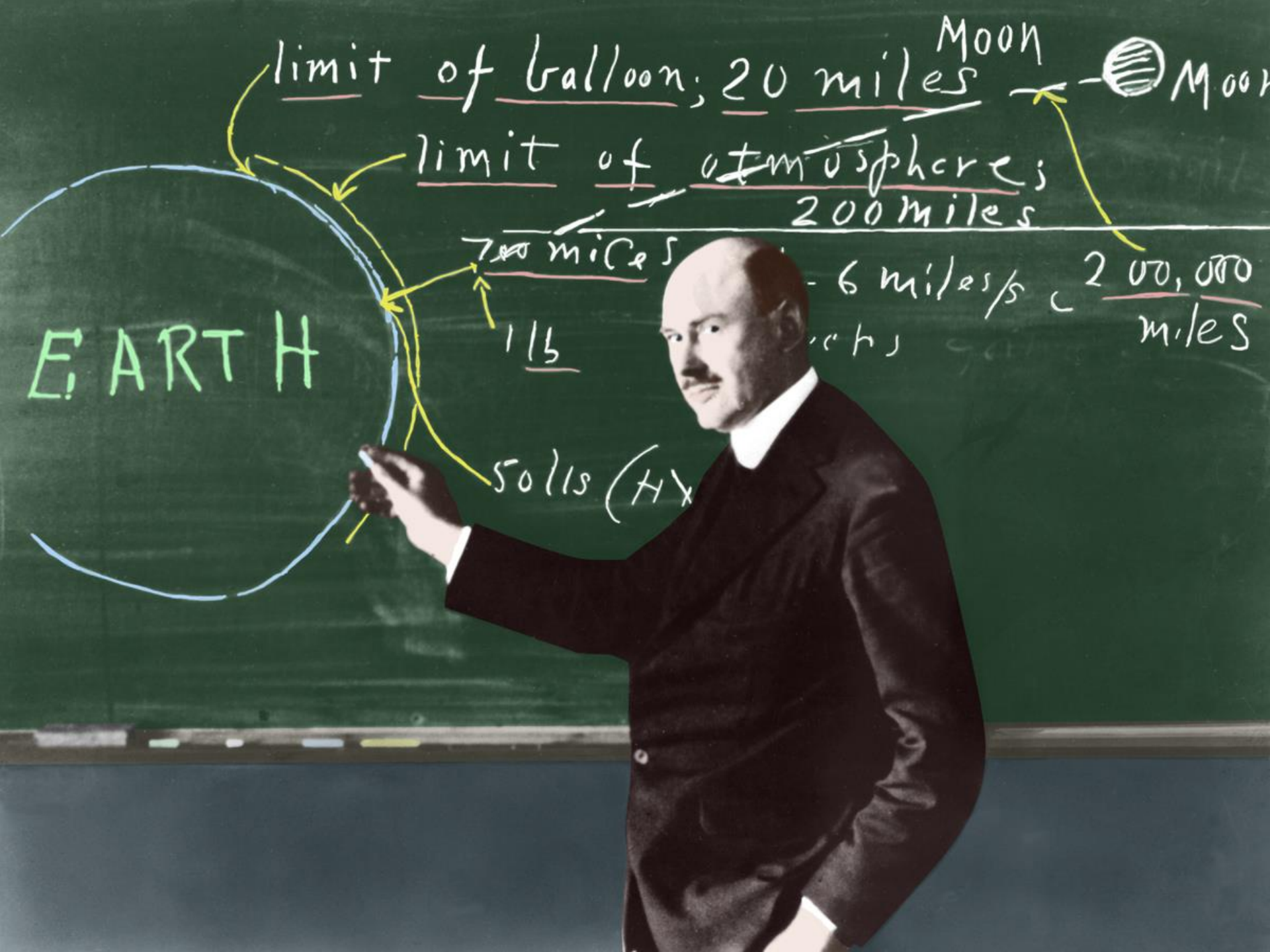




Why going to
Mars is
Hard!



limit of balloon; 20 miles

limit of atmosphere; 200 miles

700 miles

6 miles/s

200,000 miles

115

50115 (HX)

EARTH

MOON

1. Low Earth Orbit
2. The Moon
3. Mars

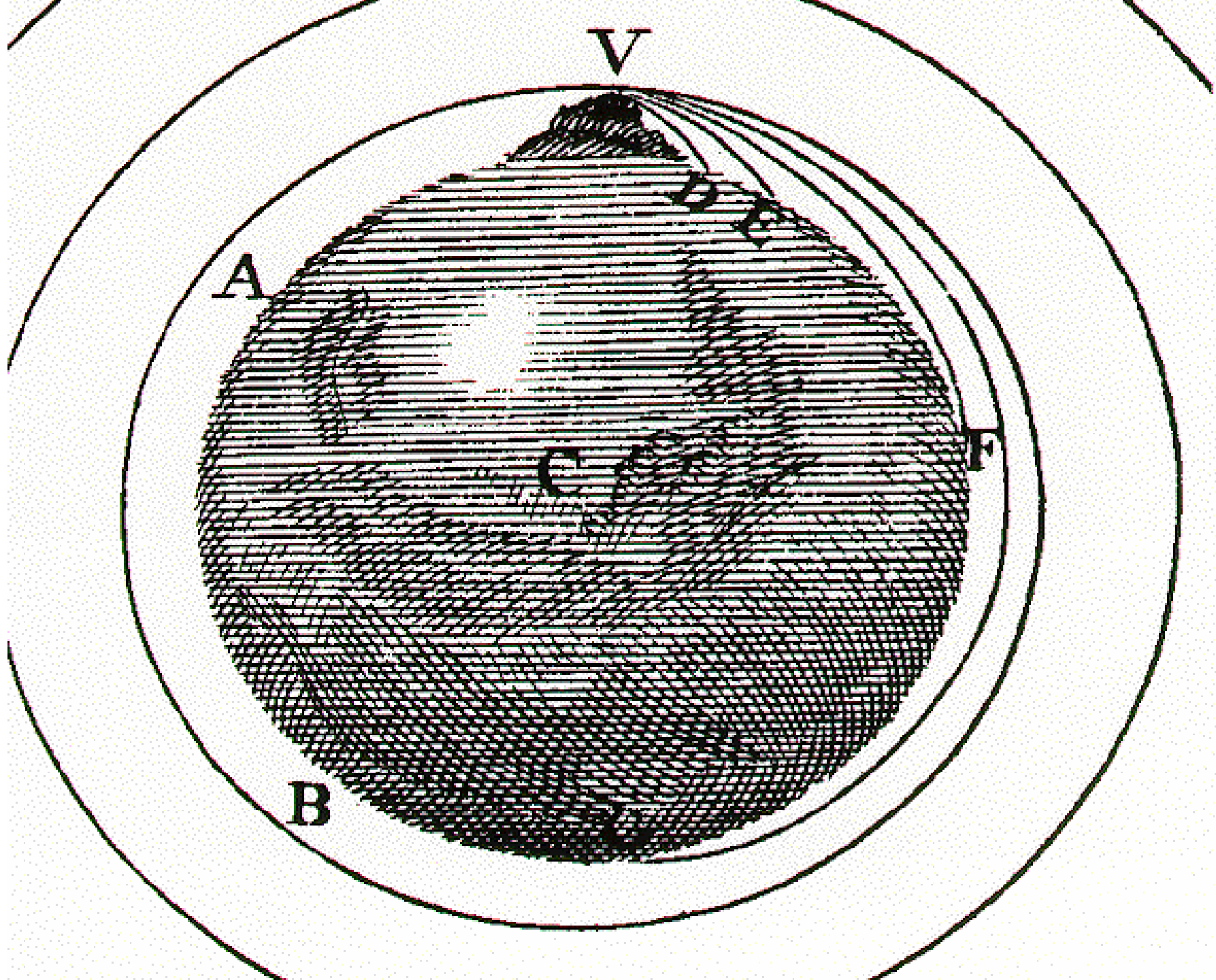
1. Low Earth Orbit



8,000 miles



250 miles



20,000 mph

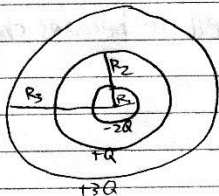
99/100

Homework II

F

4

2.



Inside of $R_1 = 0$ since inside R_1 is isolated

Outside of R_1 must be $-2Q$ to get total charge on small shell

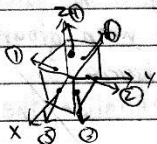
To cancel out $-2Q$ charge from outside of R_1 inside of R_2 must be $+2Q$

To get total of $+Q$ on R_2 outside of R_2 must be $-Q$

Thus inside of R_3 must cancel out $-Q$ so it's equal to $+Q$

Inside of $R_3 = +Q$

3.



$$\oint \vec{E} \cdot d\vec{A} = q_{enc}$$

① left $y=0$ $0 \leq x, z \leq 1$

$$d\vec{A} = -\hat{j}$$

$$\oint ((3.0\hat{i} + 2.5\hat{j}) \cdot d\vec{A})$$

$$\oint 2.5(-1) dA = E_0 (2.5)(1m^2) = q$$

$$\text{② right} = + E_0 (2.5)(1m^2)$$

① & ② cancel out (symmetry)

③ & ④ = 0 (L to E)

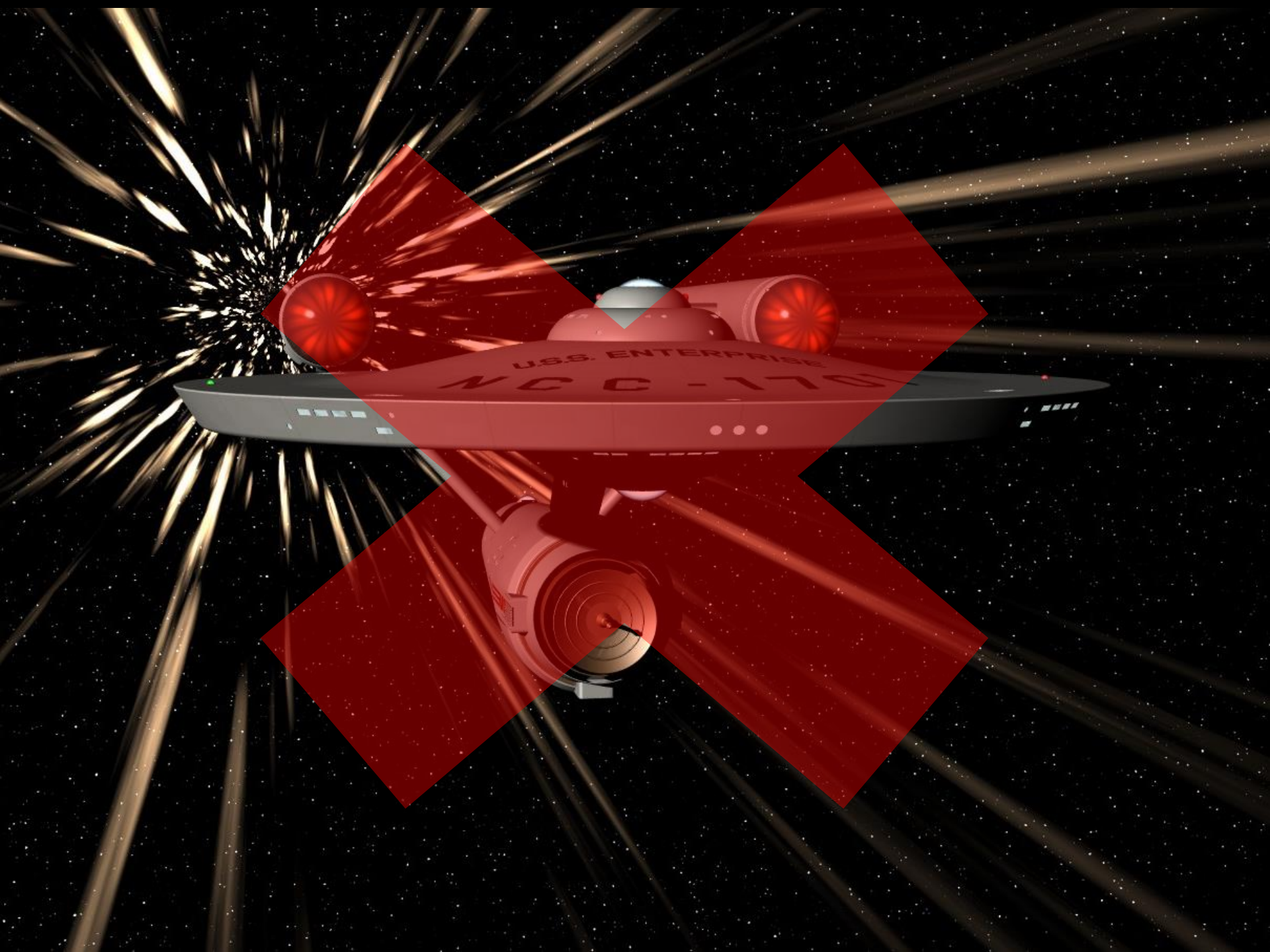
⑤ & ⑥ cancel out (symmetry)

Total charge contained in cube = Q

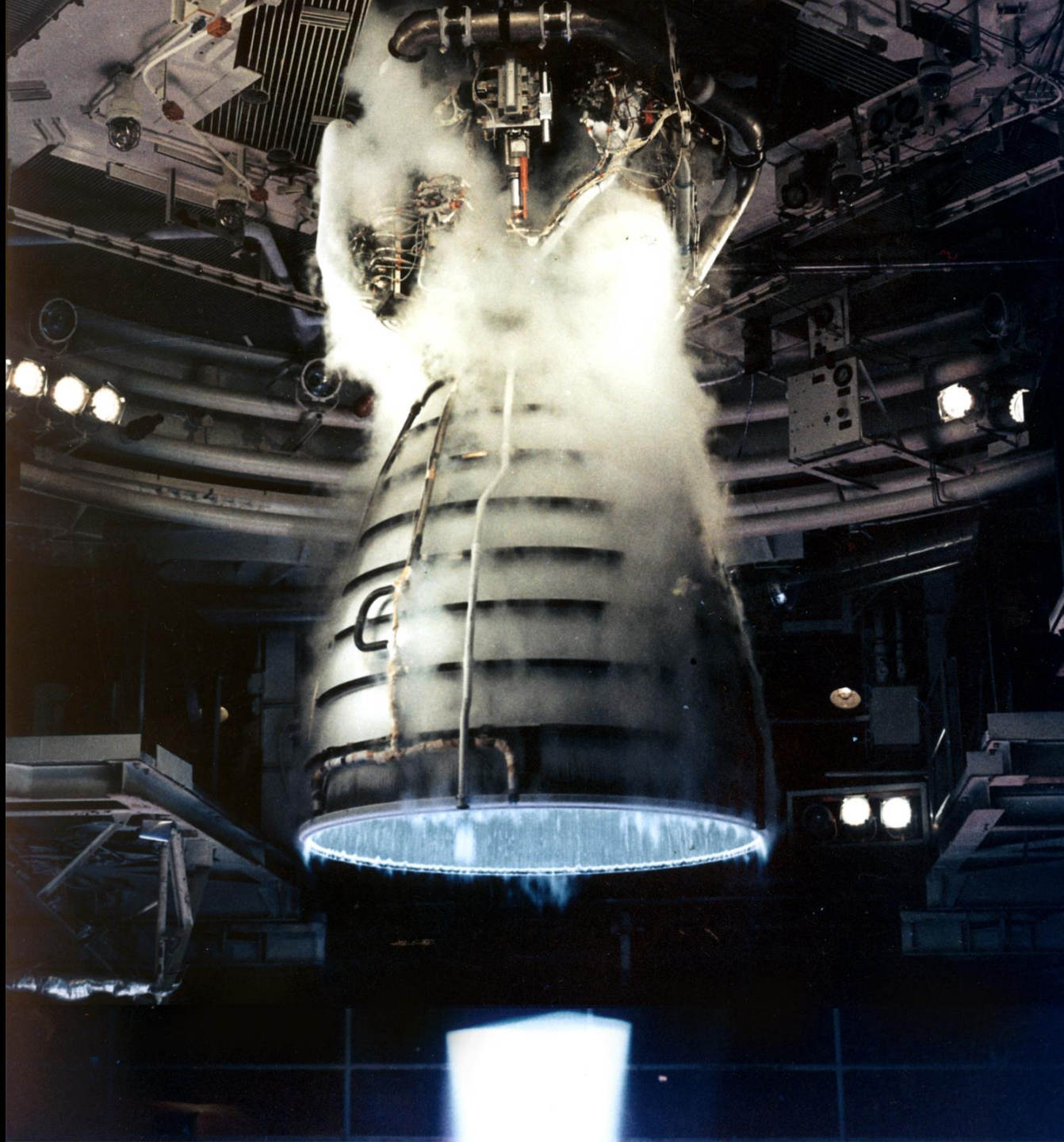
4.

