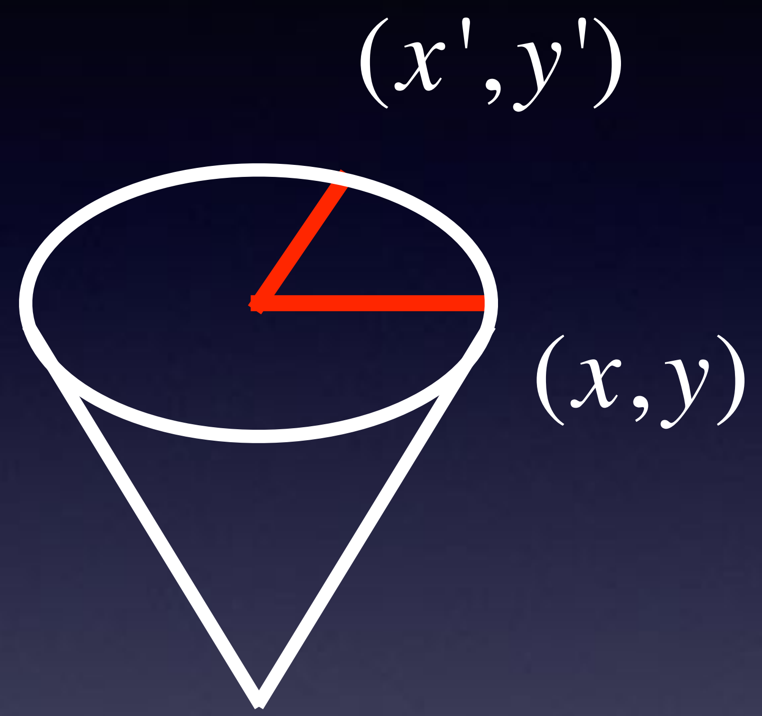
Angle

Angle



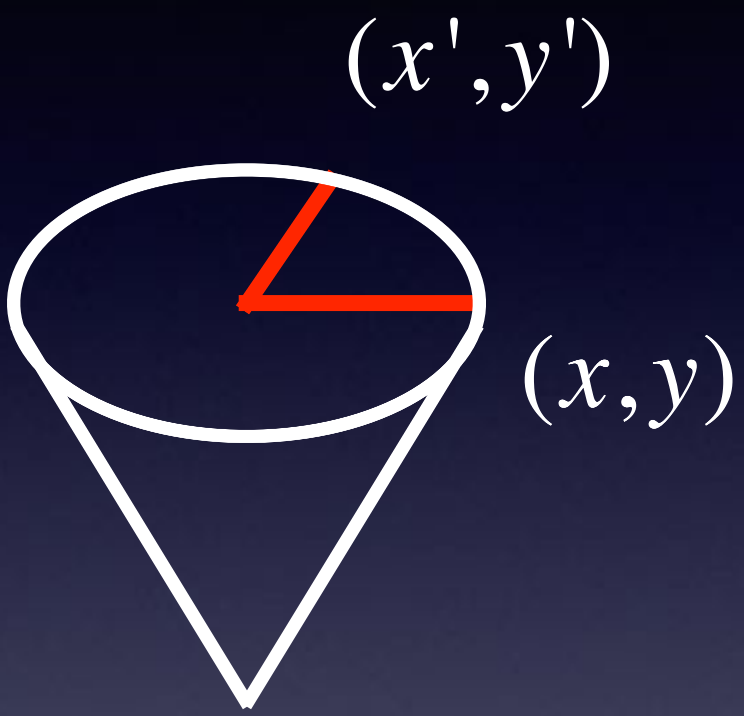
- Real angle is defined via the relationship arc length divided by non-zero radius
- What is the transreal angle when the radius is zero?

Angle



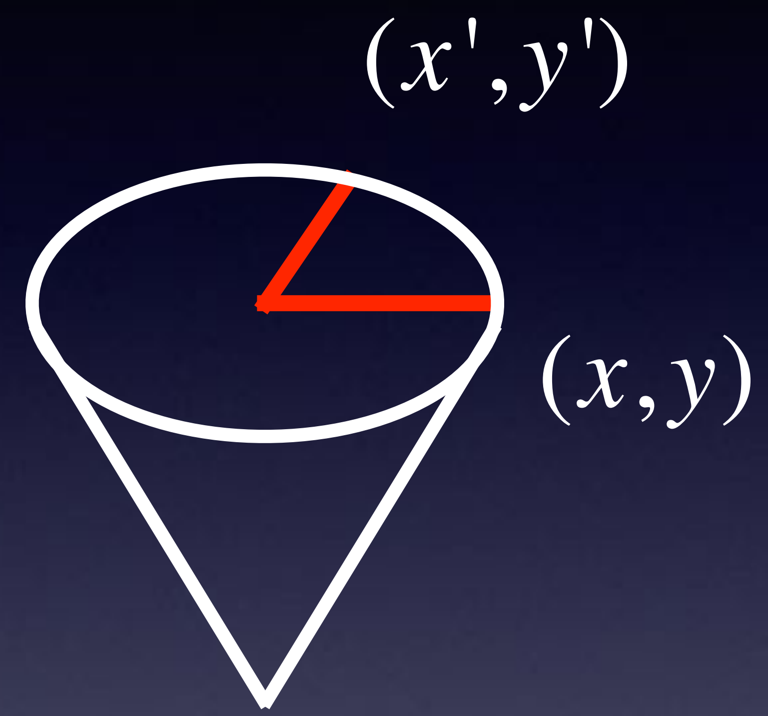
- Lay off a rotation of angle θ in the base of a unit cone using an arc of non-zero length