$$Q_{inside} r = \frac{4}{3} \pi r^3 \quad Q_{total}$$











2. The Moon

8,000 miles











240,000 miles





Distance

Speed

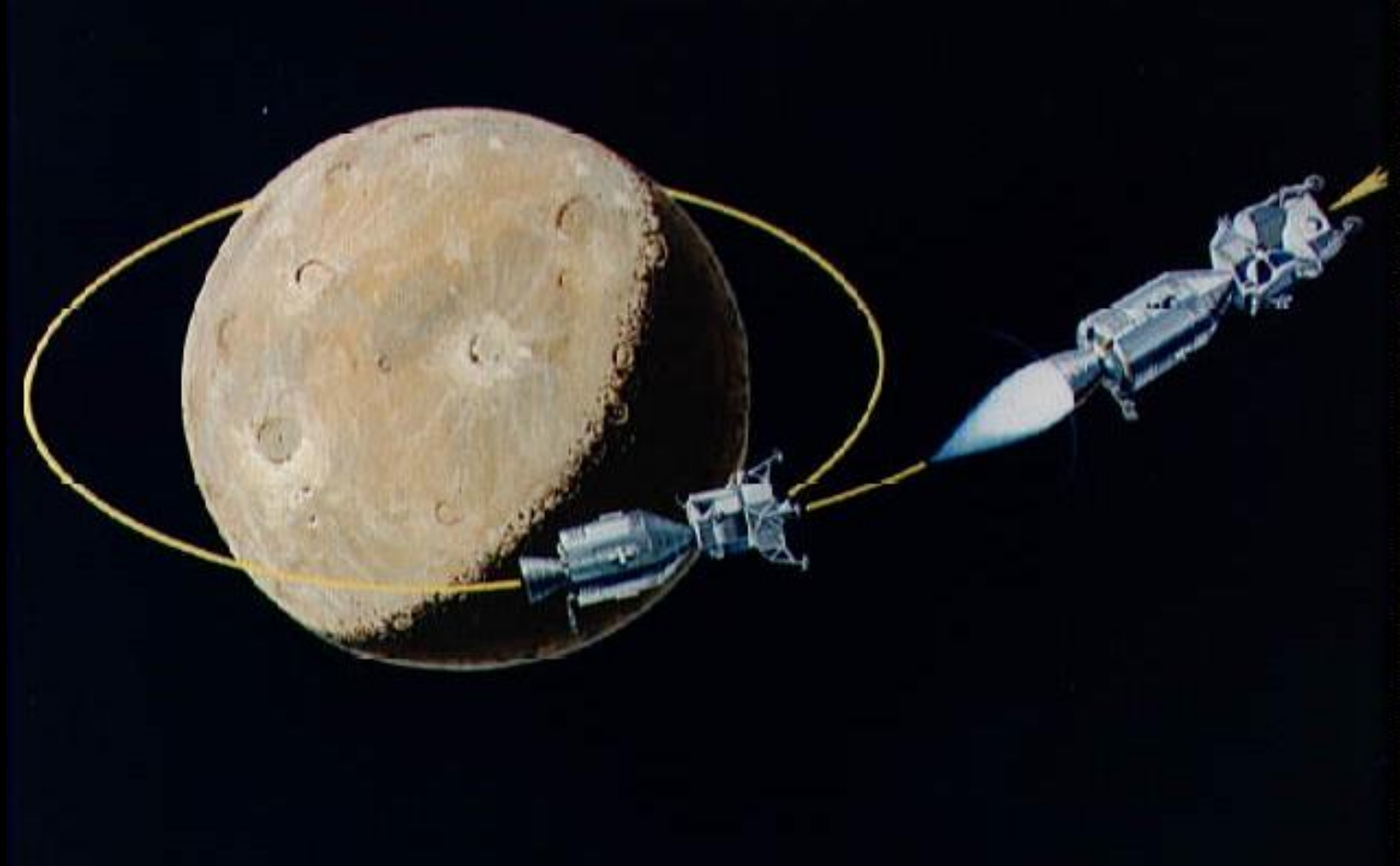
20,000 mph



20,000 mph
8,200 mph



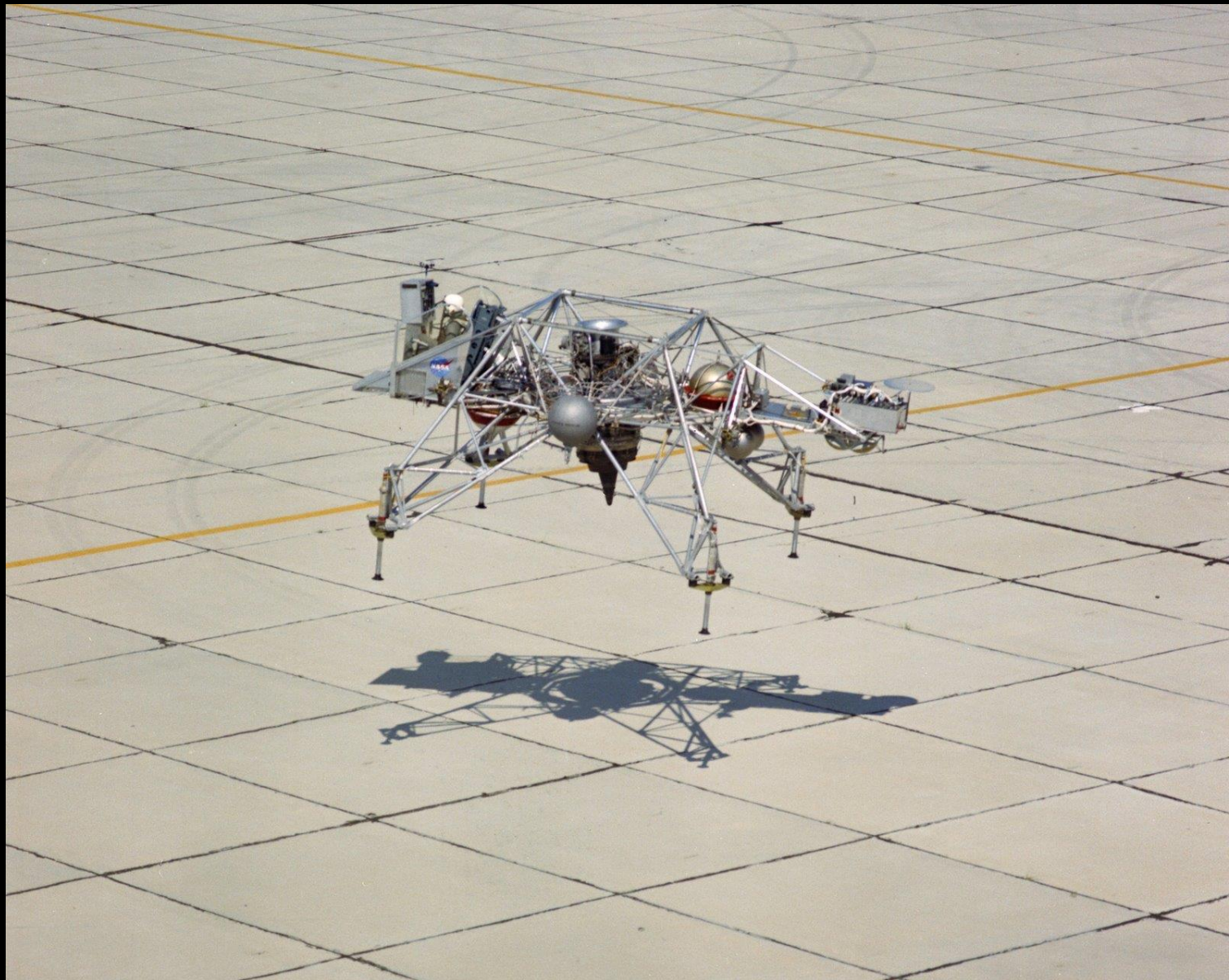
20,000 mph
8,200 mph
2,400 mph



20,000 mph
8,200 mph
2,400 mph
3,900 mph



20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph



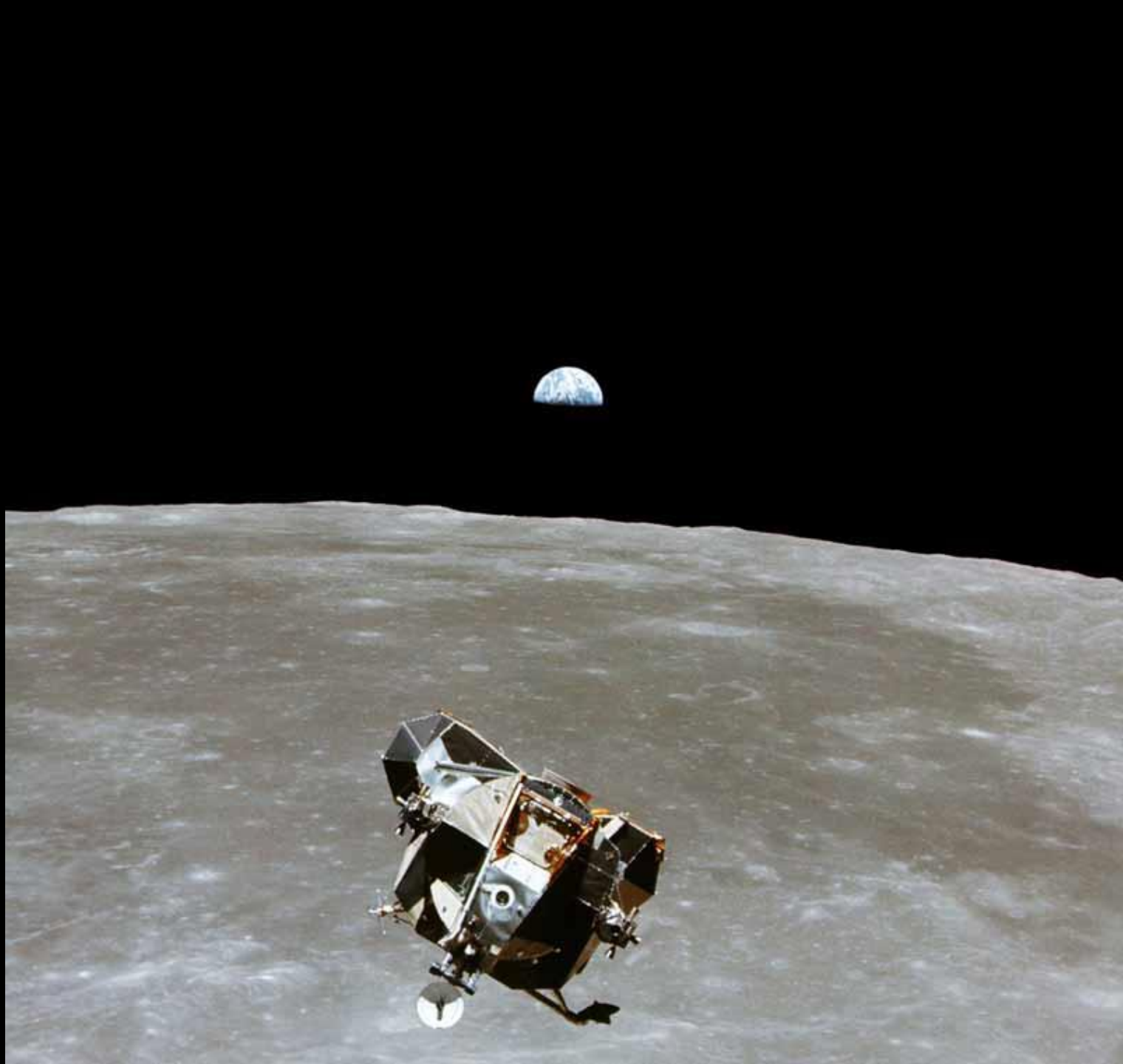
20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph
0 mph



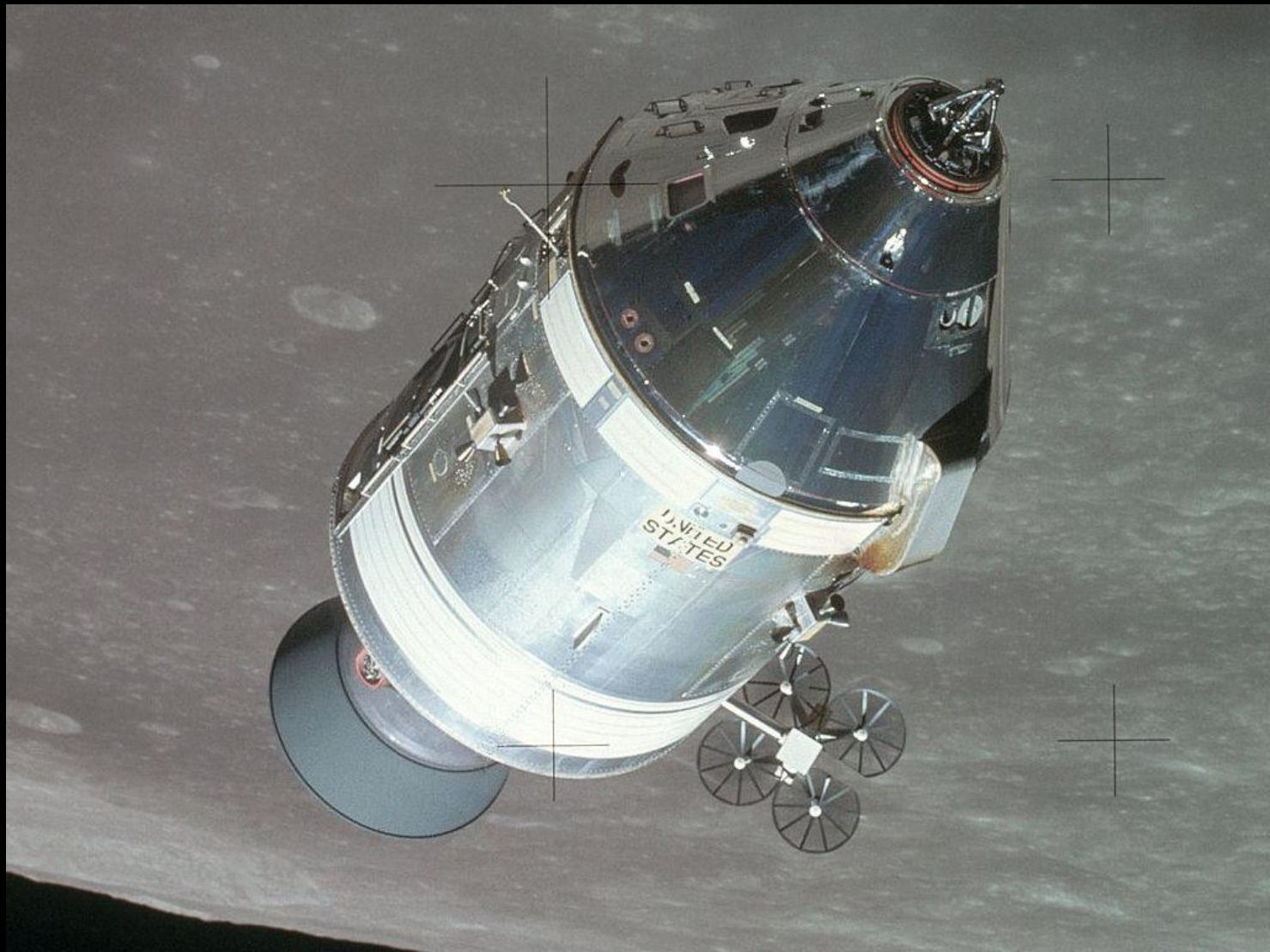
20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph
0 mph
700 mph



20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph
0 mph
700 mph
3,900 mph



20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph
0 mph
700 mph
3,900 mph
2,400 mph



20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph
0 mph
700 mph
3,900 mph
2,400 mph
0 mph

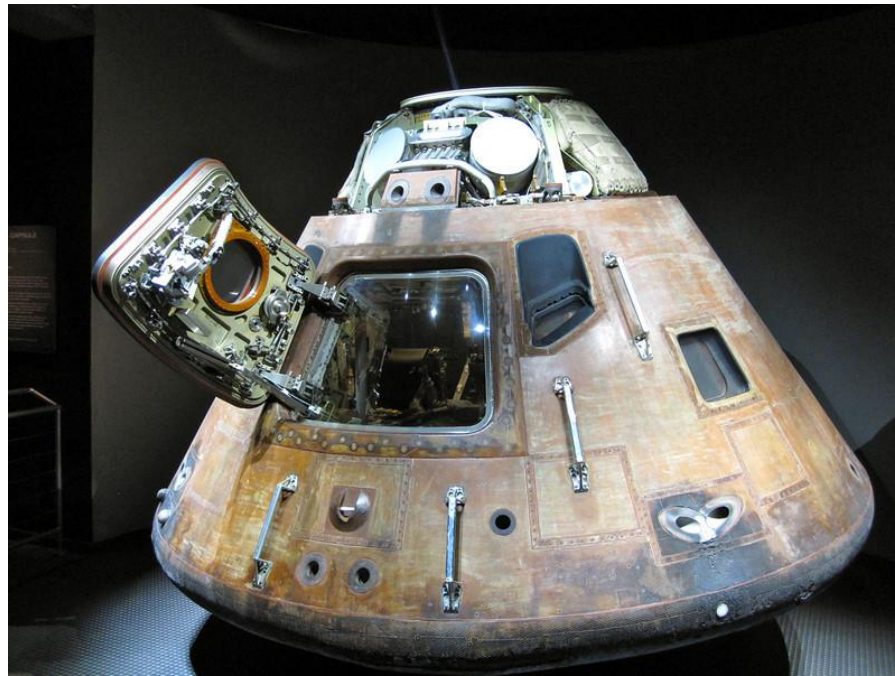


20,000 mph
8,200 mph
2,400 mph
3,900 mph
700 mph
0 mph
700 mph
3,900 mph
2,400 mph
0 mph
+ 0 mph



42,000 mph





6 tons



+

×33



+

×4

+



×1

3. Mars

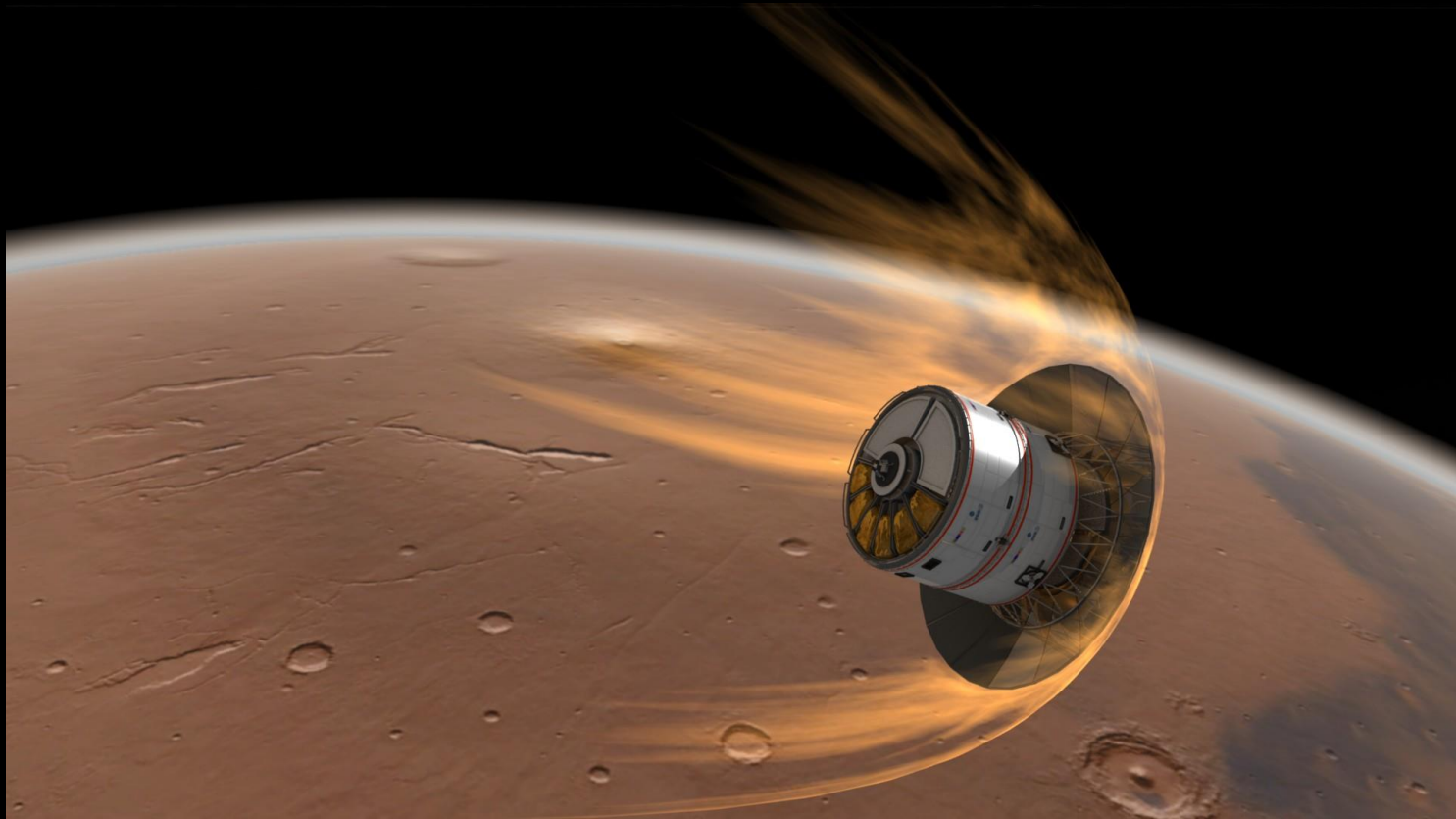
20,000 mph



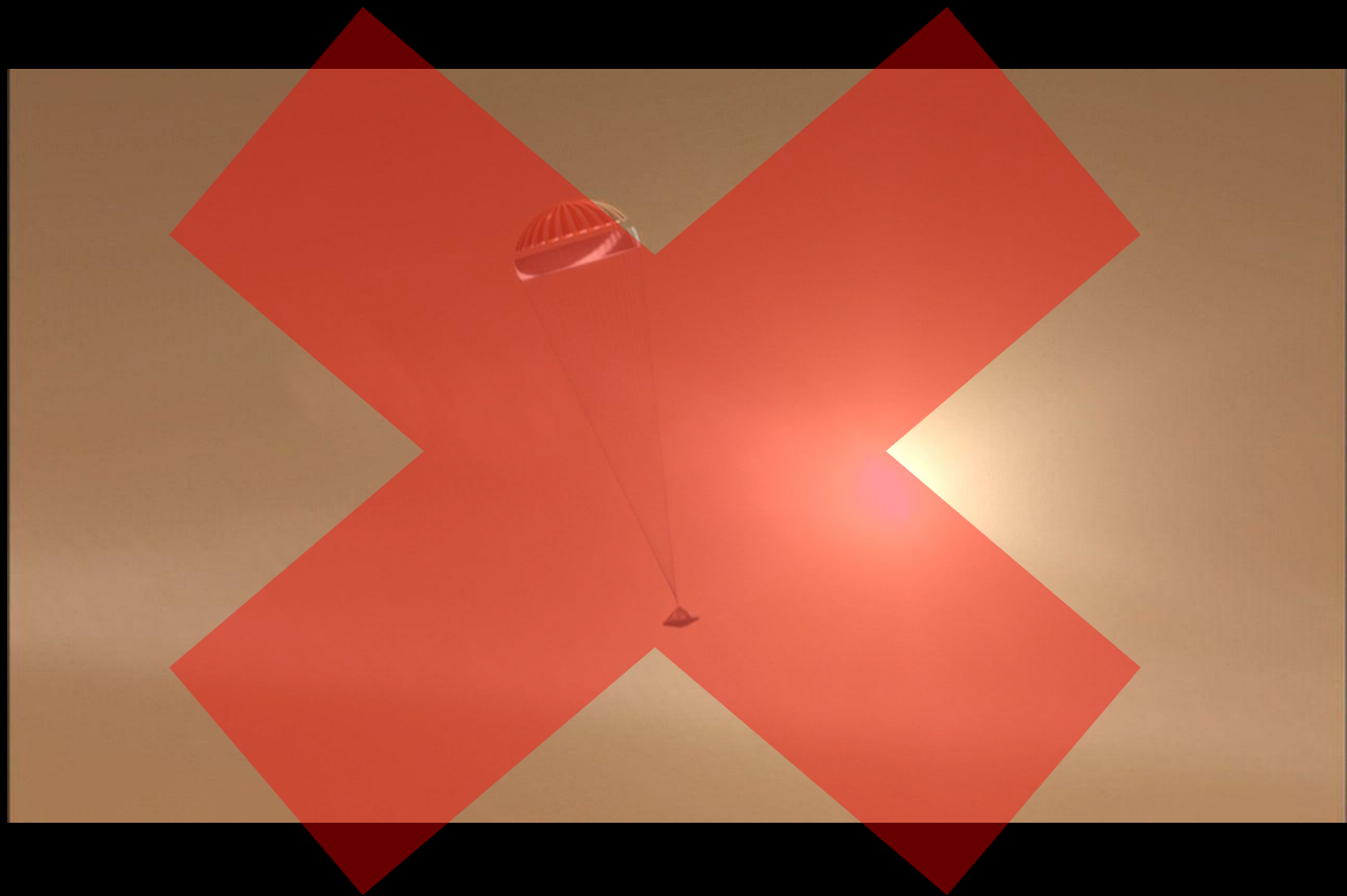
20,000 mph
9,000 mph



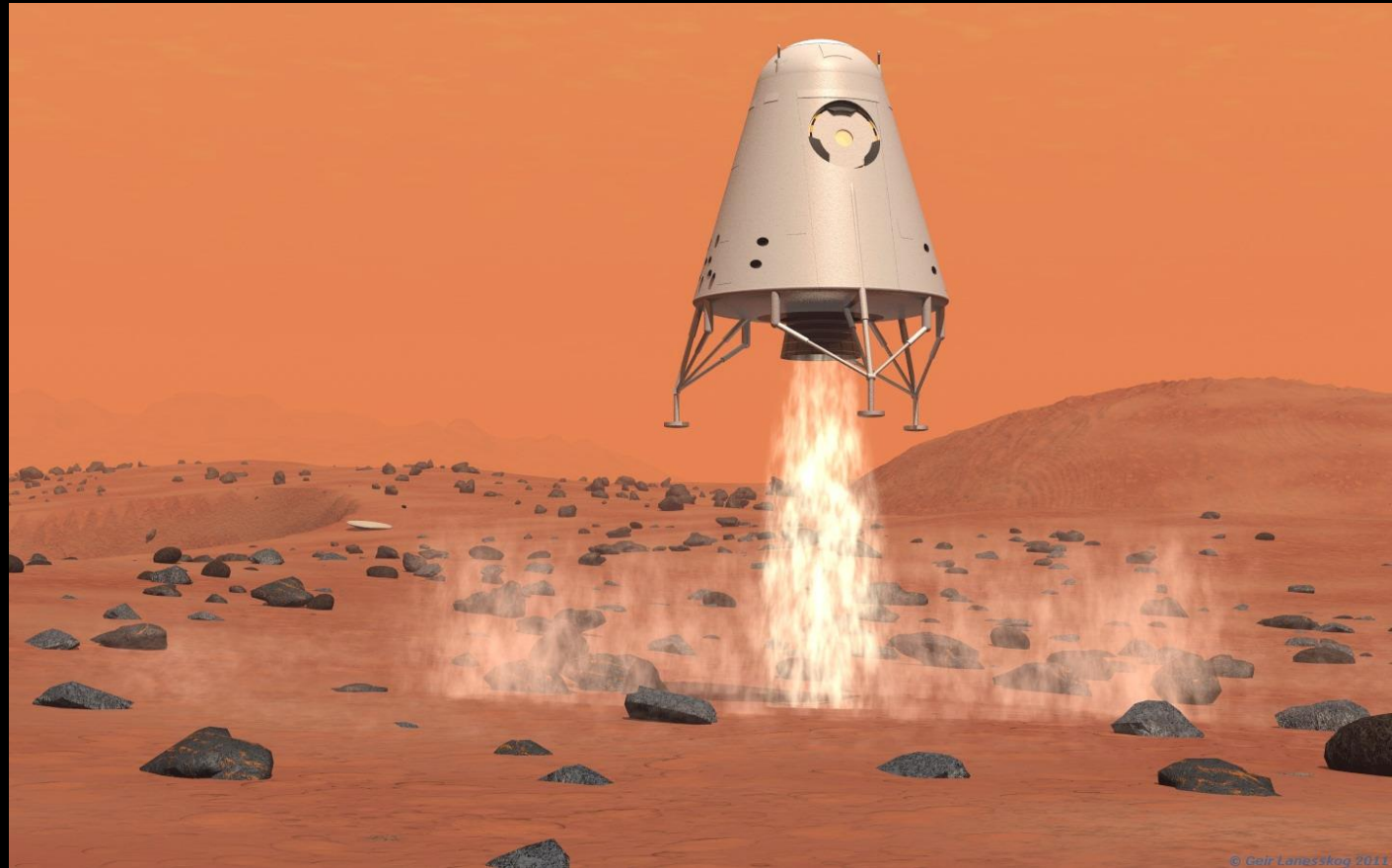
20,000 mph
9,000 mph
0 mph



20,000 mph
9,000 mph
0 mph
0 mph



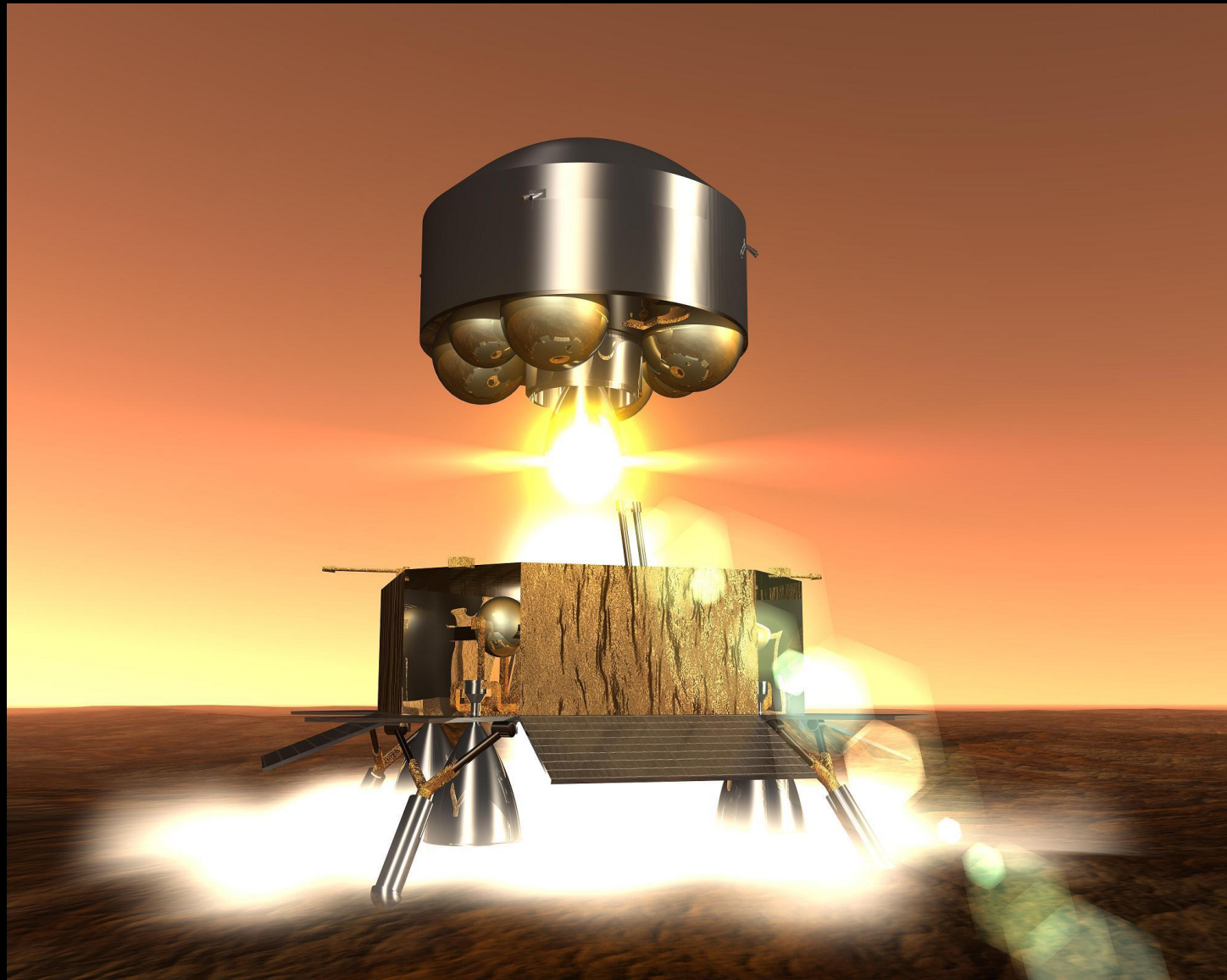
20,000 mph
9,000 mph
0 mph
2,000 mph



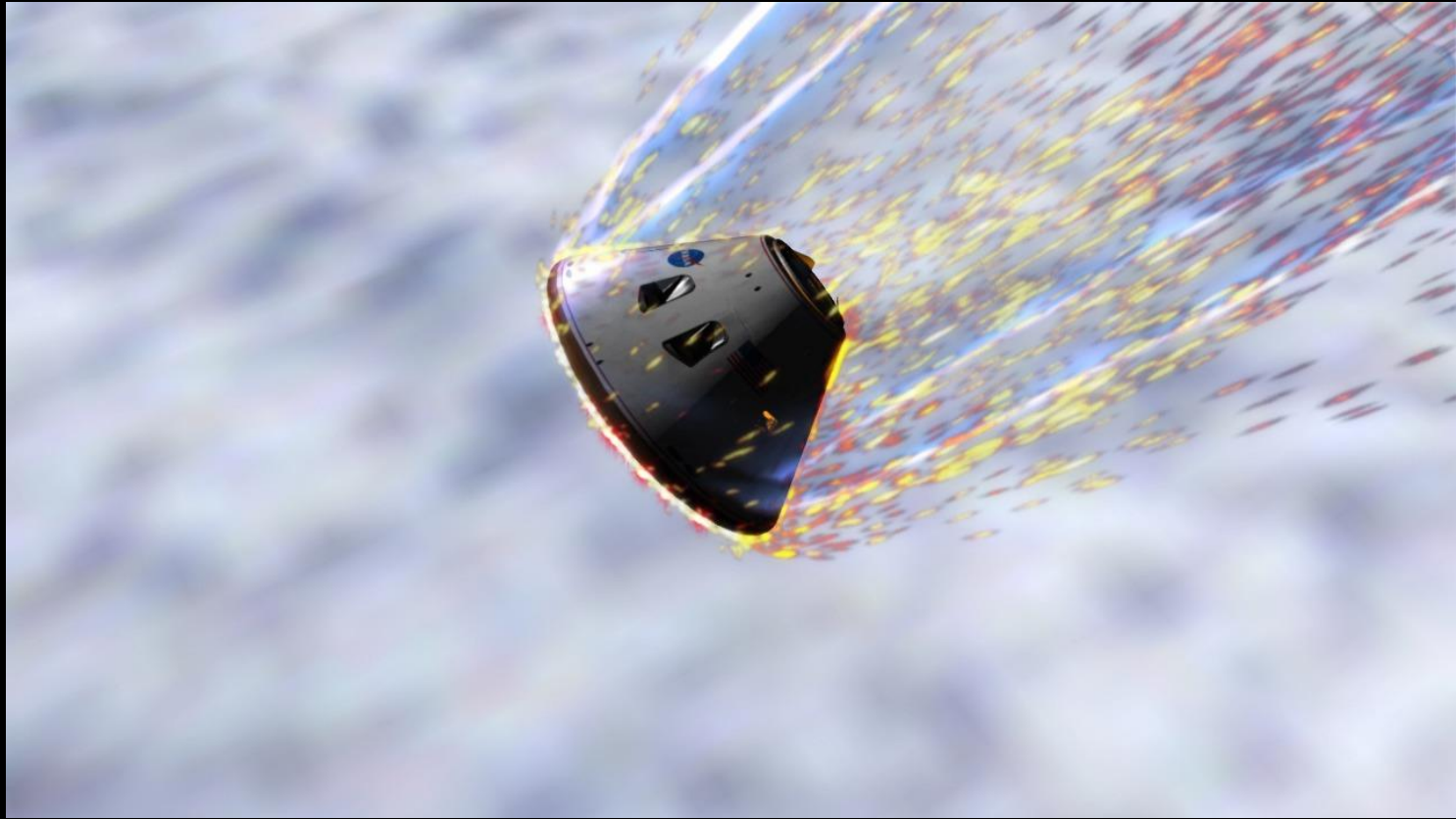
20,000 mph
9,000 mph
0 mph
2,000 mph
0 mph