Angle



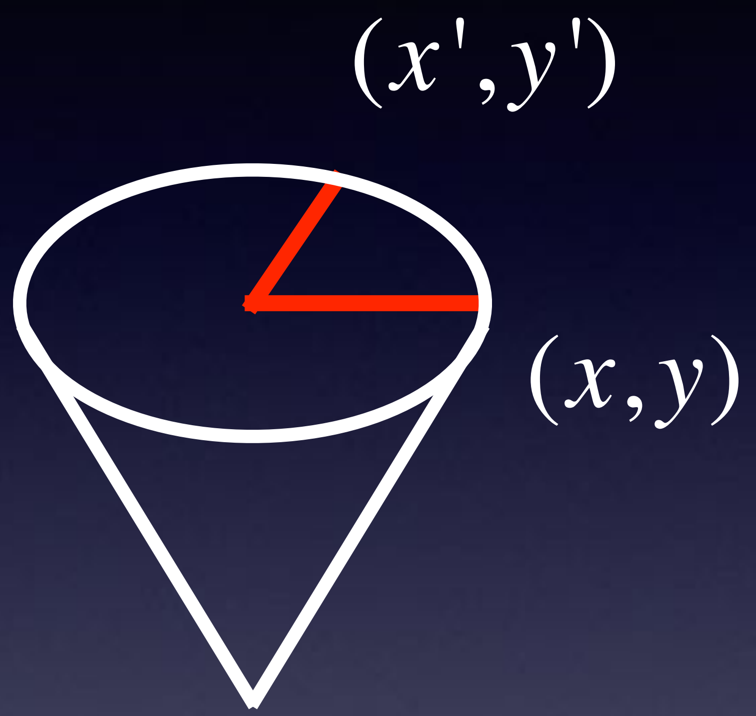
- Lay off a rotation of angle $2k\pi+\theta$ by winding the given arc on the surface of the cone

Angle



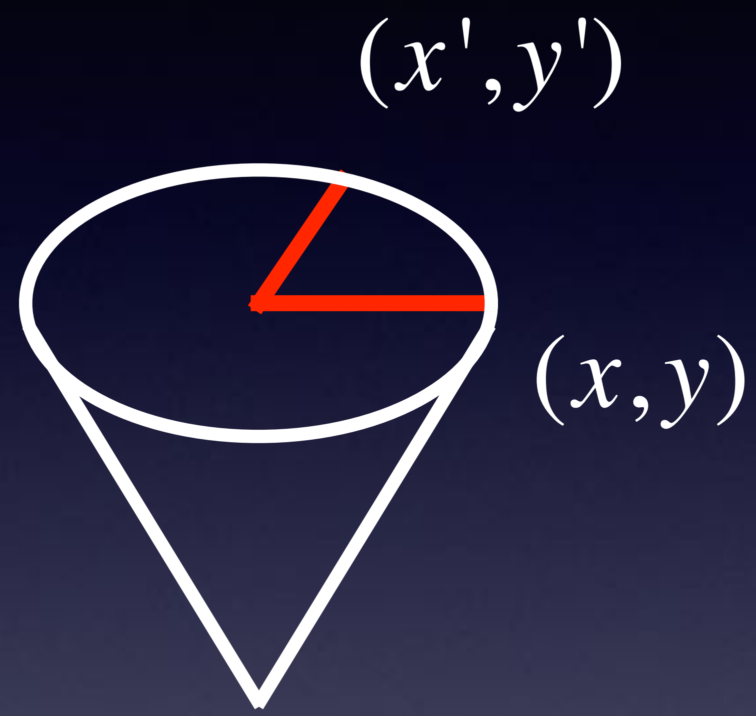
- As k increases, what happens to the position of the winding?

Angle



- What is the value of k at the apex of the cone?

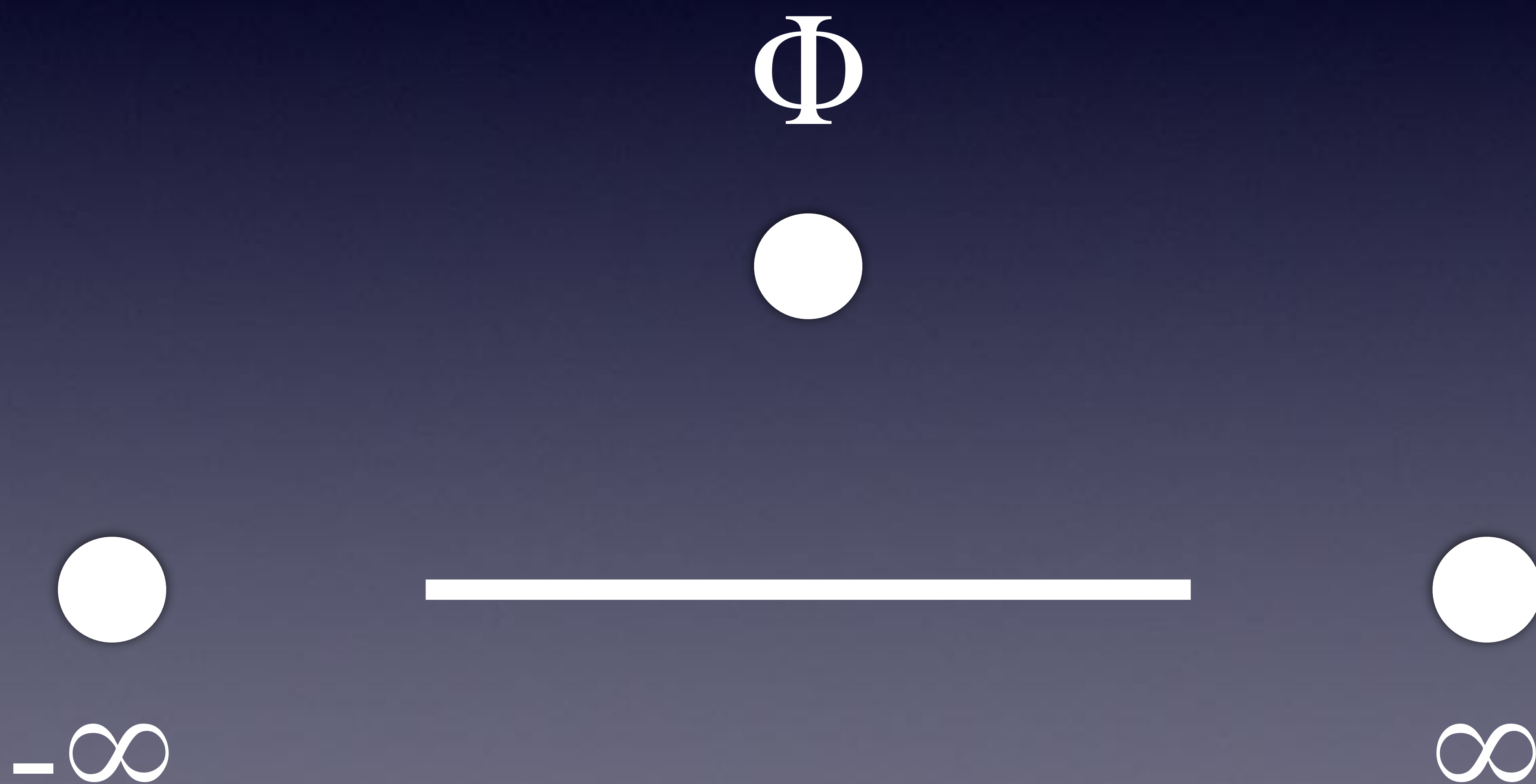
Angle



- All transreal angles can be defined via the unit real cone

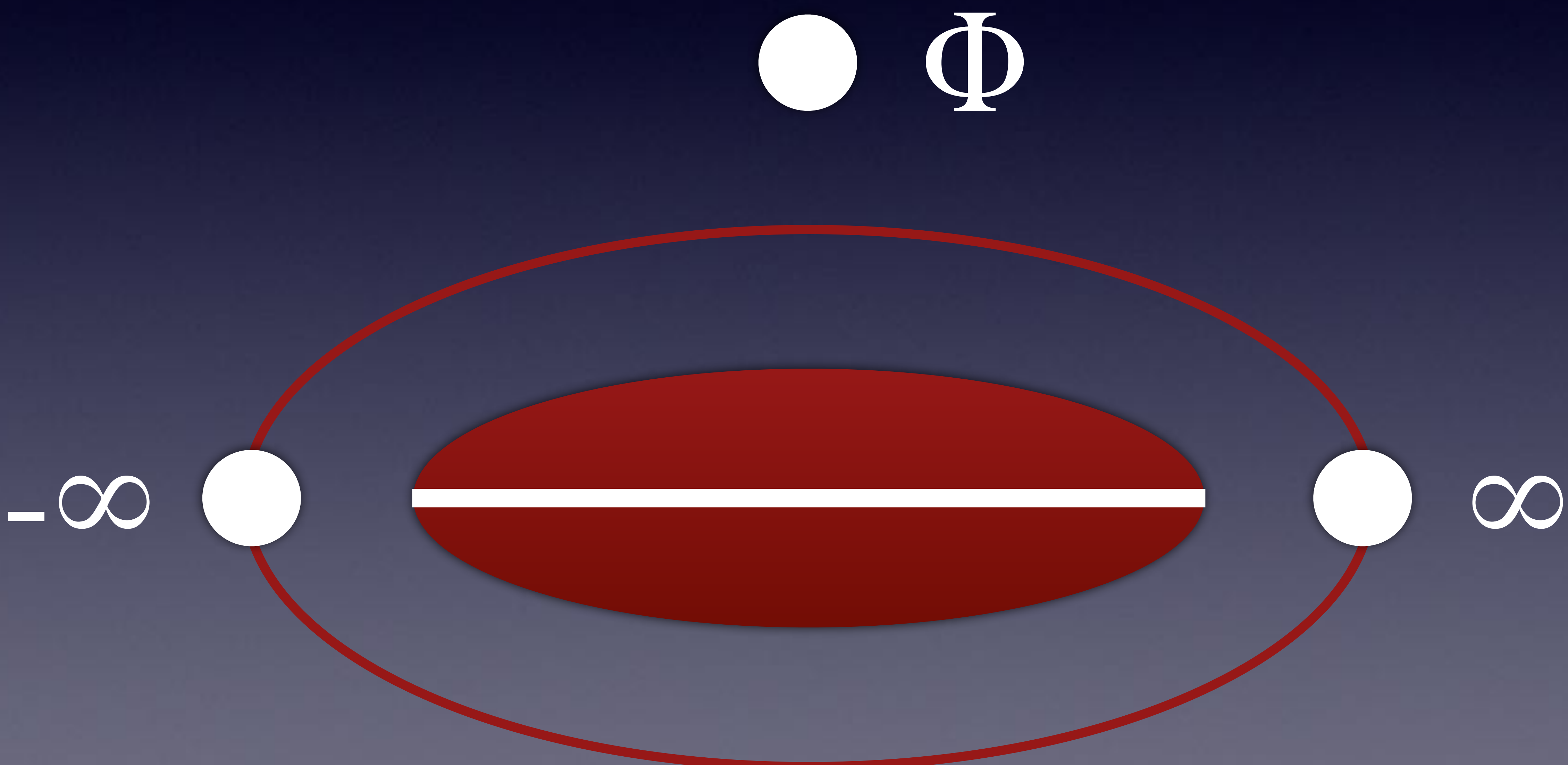