20,000 mph
9,000 mph
0 mph
2,000 mph
0 mph
17,000 mph



20,000 mph
9,000 mph
0 mph
2,000 mph
0 mph
17,000 mph
0 mph



20,000 mph

9,000 mph

0 mph

2,000 mph

0 mph

17,000 mph

0 mph

+ 0 mph



48,000 mph



Speed

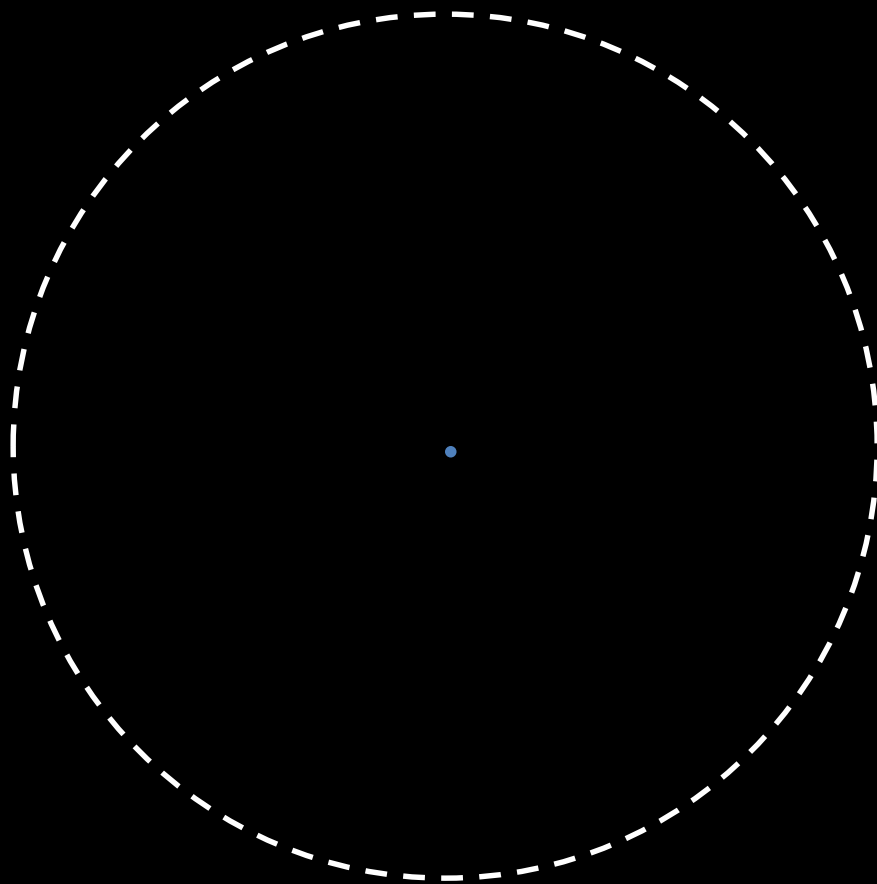
Distance

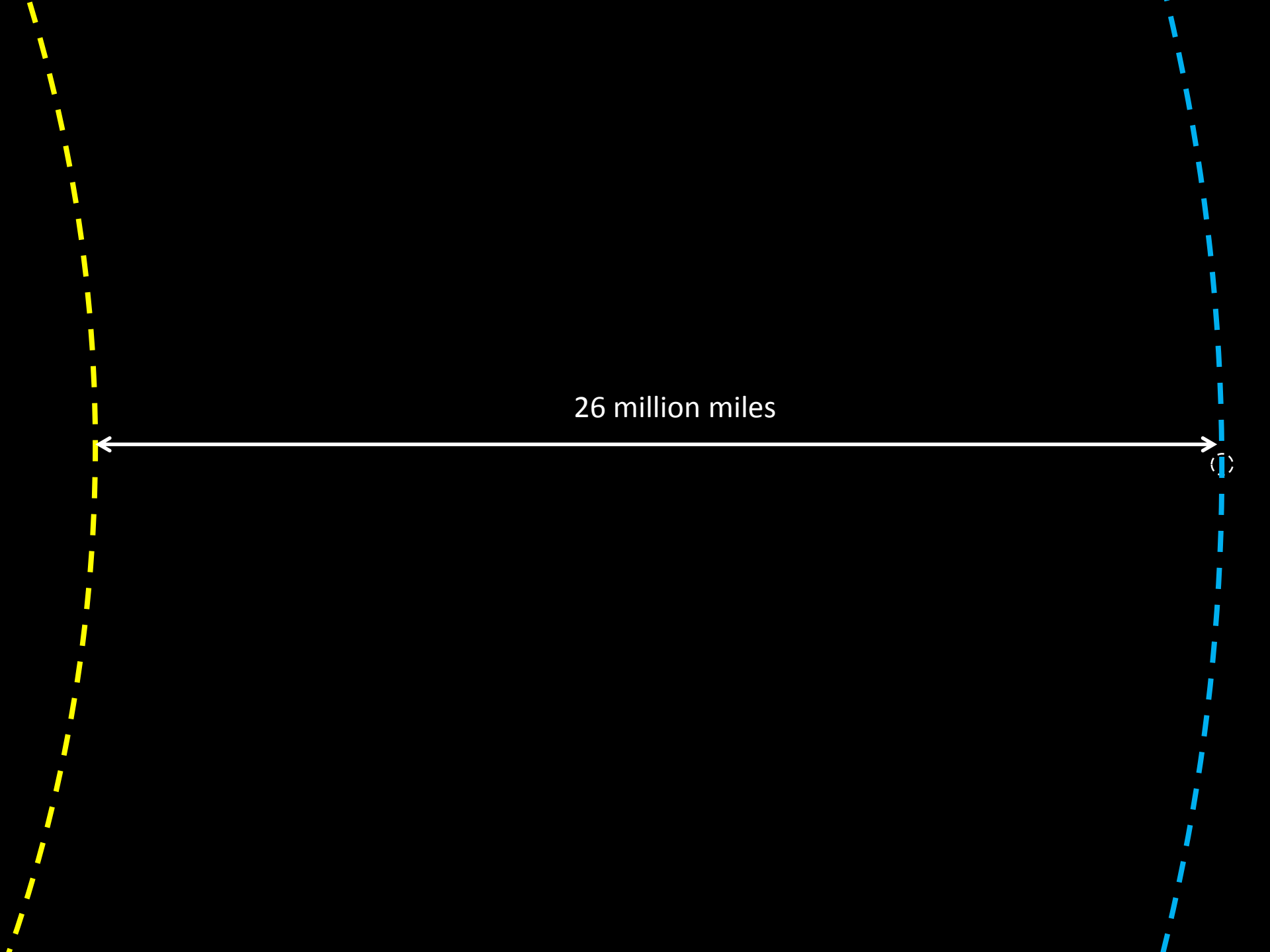
240,000 miles