Polar-transcomplex numbers

Transreal number line

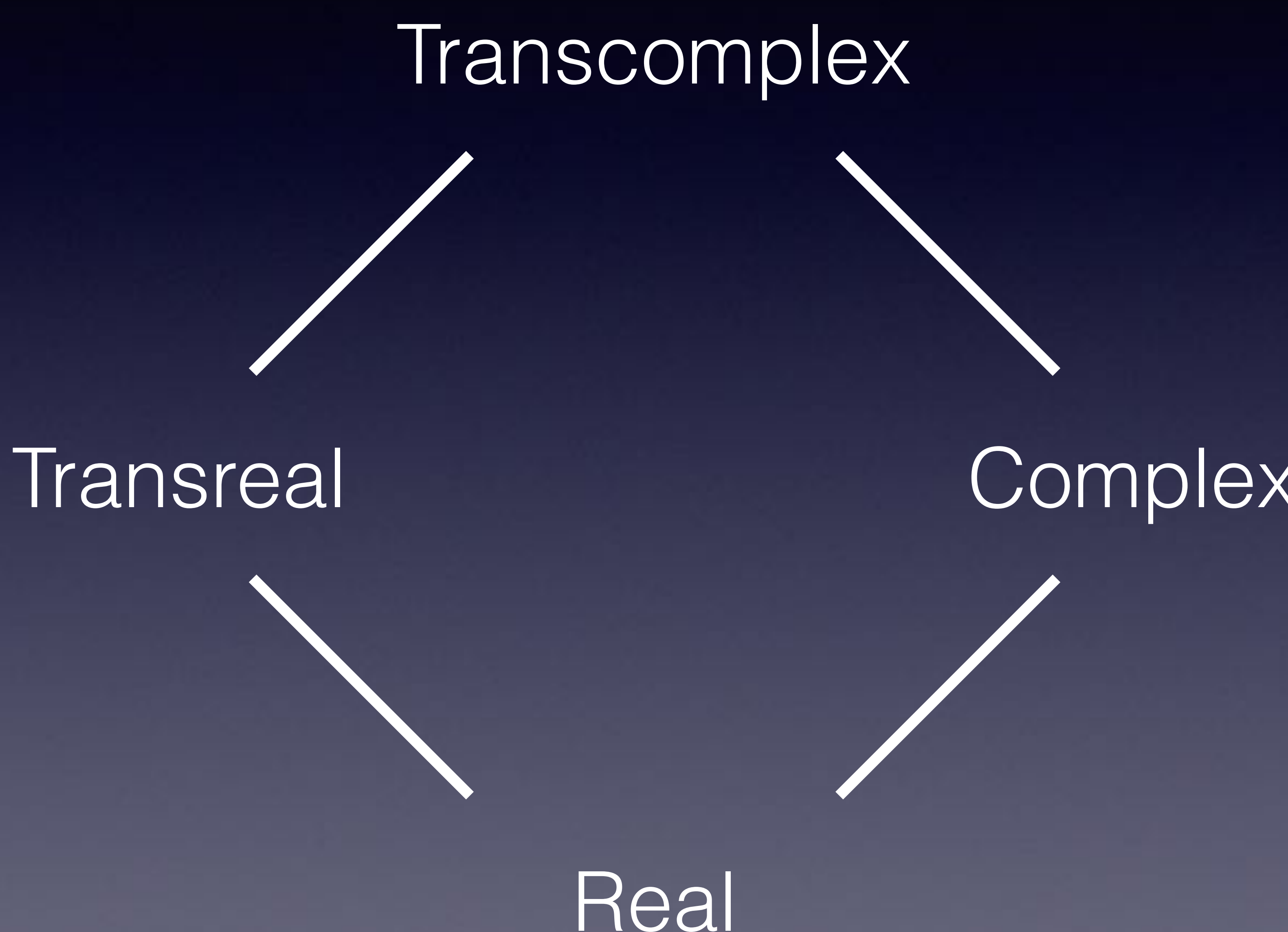


Transcomplex plane

Revolution of the transreal number line