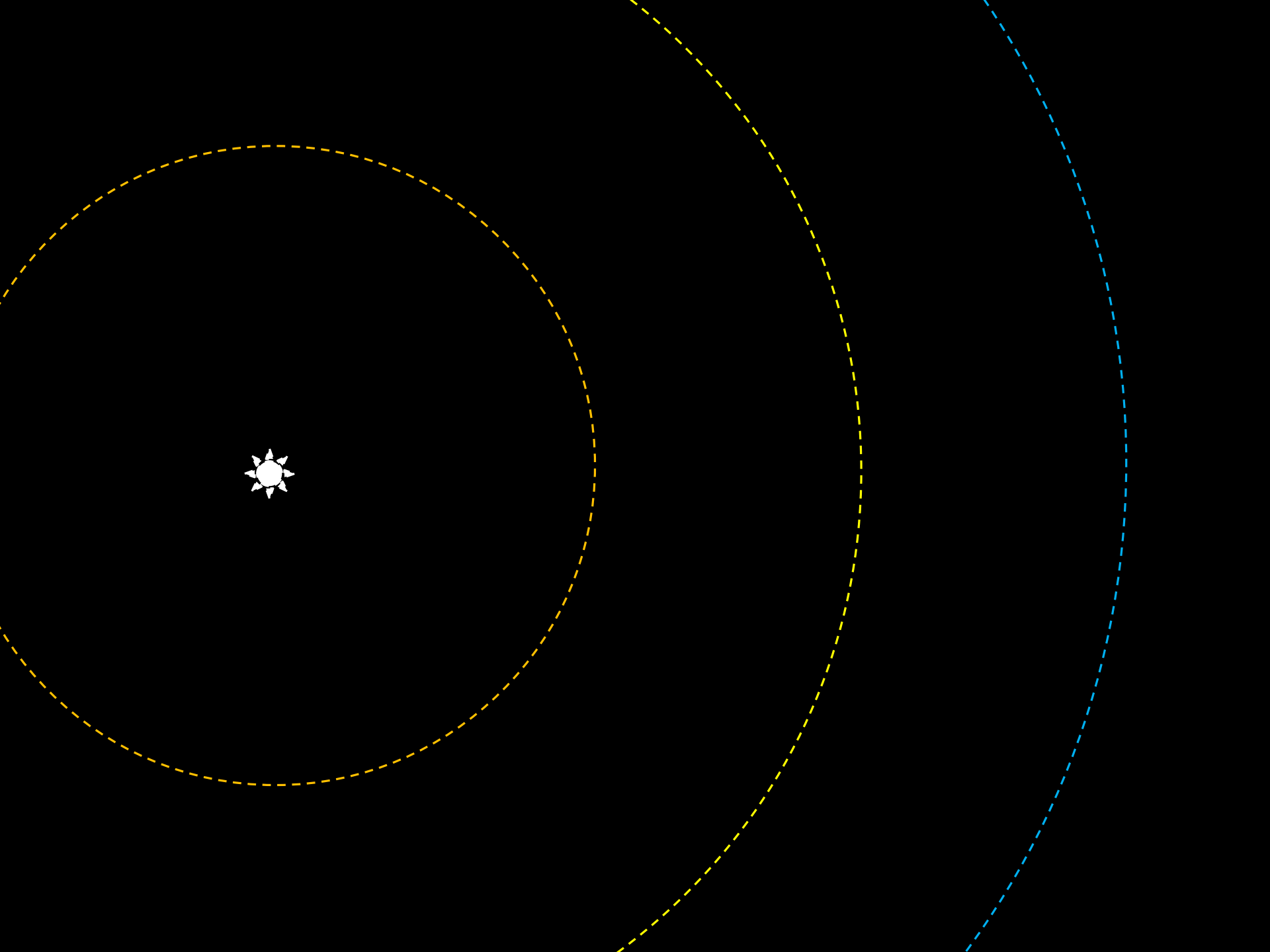
1/2 million miles

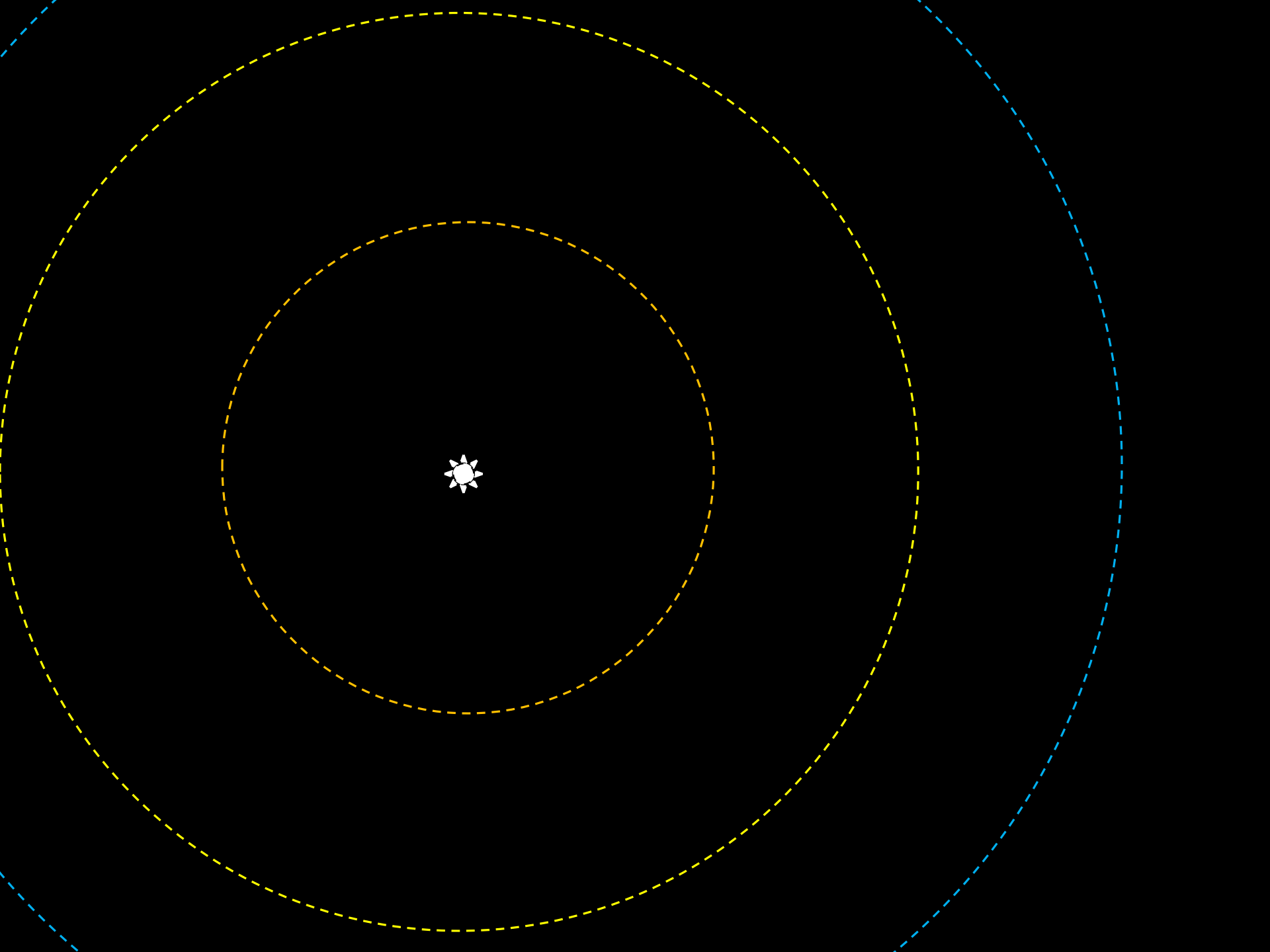


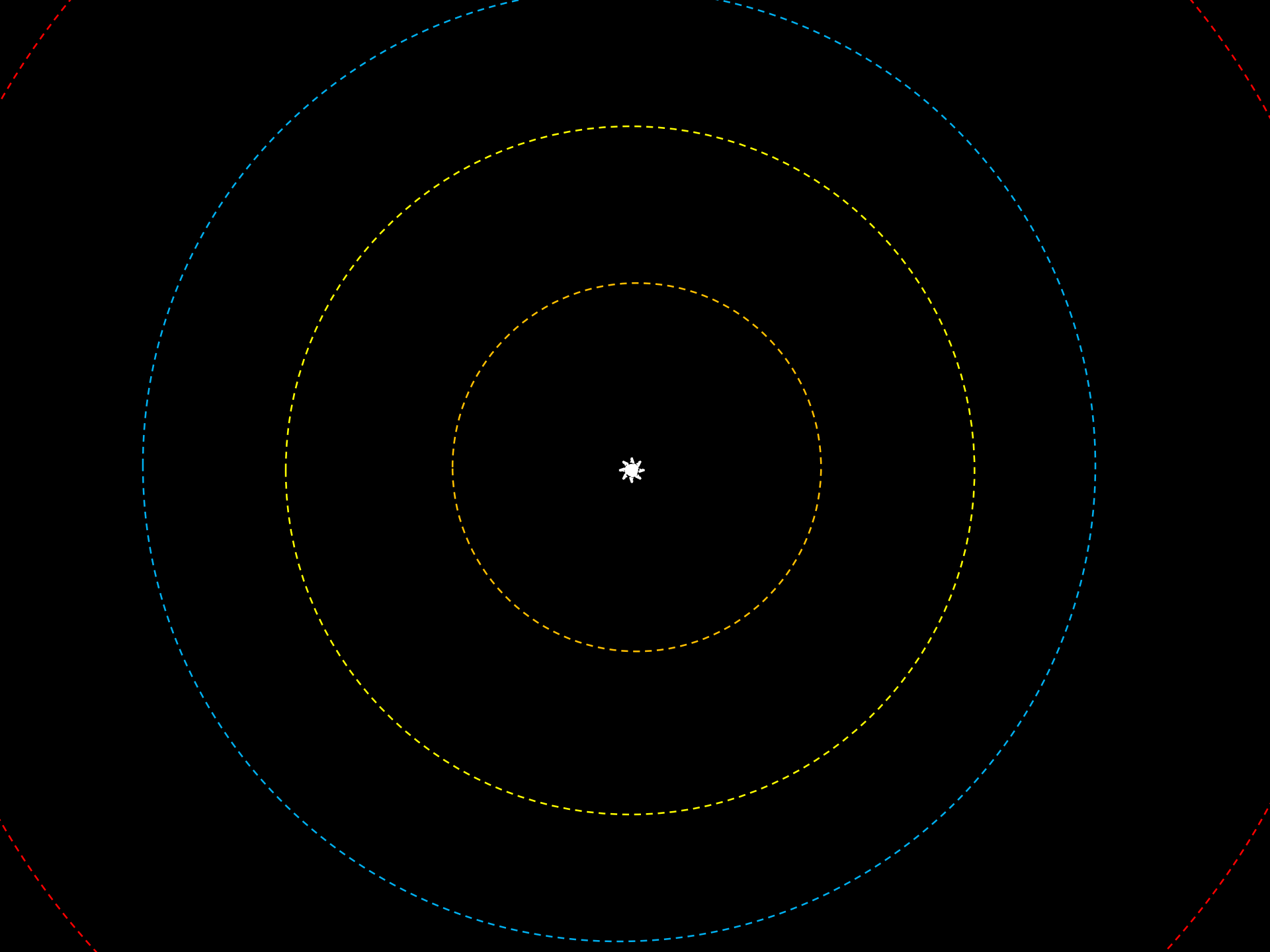


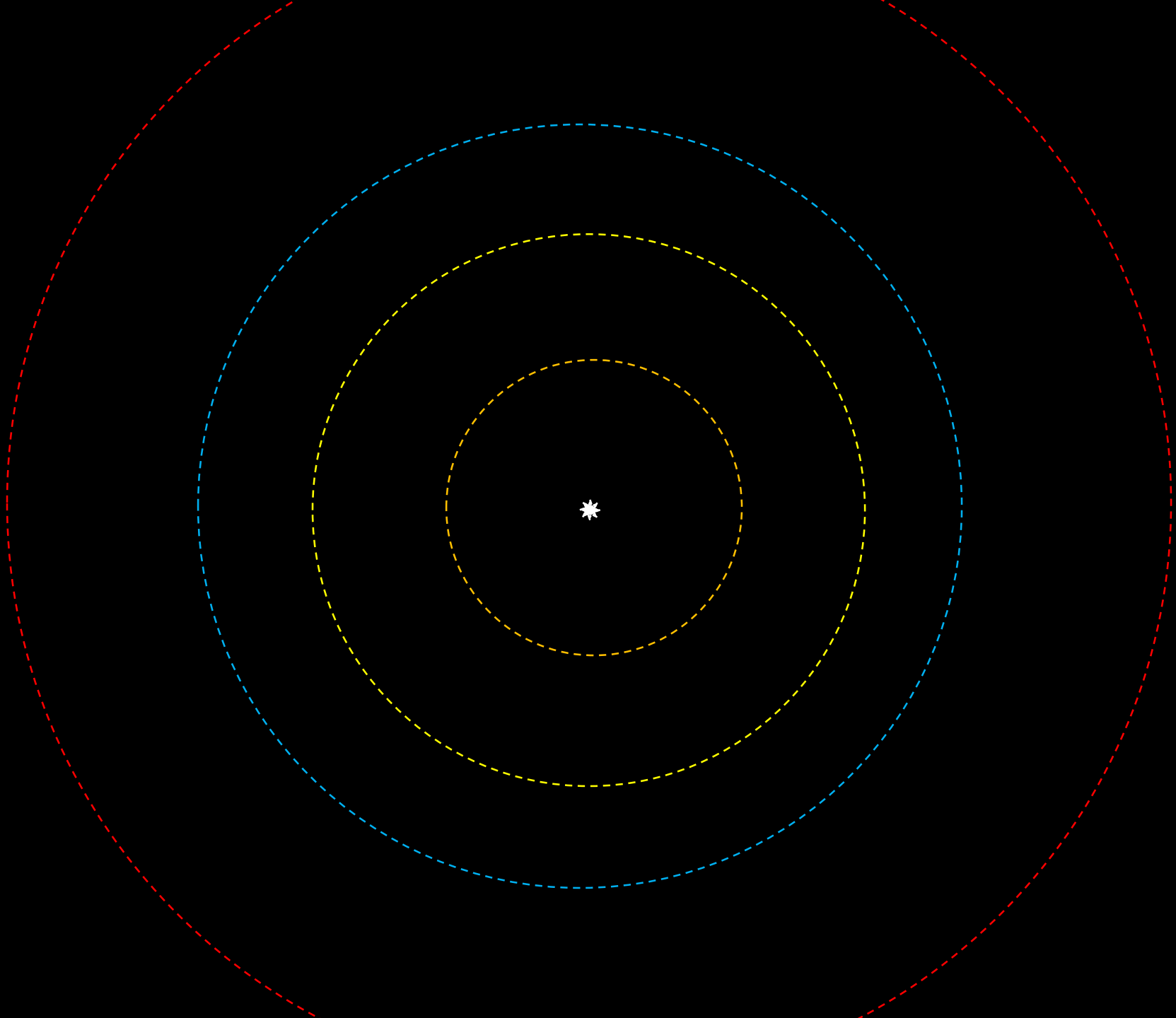
26 million miles

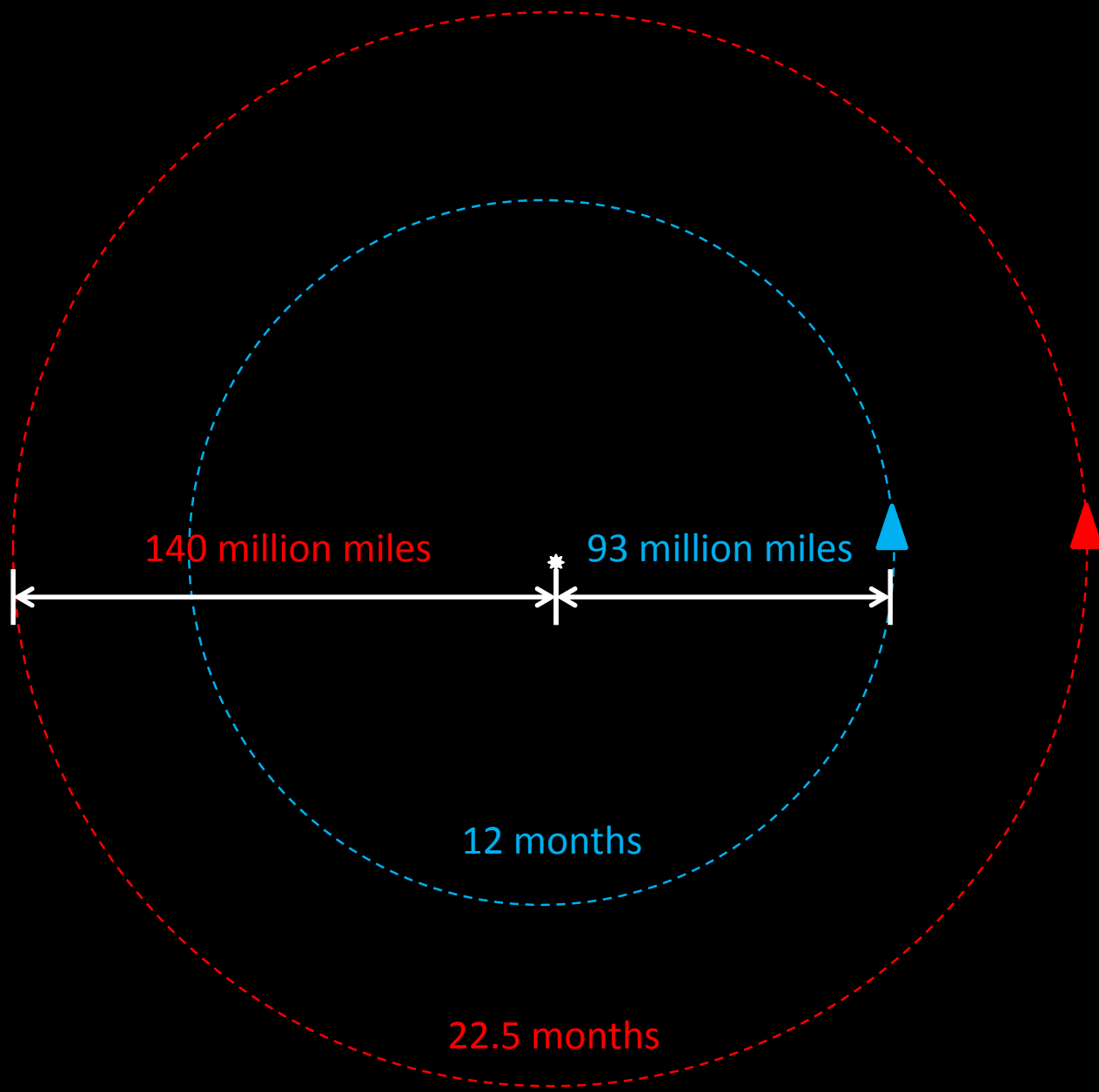


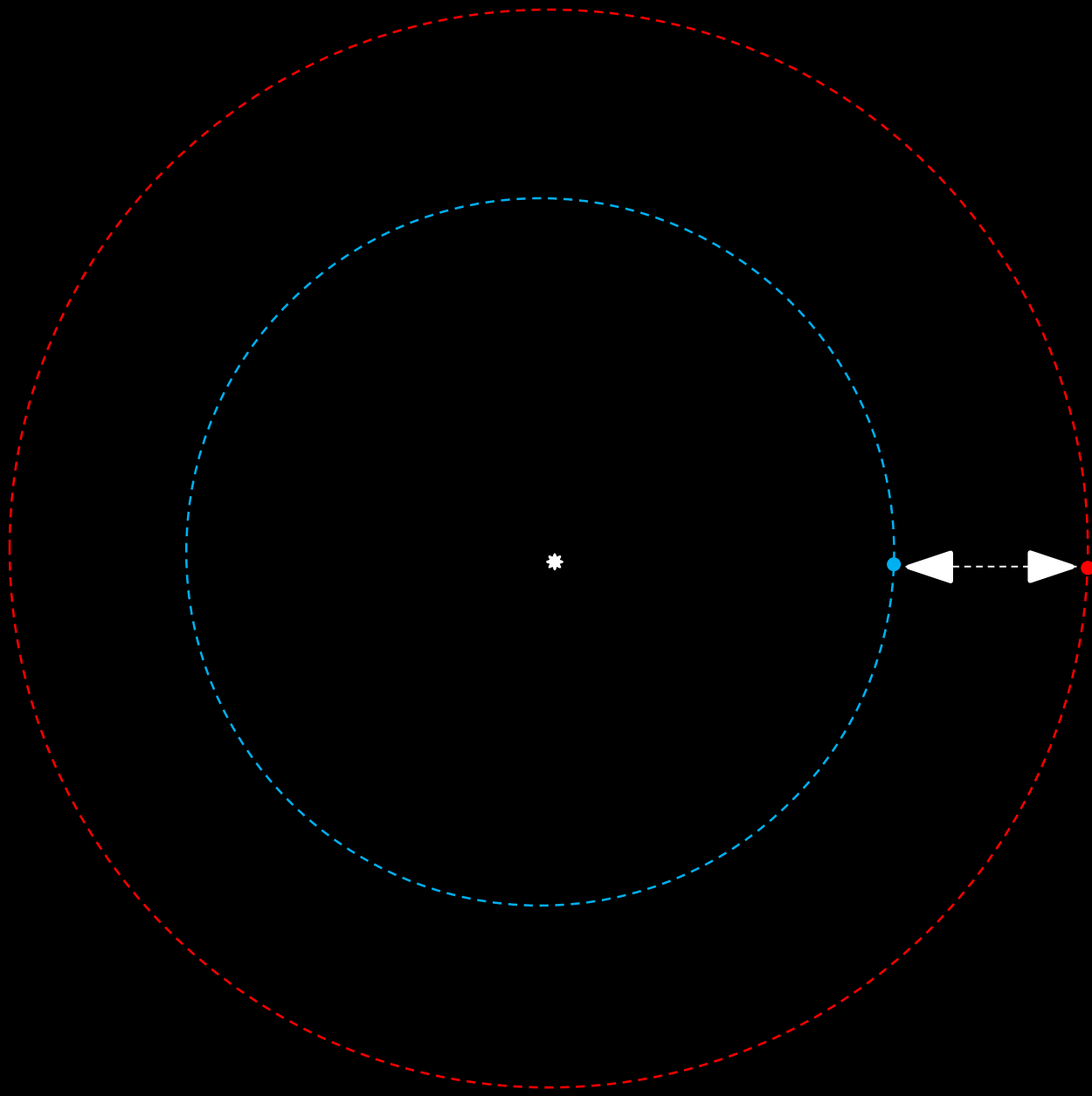




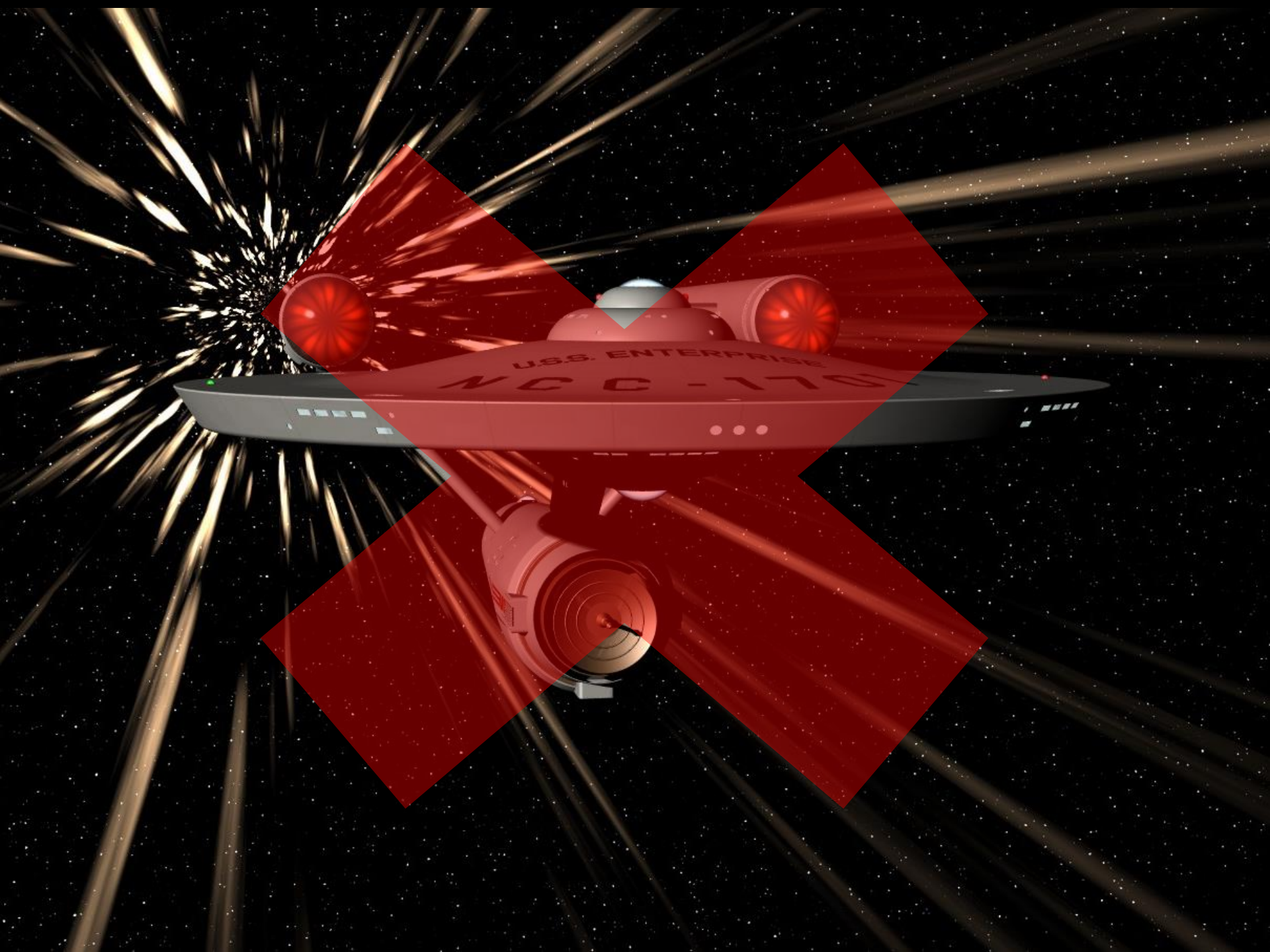


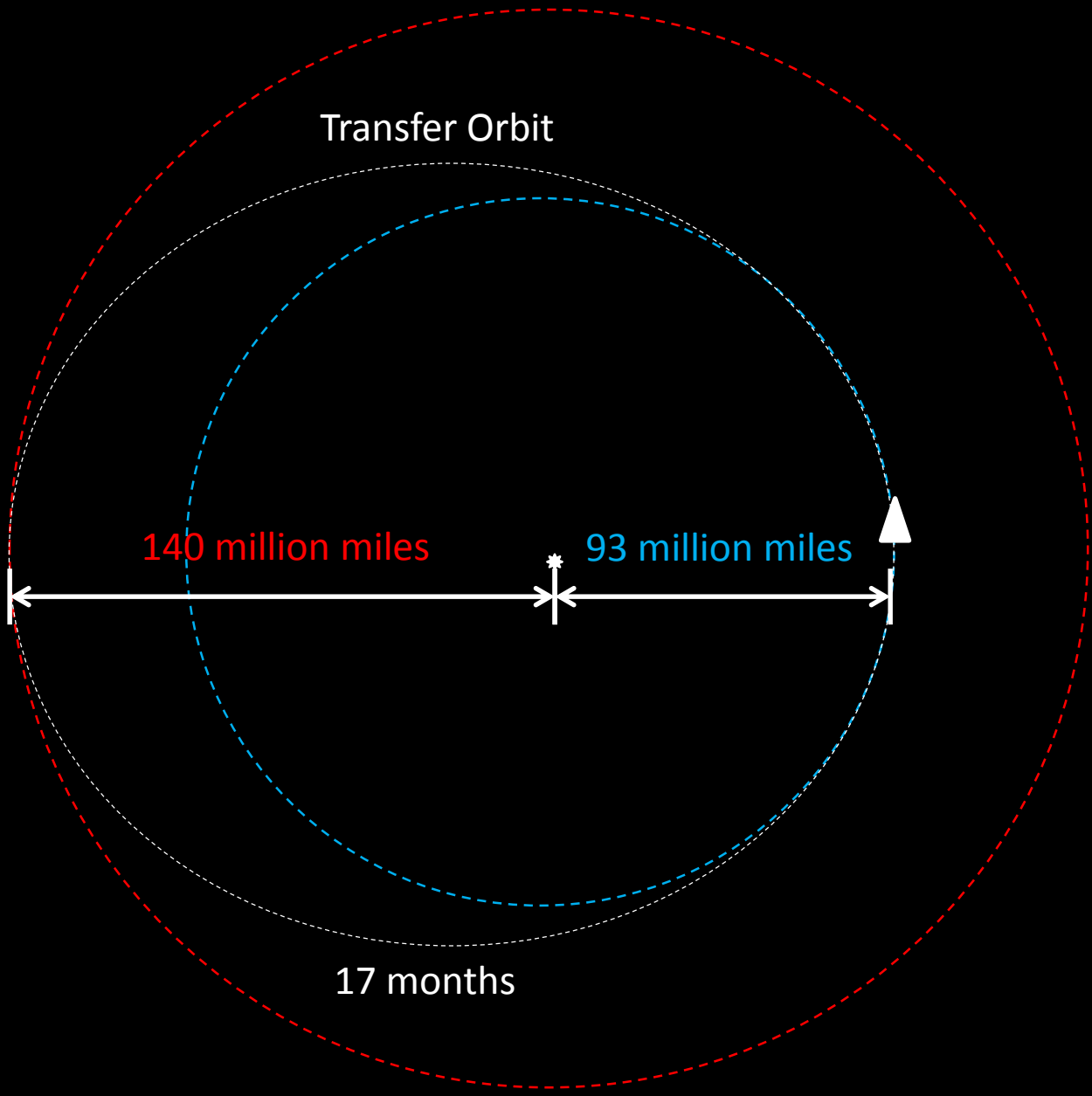






250,000+ mph



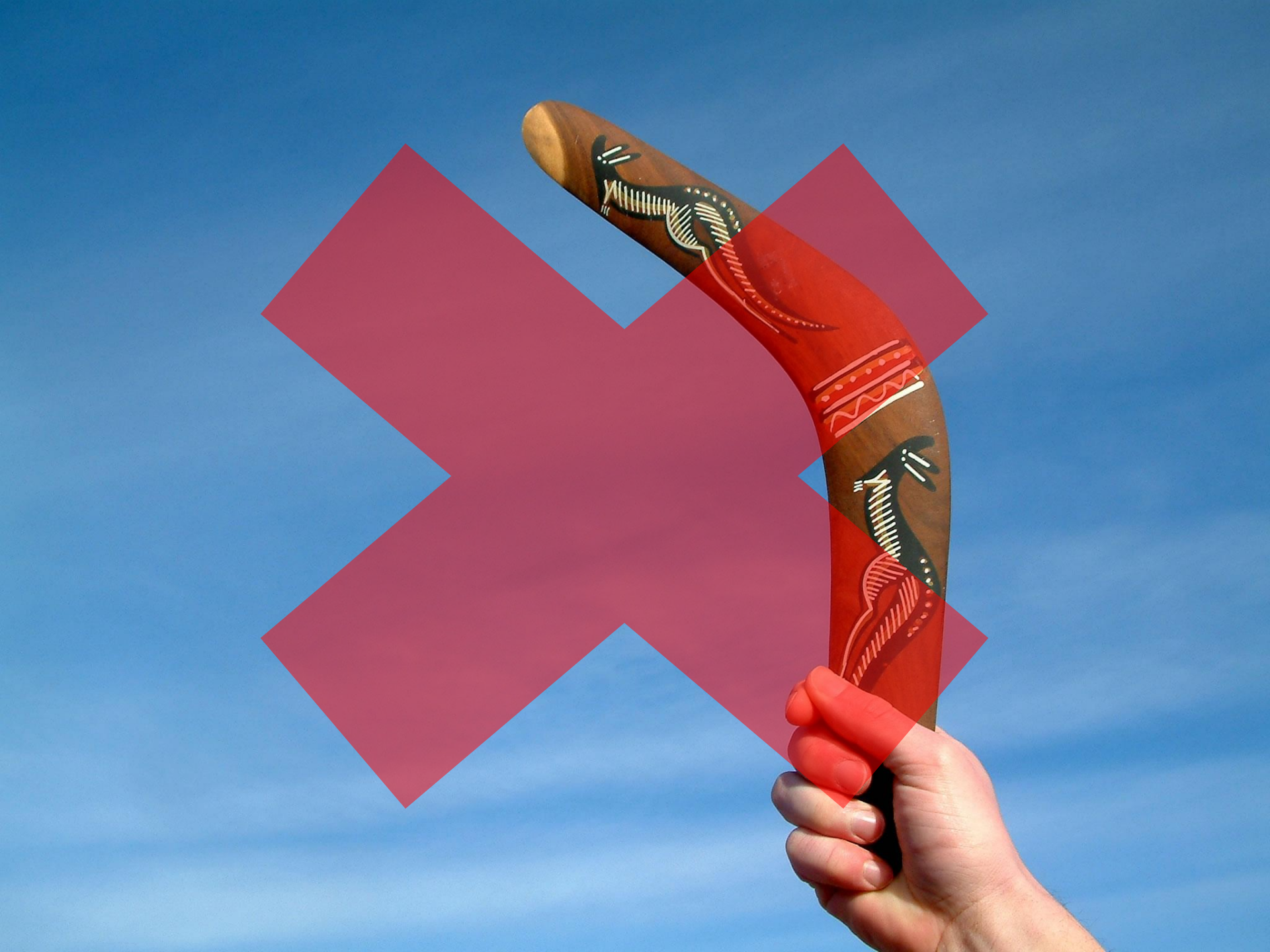


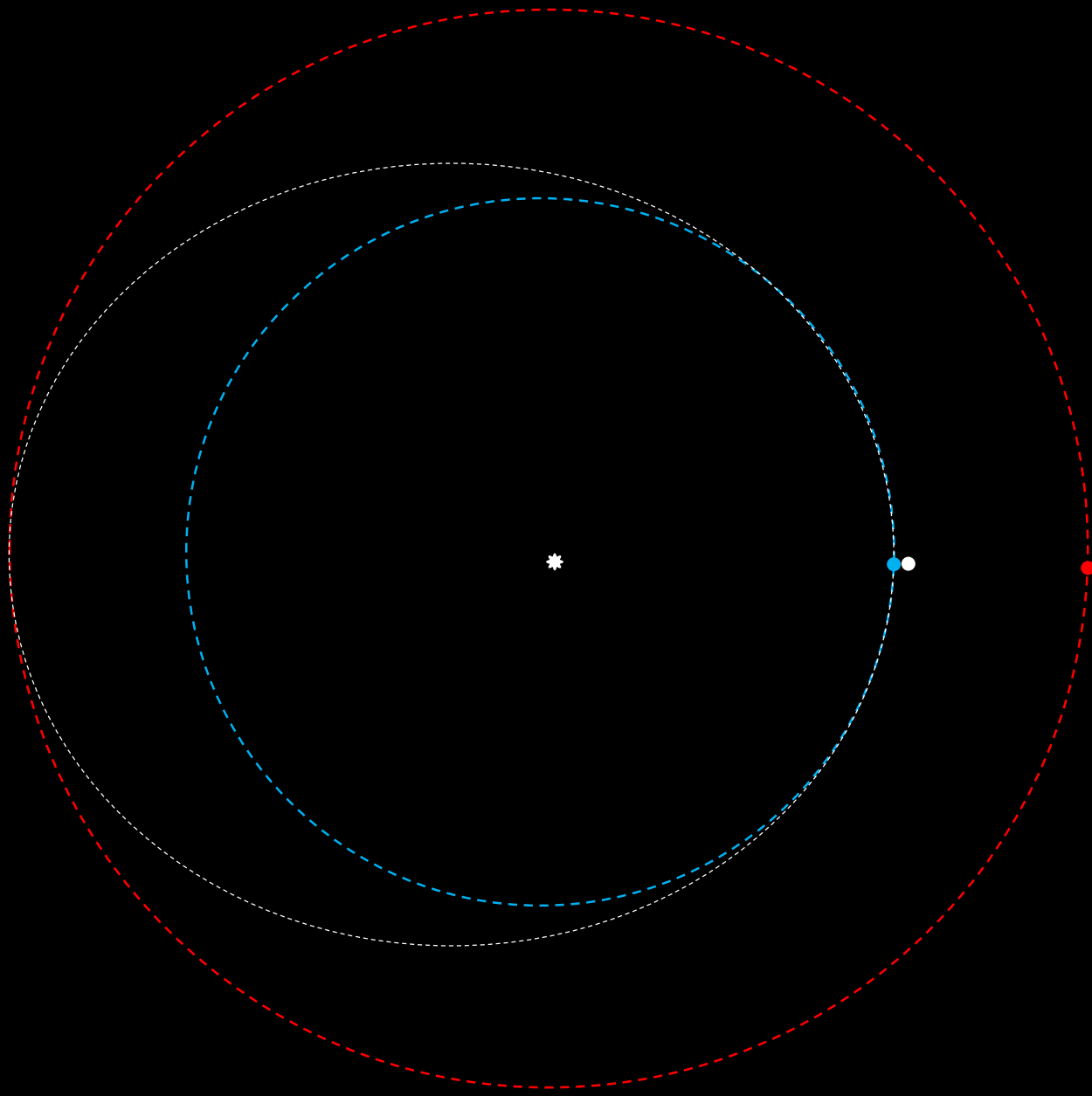
Transfer Orbit

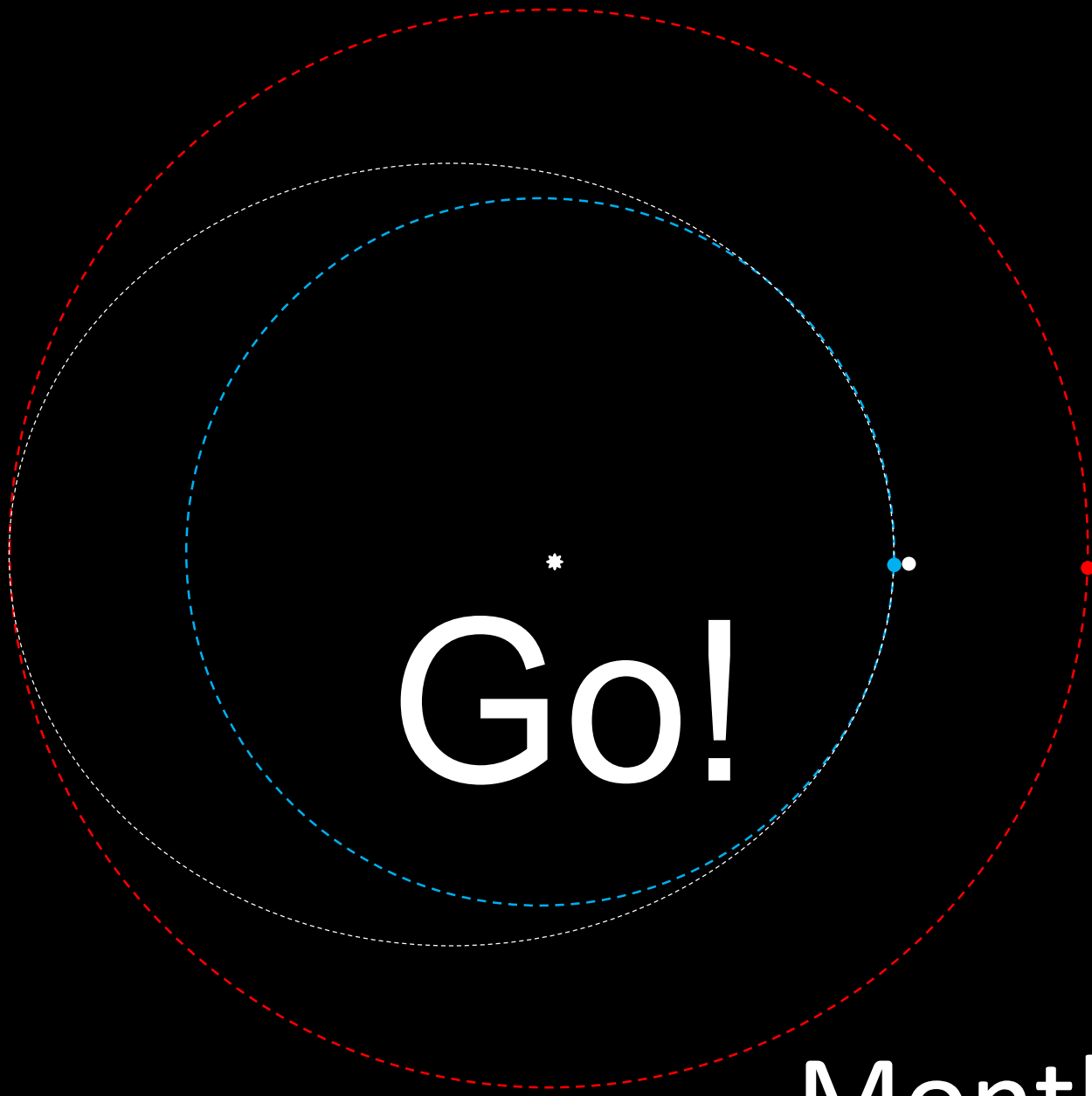
140 million miles

93 million miles

17 months

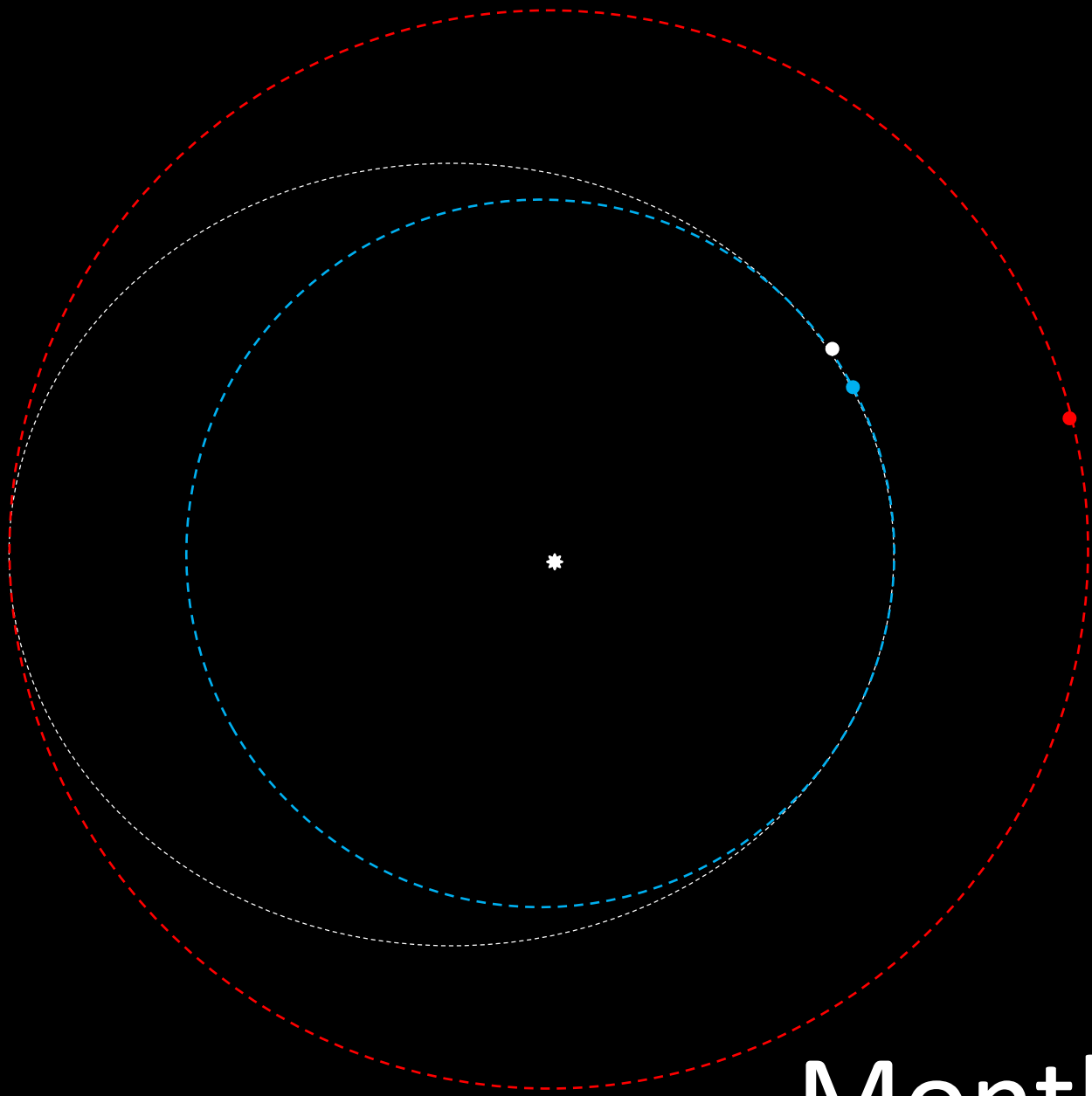




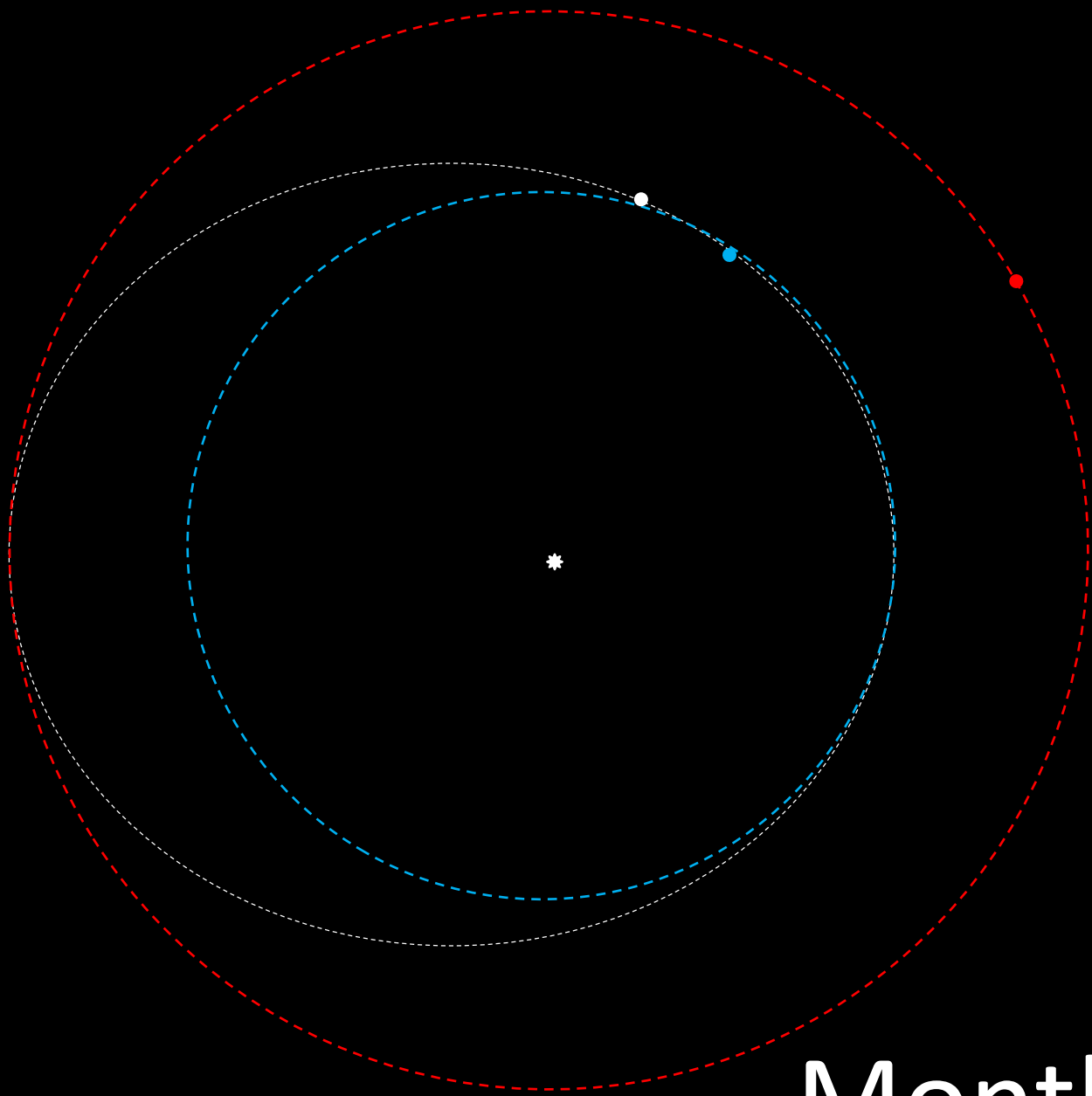


Go!