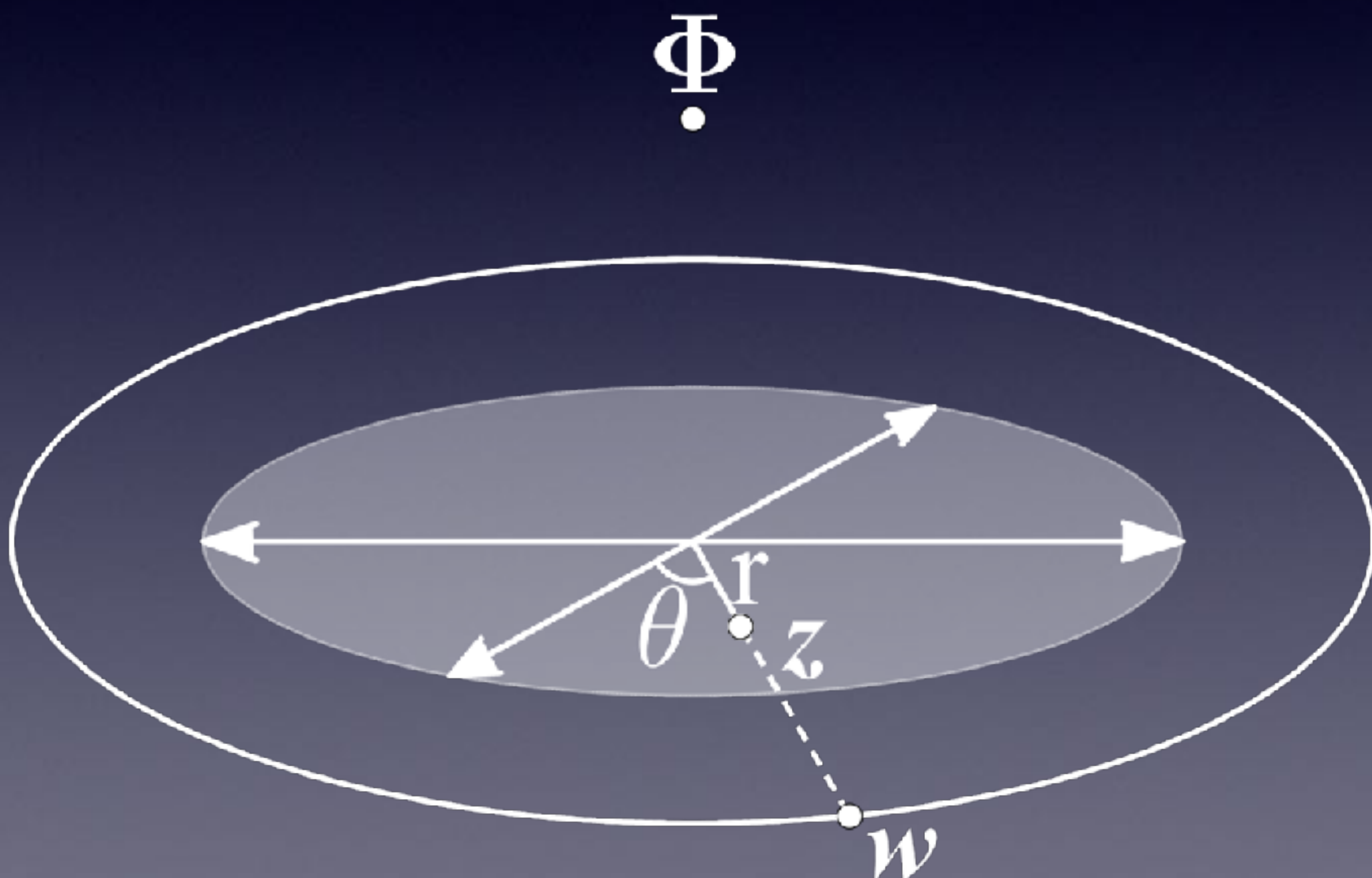


Containment



Construction

$$\mathbb{C}^T = \mathbb{C} \cup \left\{ (\infty, \theta);\ \theta \in (-\pi, \pi] \right\} \cup \{\Phi\}$$



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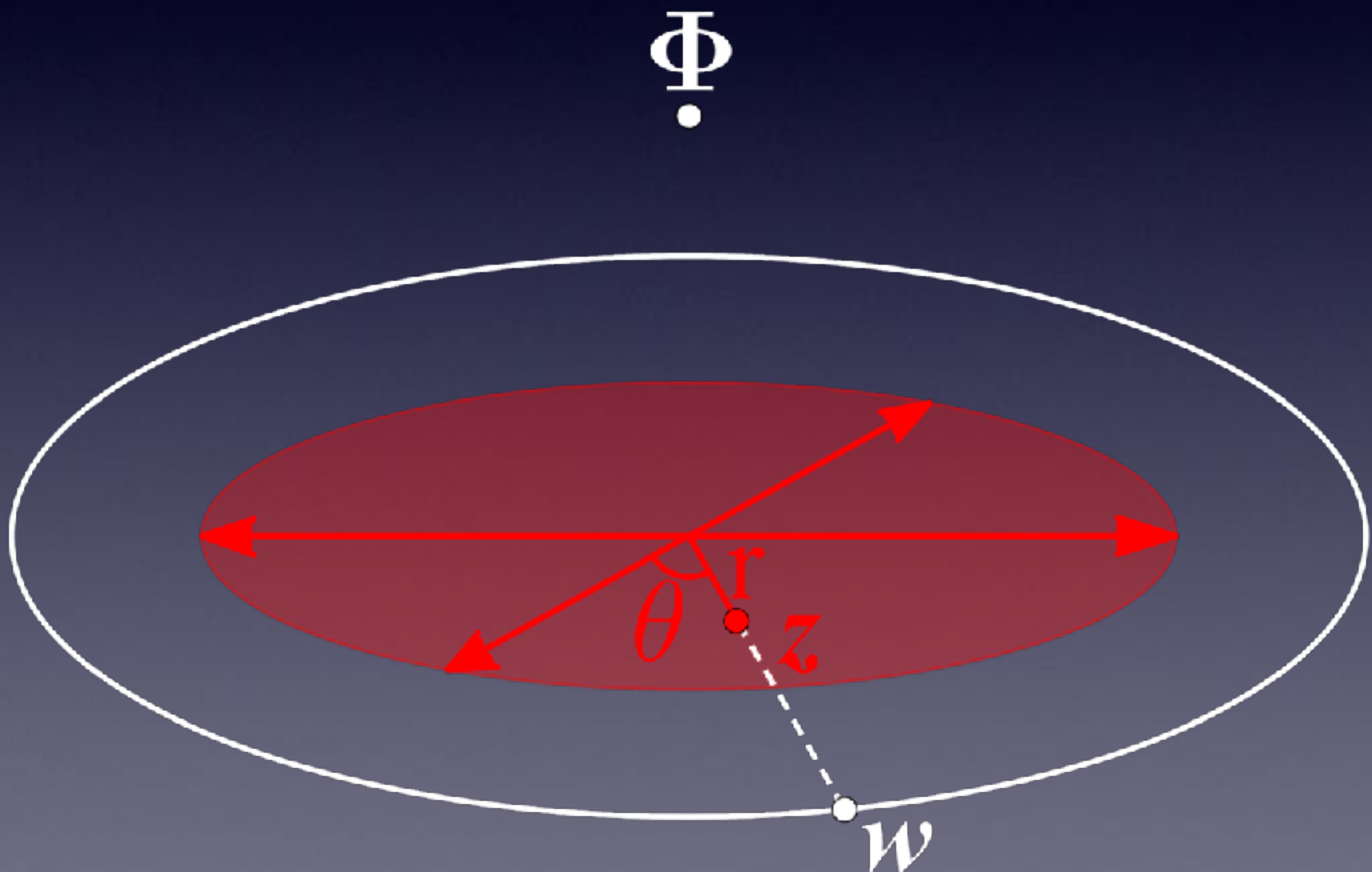