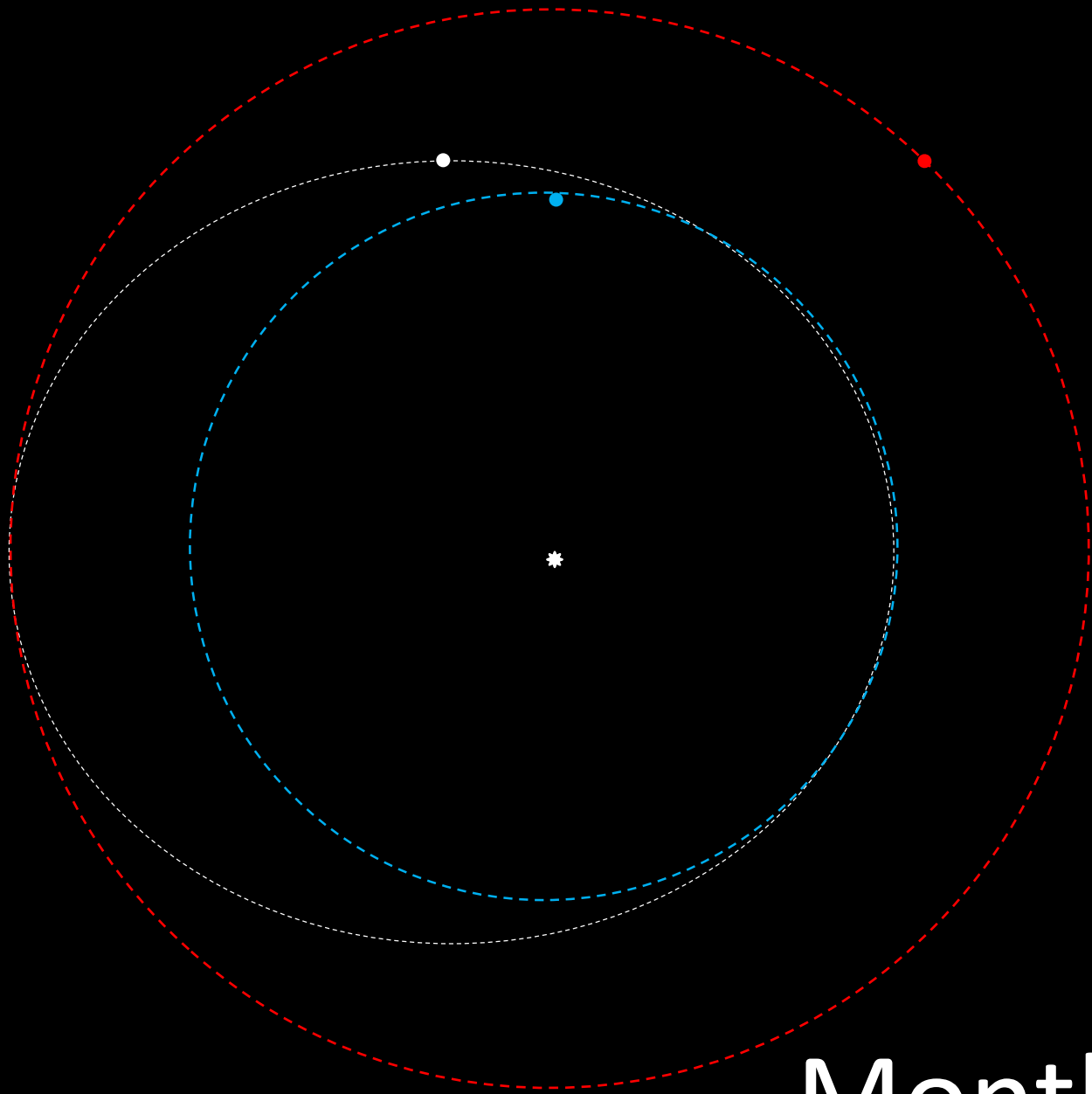
Month 0



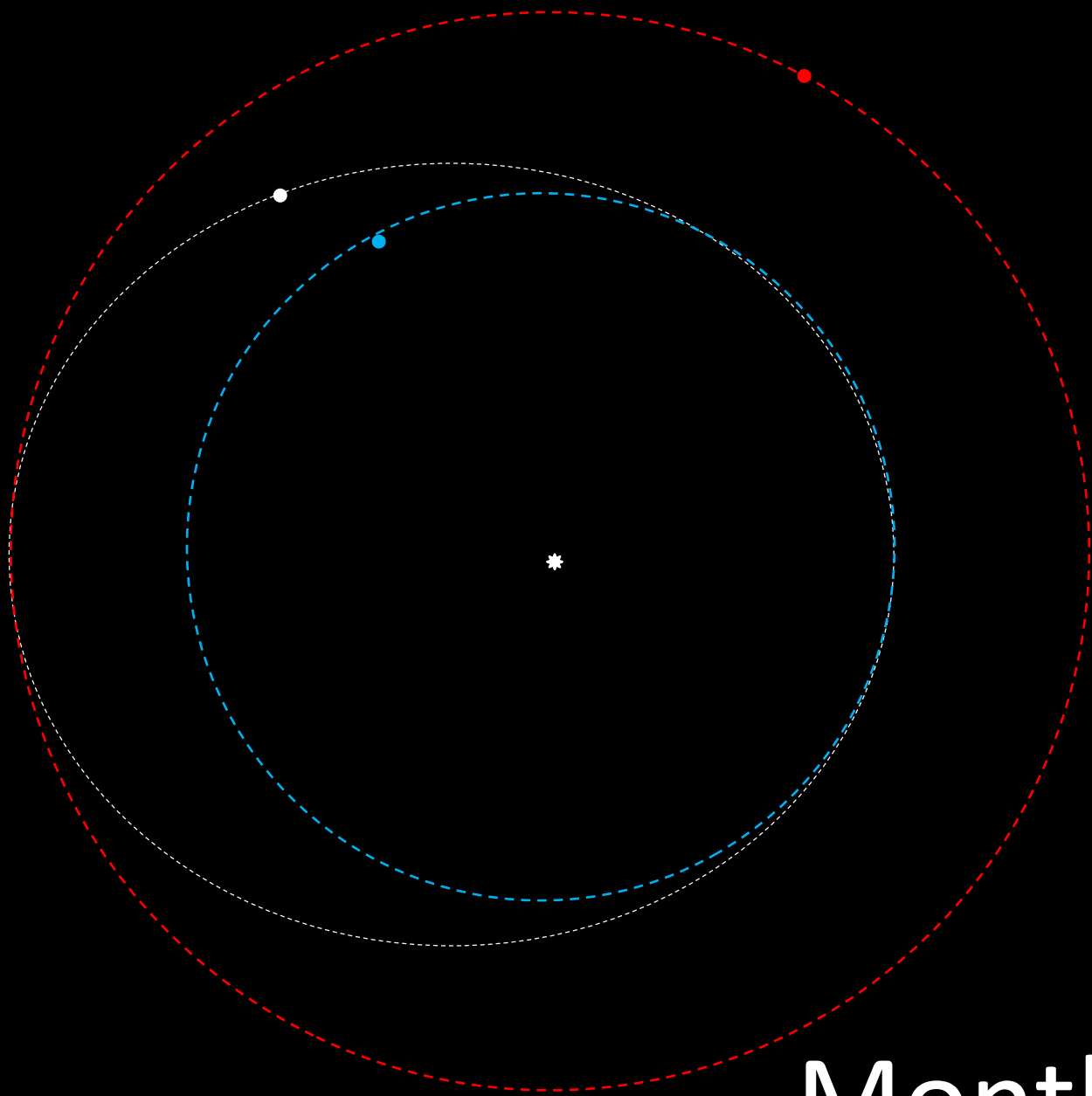
Month 1



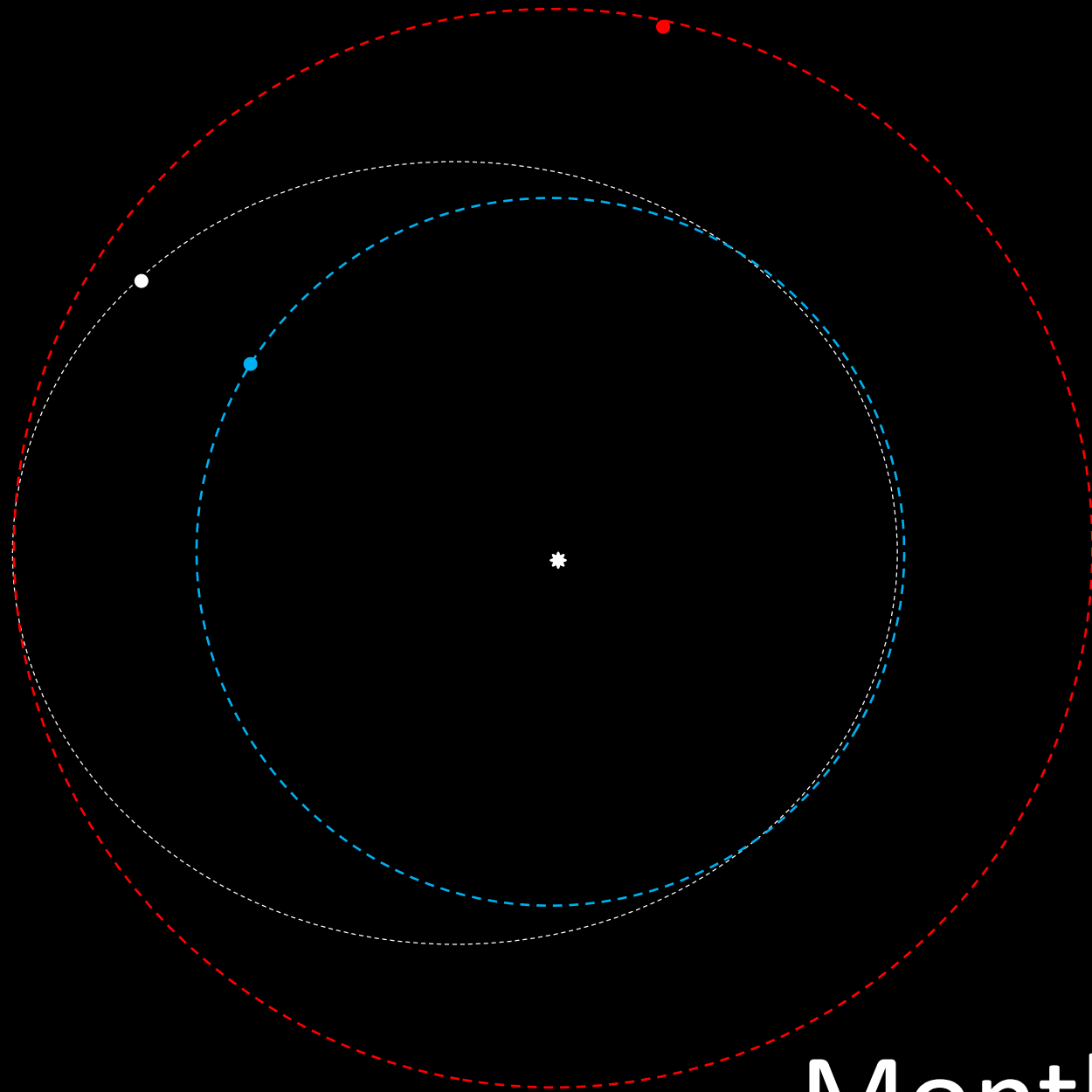
Month 2



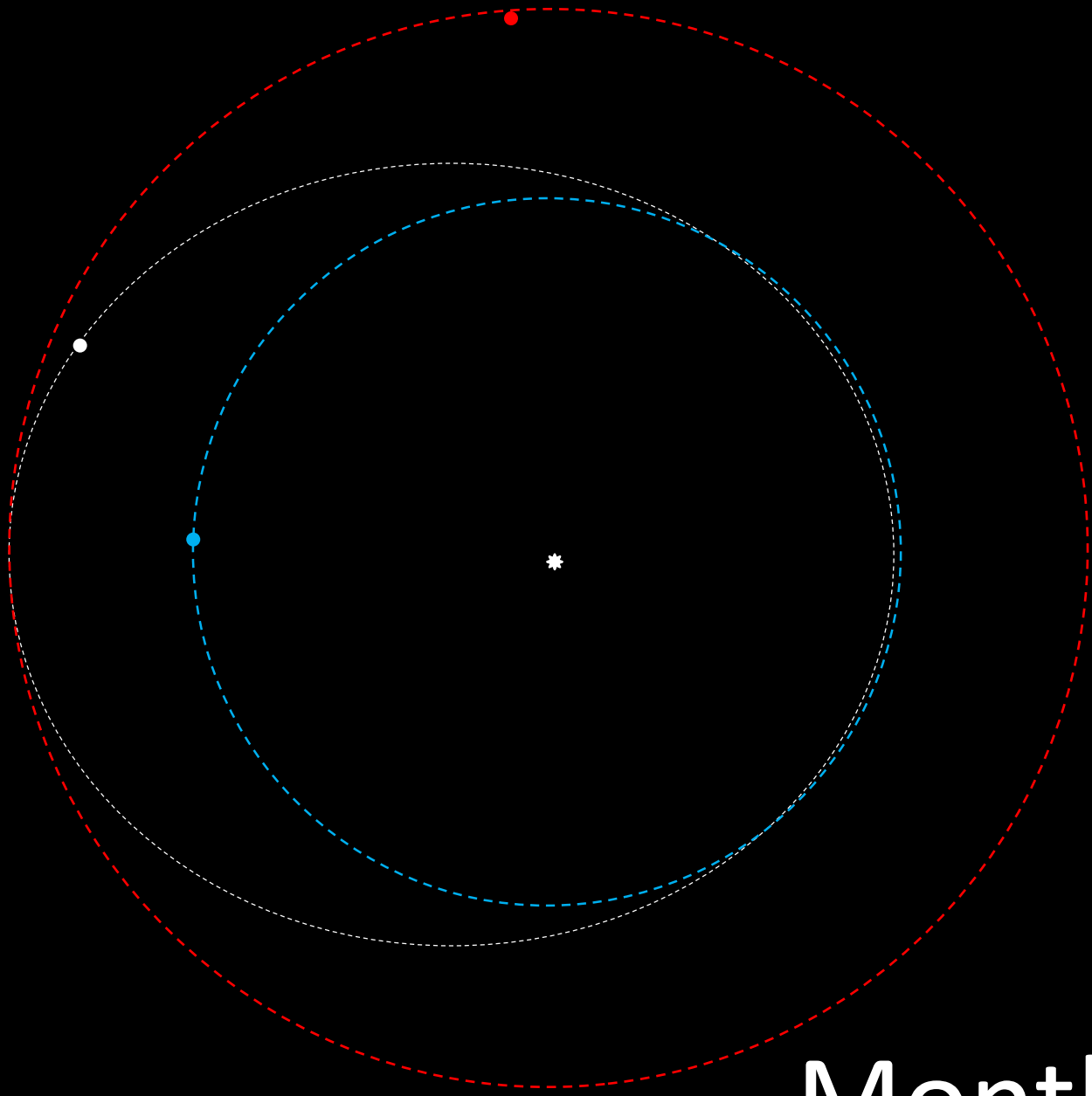
Month 3



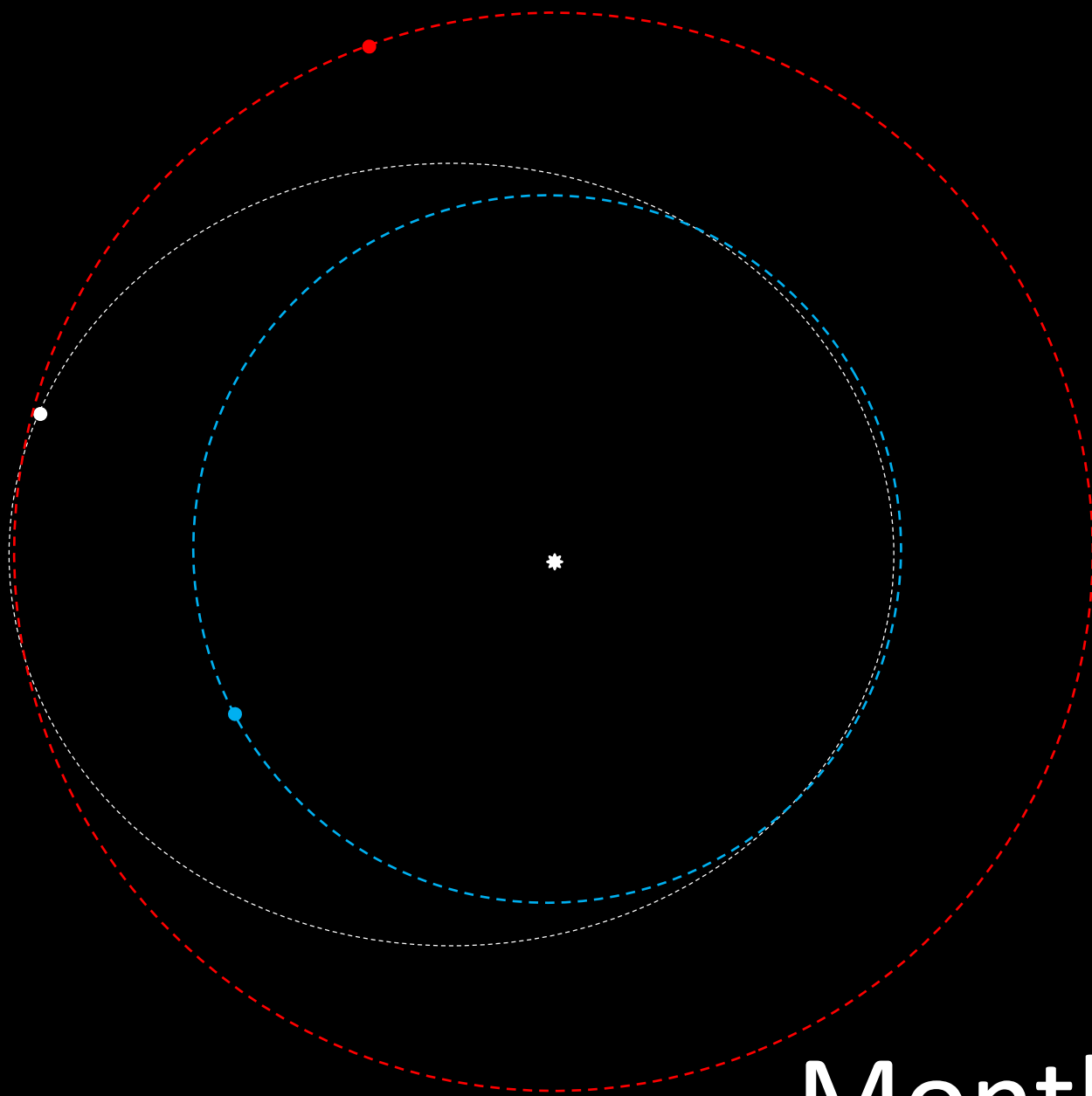
Month 4



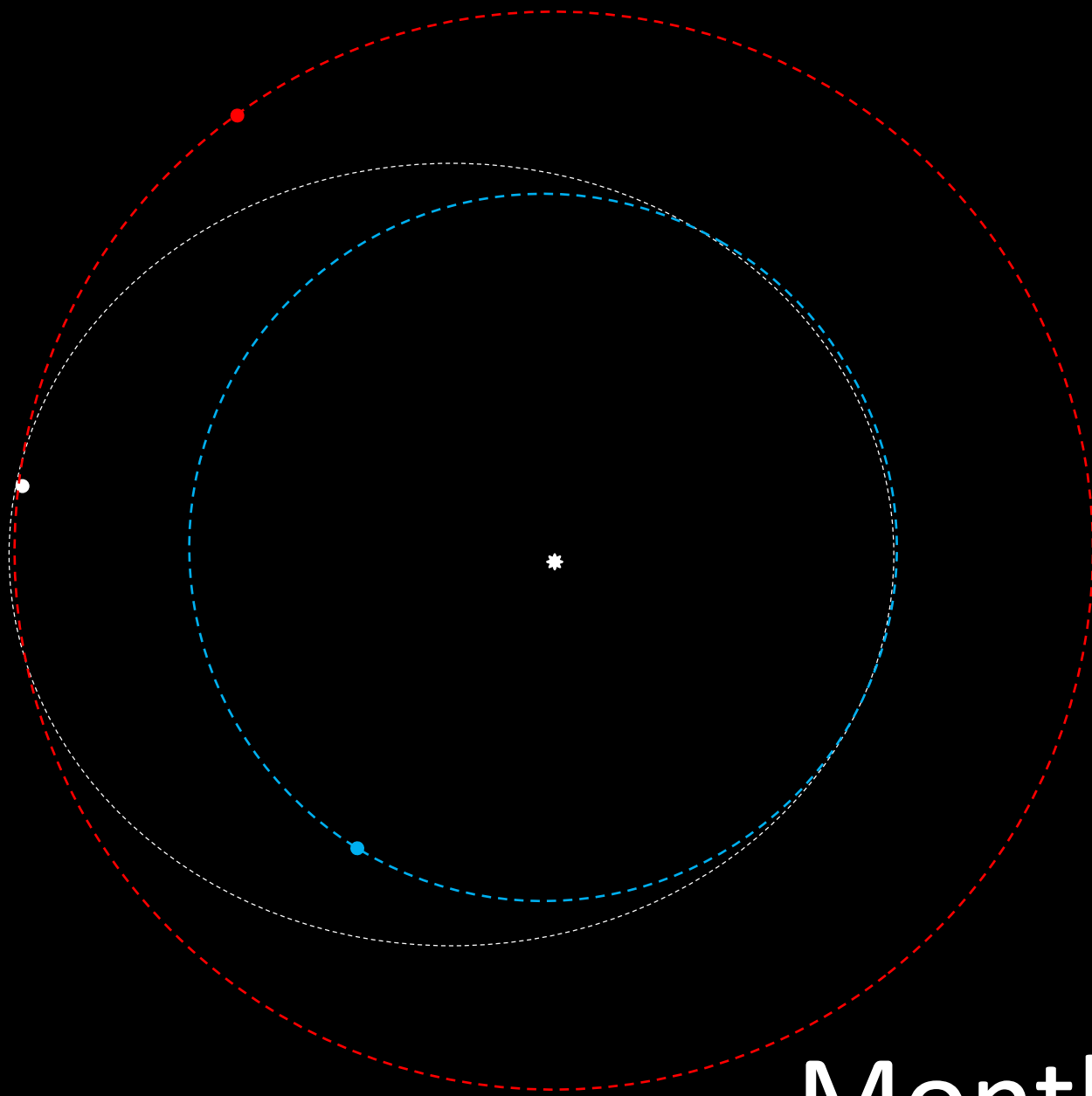
Month 5



Month 6



Month 7

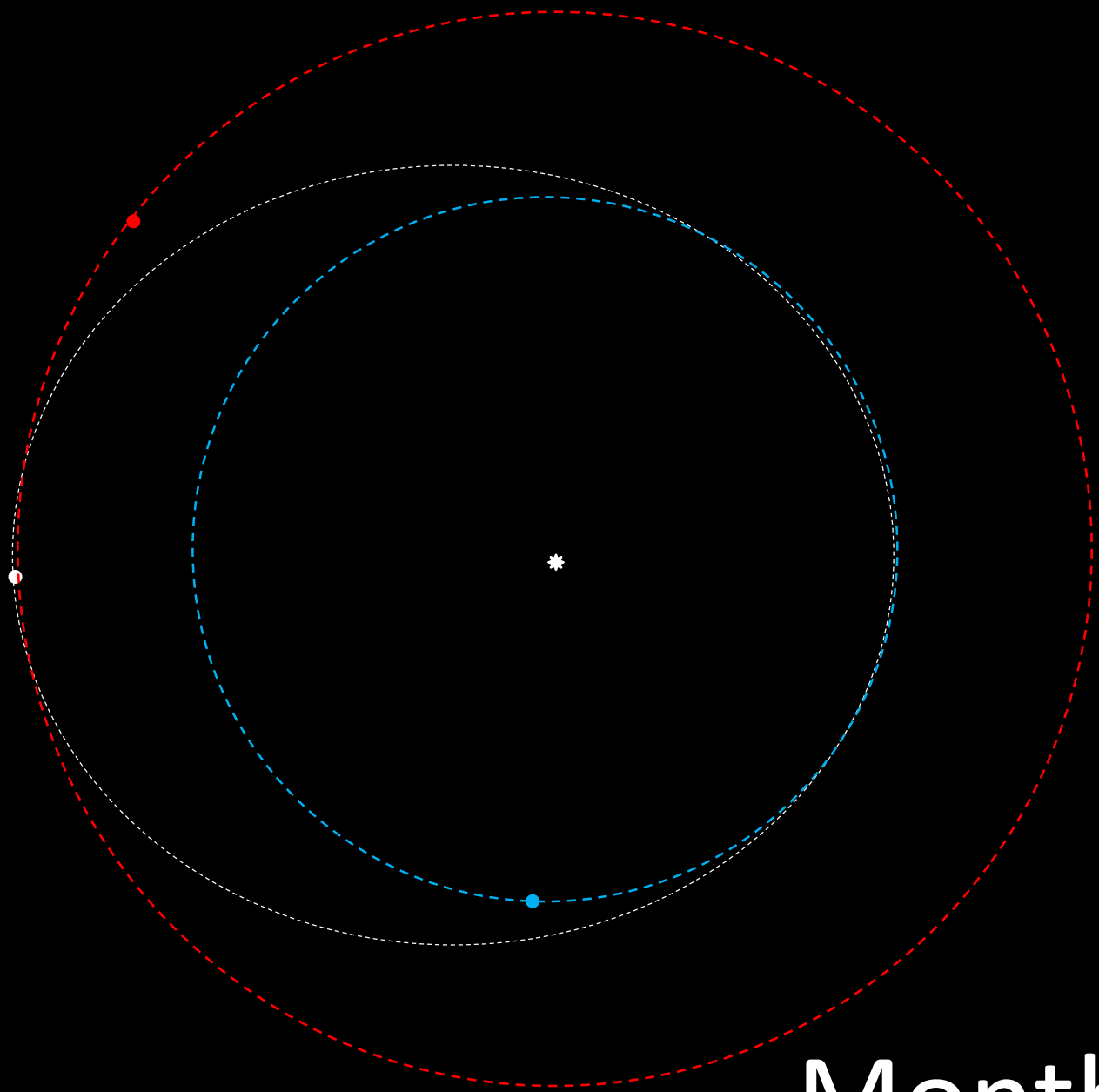


Month 8

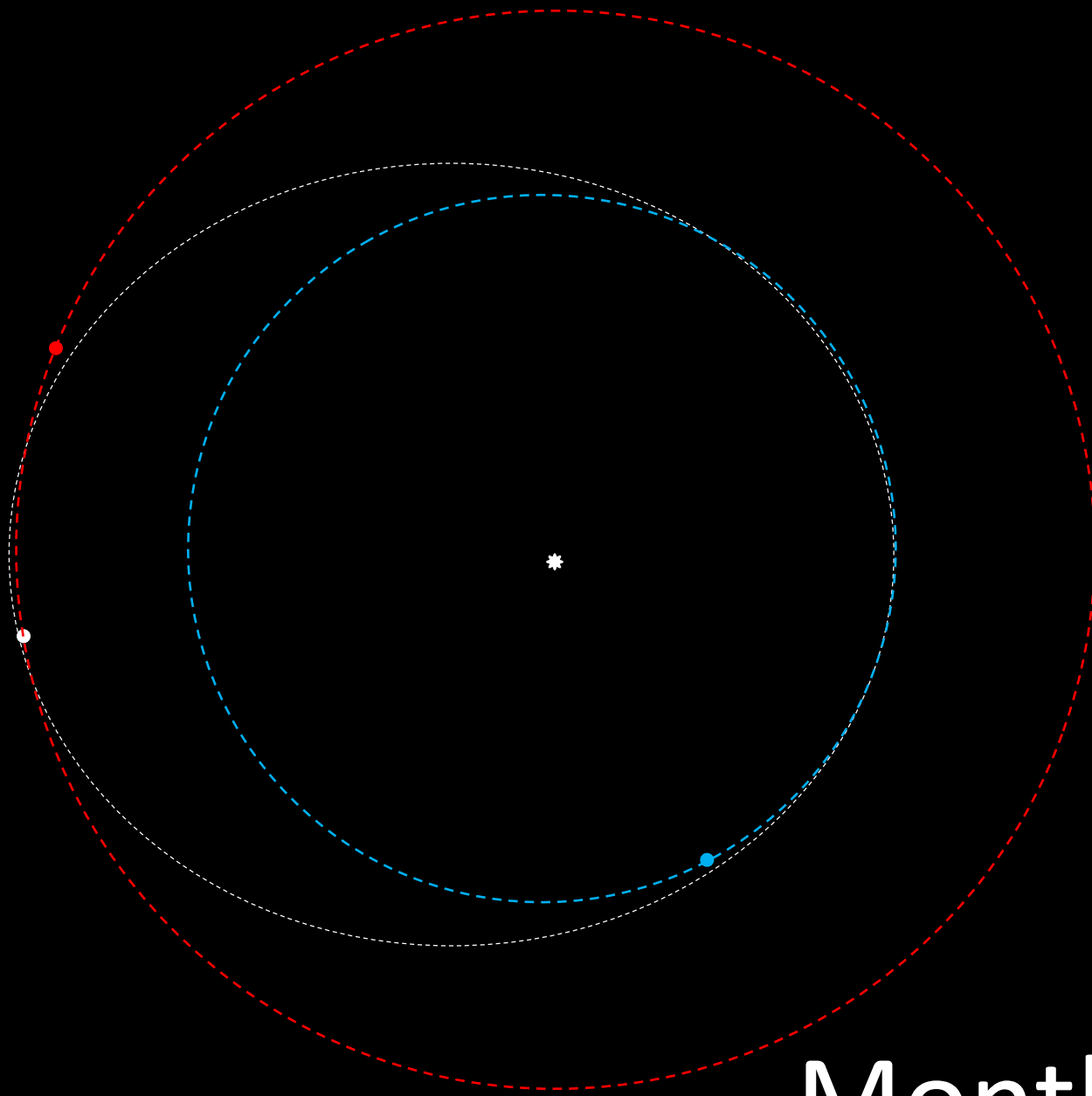


Now we're embarrassed.