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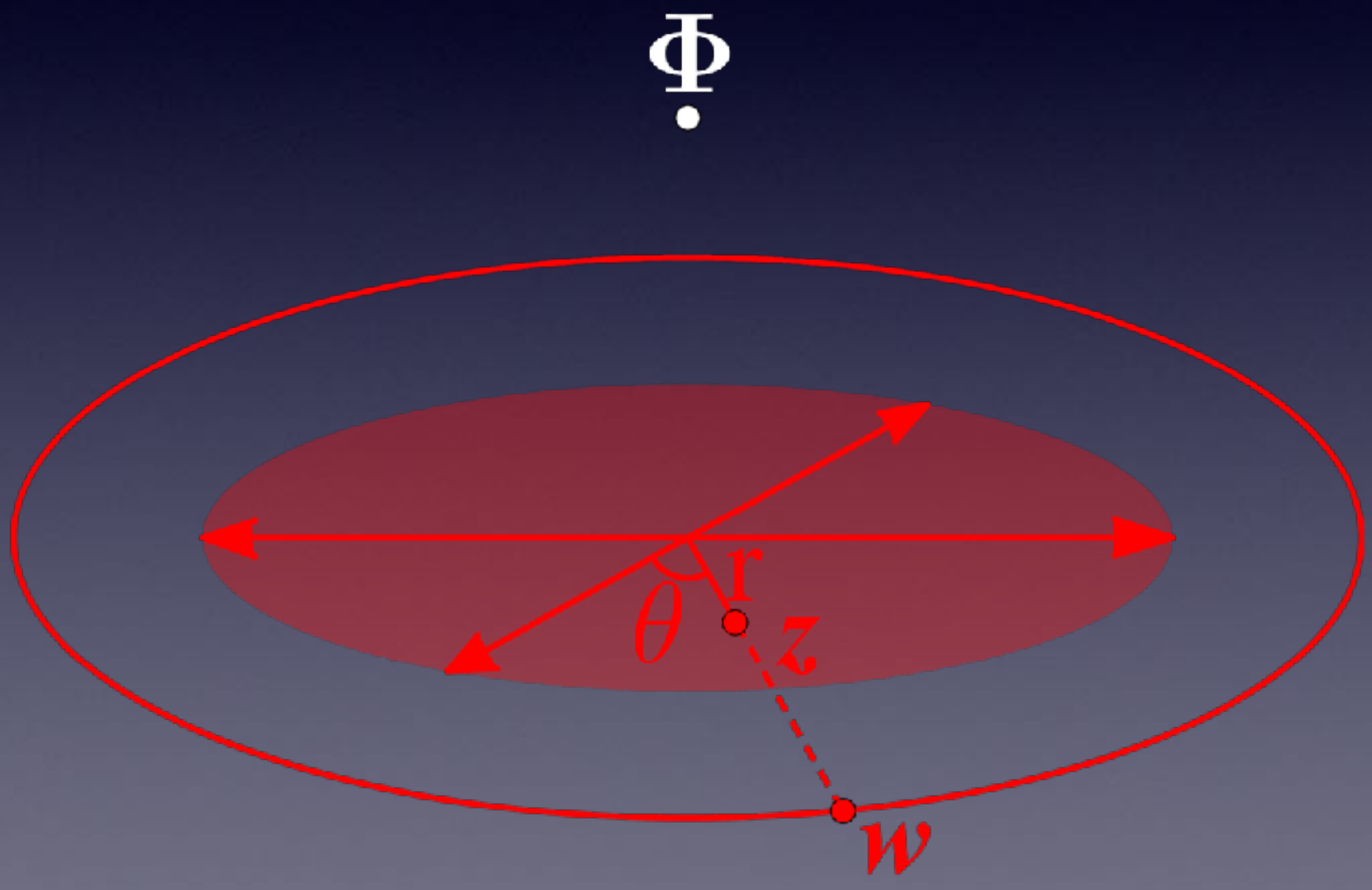

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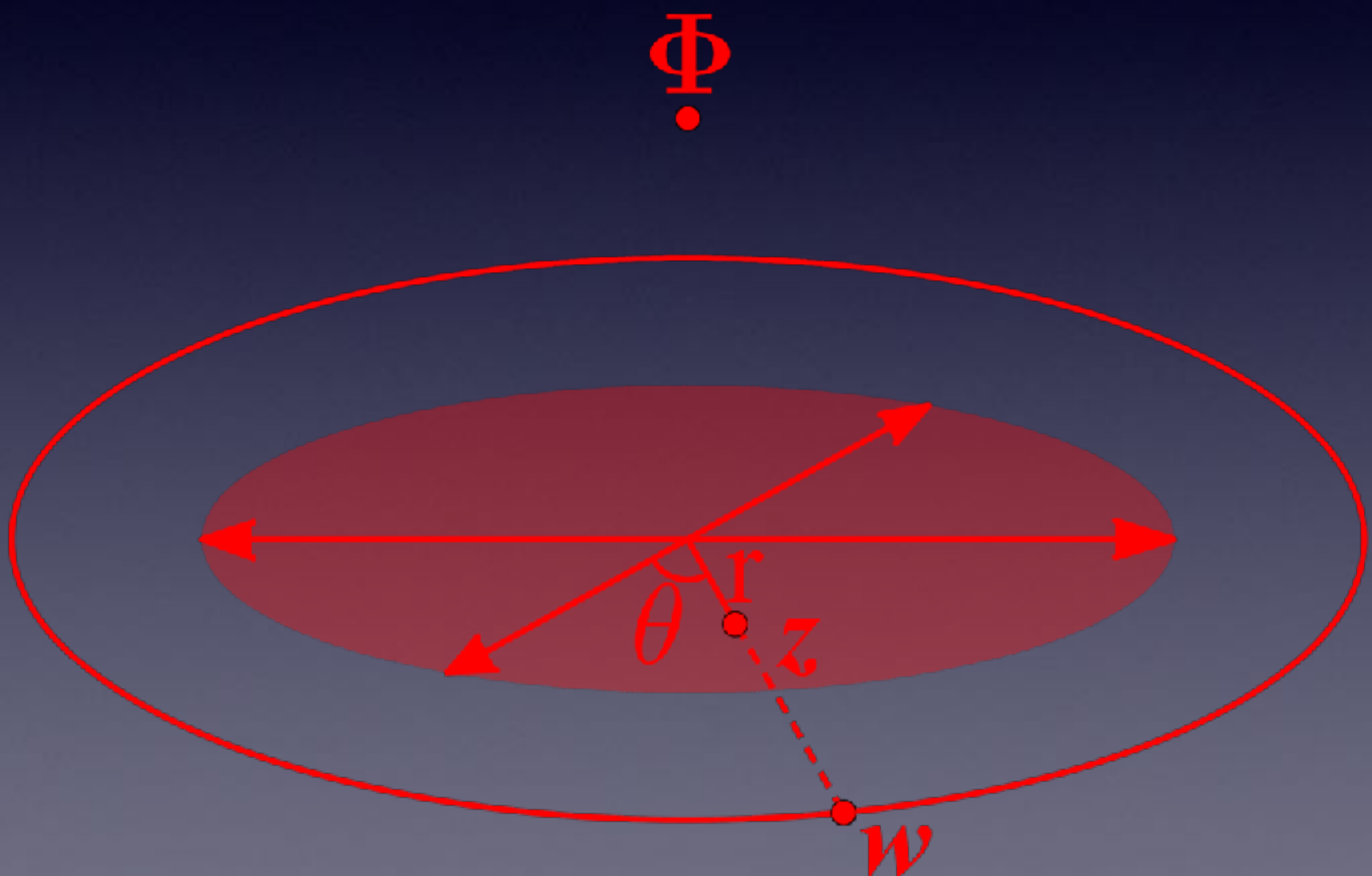

Arithmetic

- $(r_1, \theta_1) \times (r_2, \theta_2) = (r_1 r_2, \theta_1 + \theta_2)$
- $(r_1, \theta_1) \div (r_2, \theta_2) = (r_1 / r_2, \theta_1 - \theta_2)$
- The next lecture explains addition and subtraction

Proofs

- There is a <u>proof that transcomplex arithmetic is consistent if complex arithmetic is</u>
- There is a <u>proof that transreal arithmetic is consistent if real arithmetic is</u>

Conclusion

- All transreal angles can be defined on the real unit cone
- The polar-complex plane is generated by rotating the real line
- The polar-transcomplex plane is generated by rotating the transreal line
- Polar-trancomplex multiplication and division are lexically identical, respectively, to polar-complex multiplication and division

Conclusion

Transcomplex

Transreal

Complex

Real