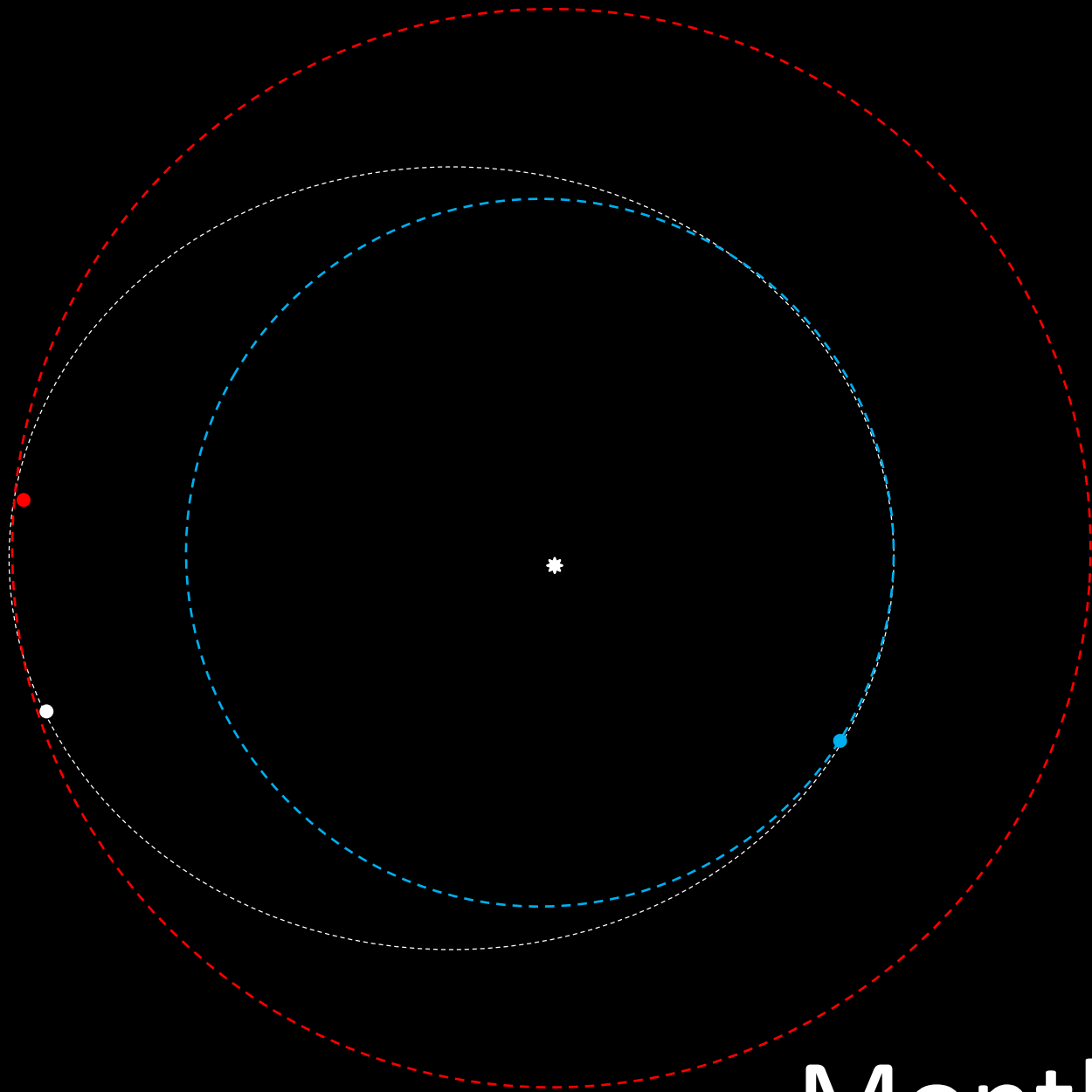
Month 8.5



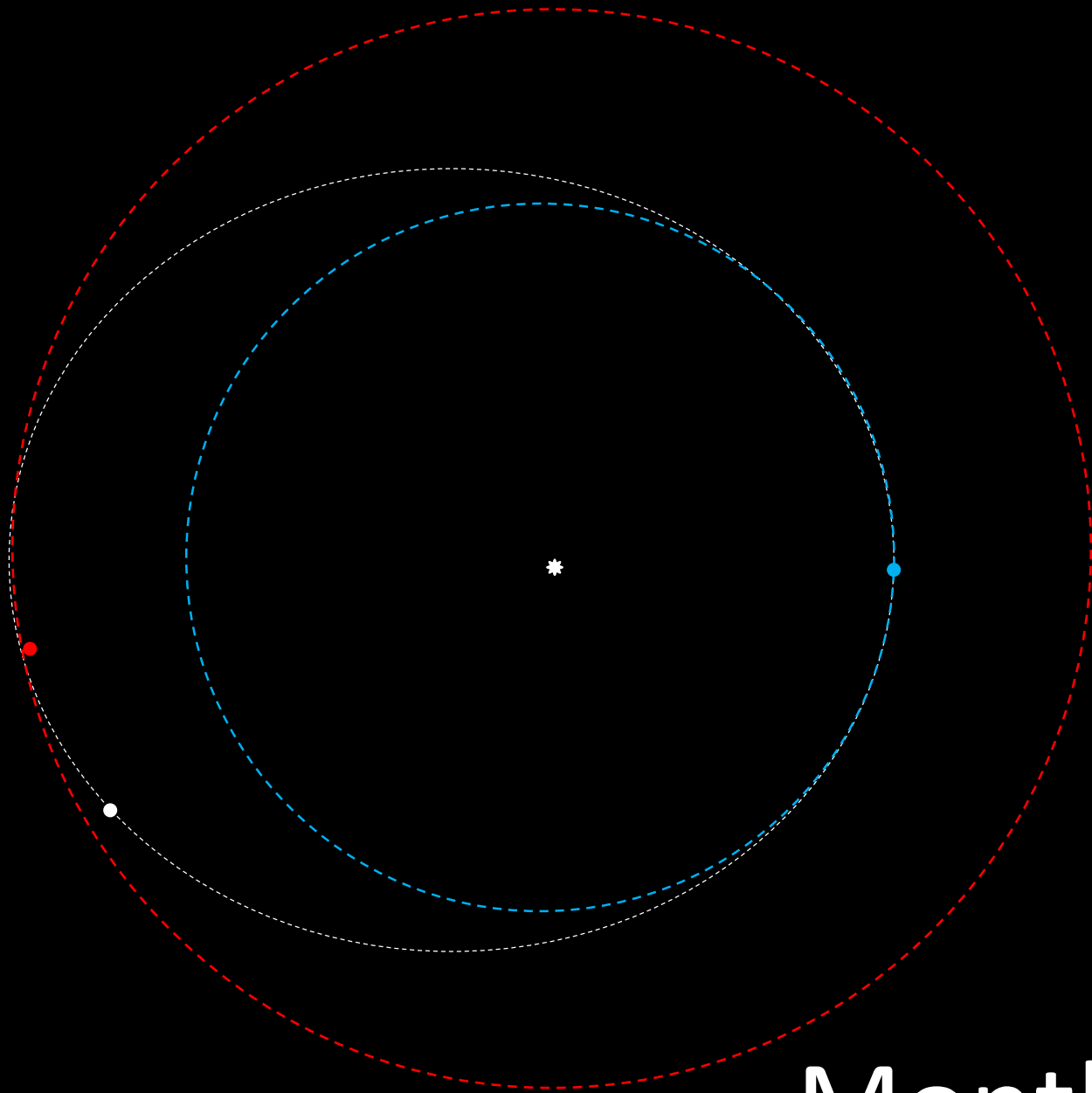
Month 9



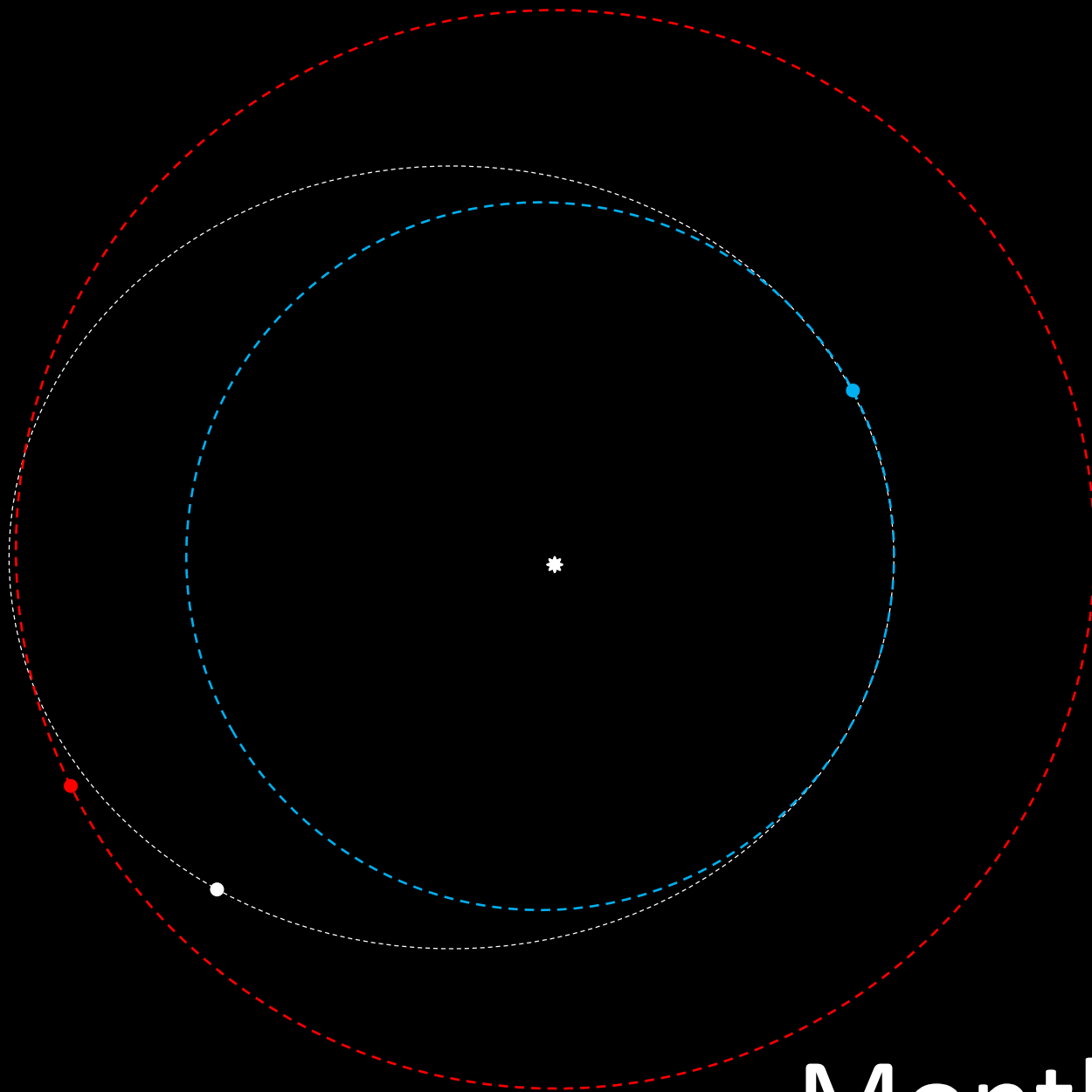
Month 10



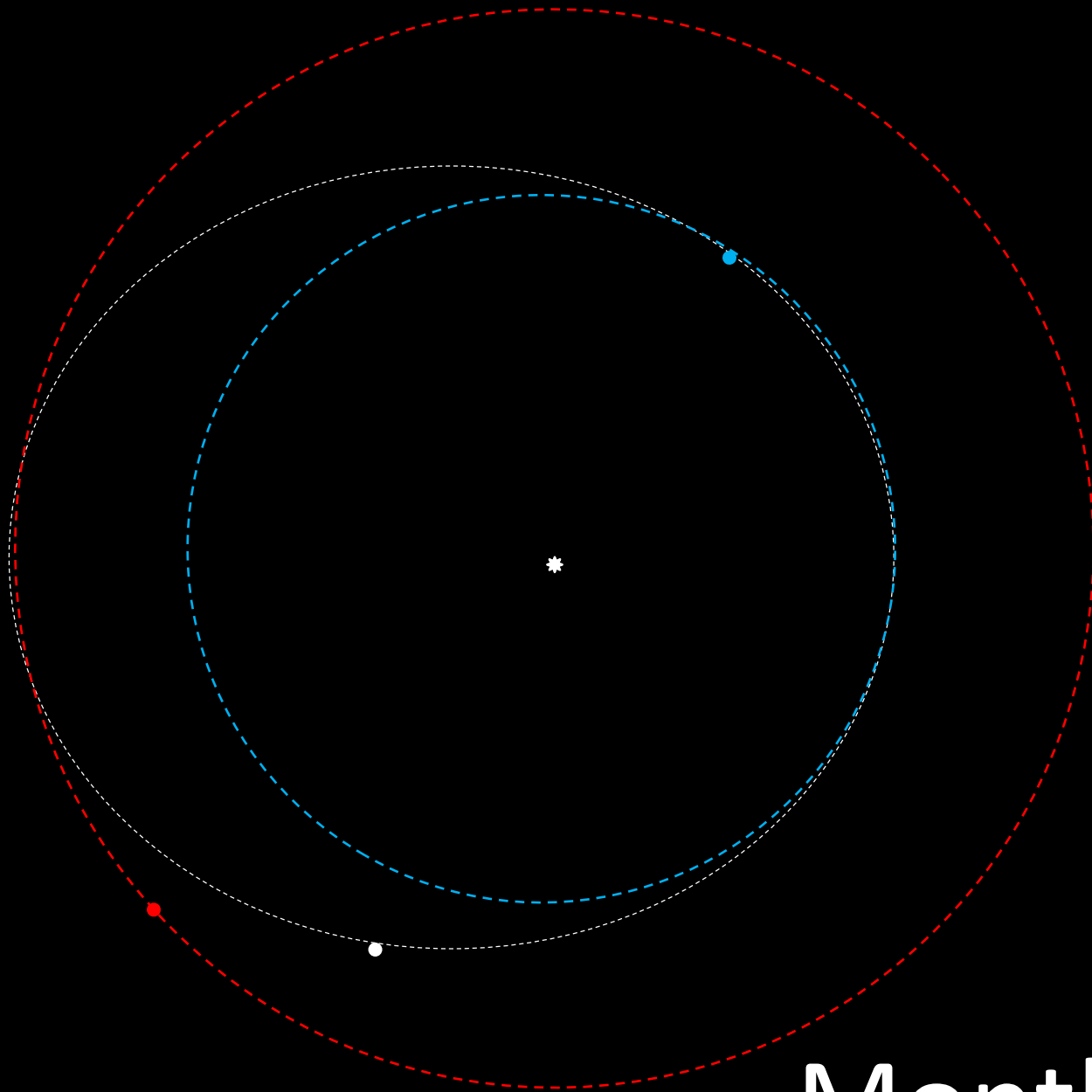
Month 11



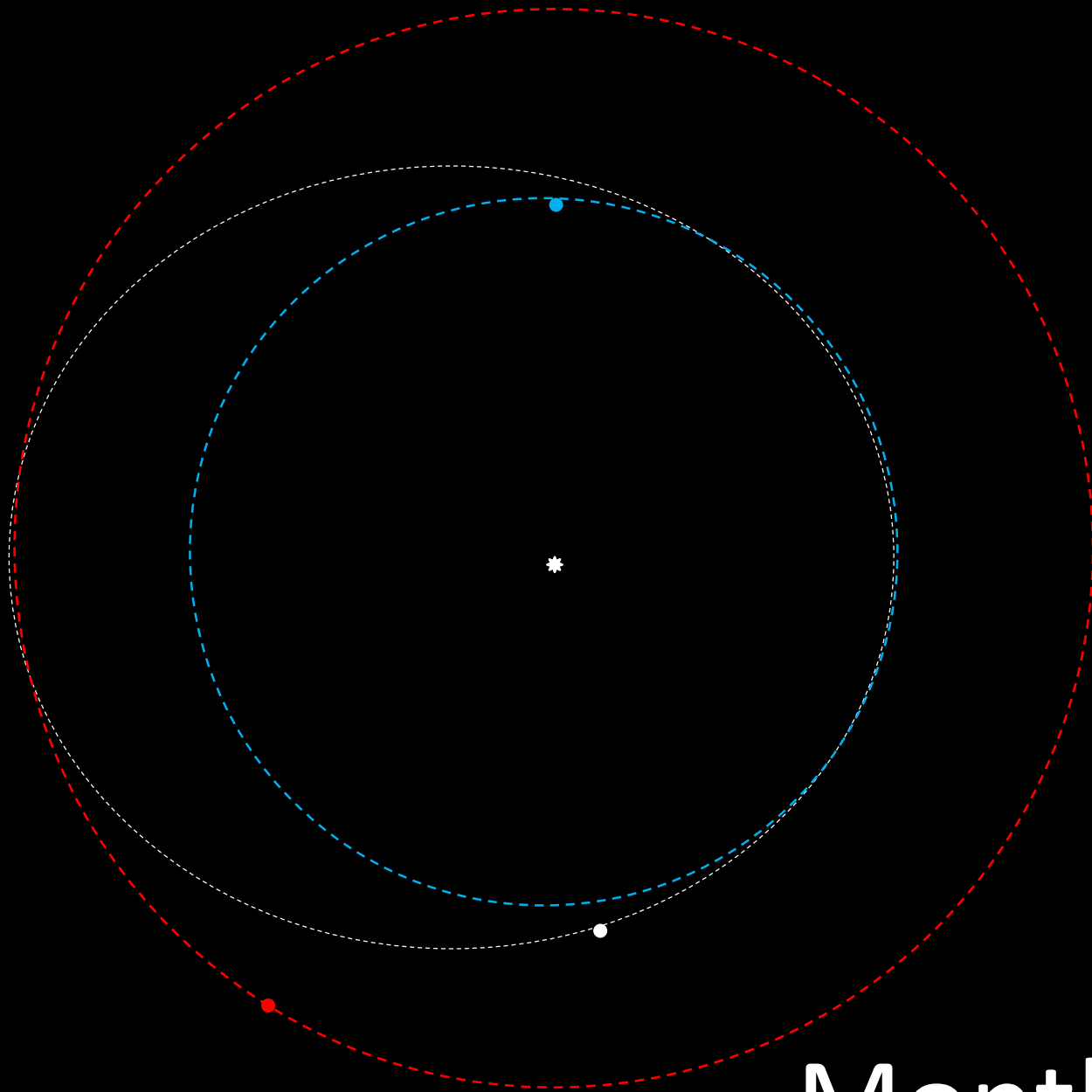
Month 12



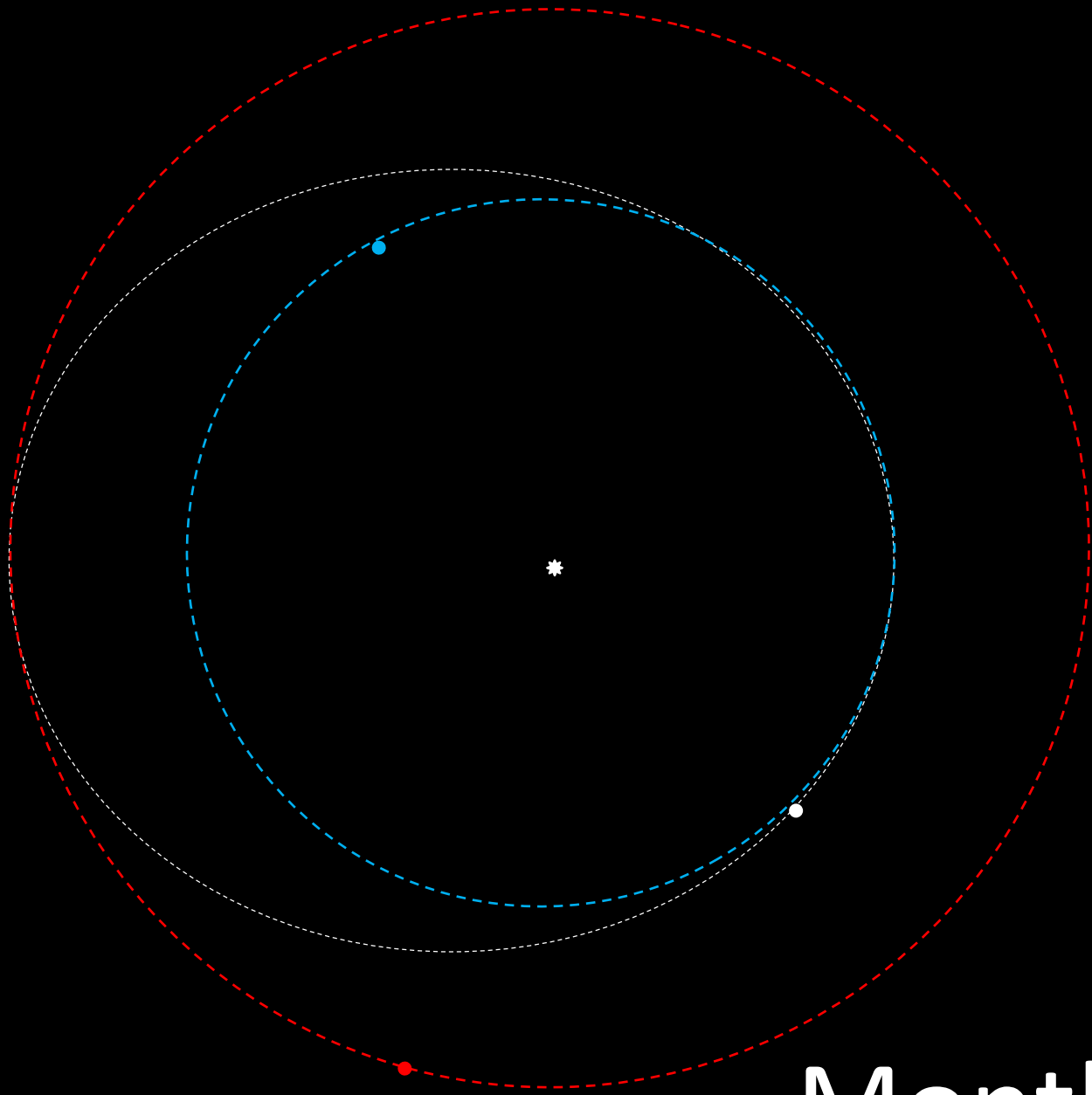
Month 13



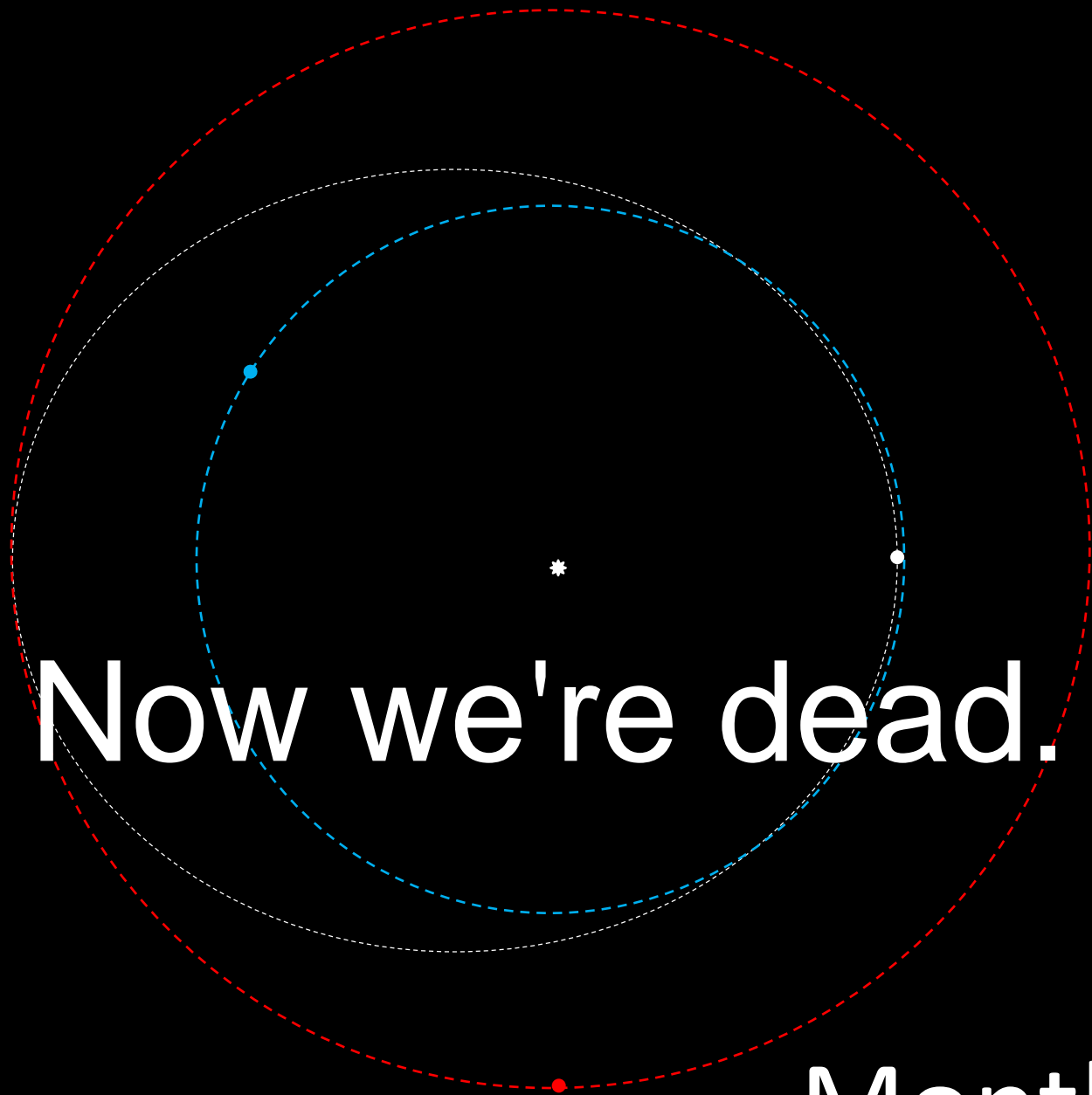
Month 14



Month 15

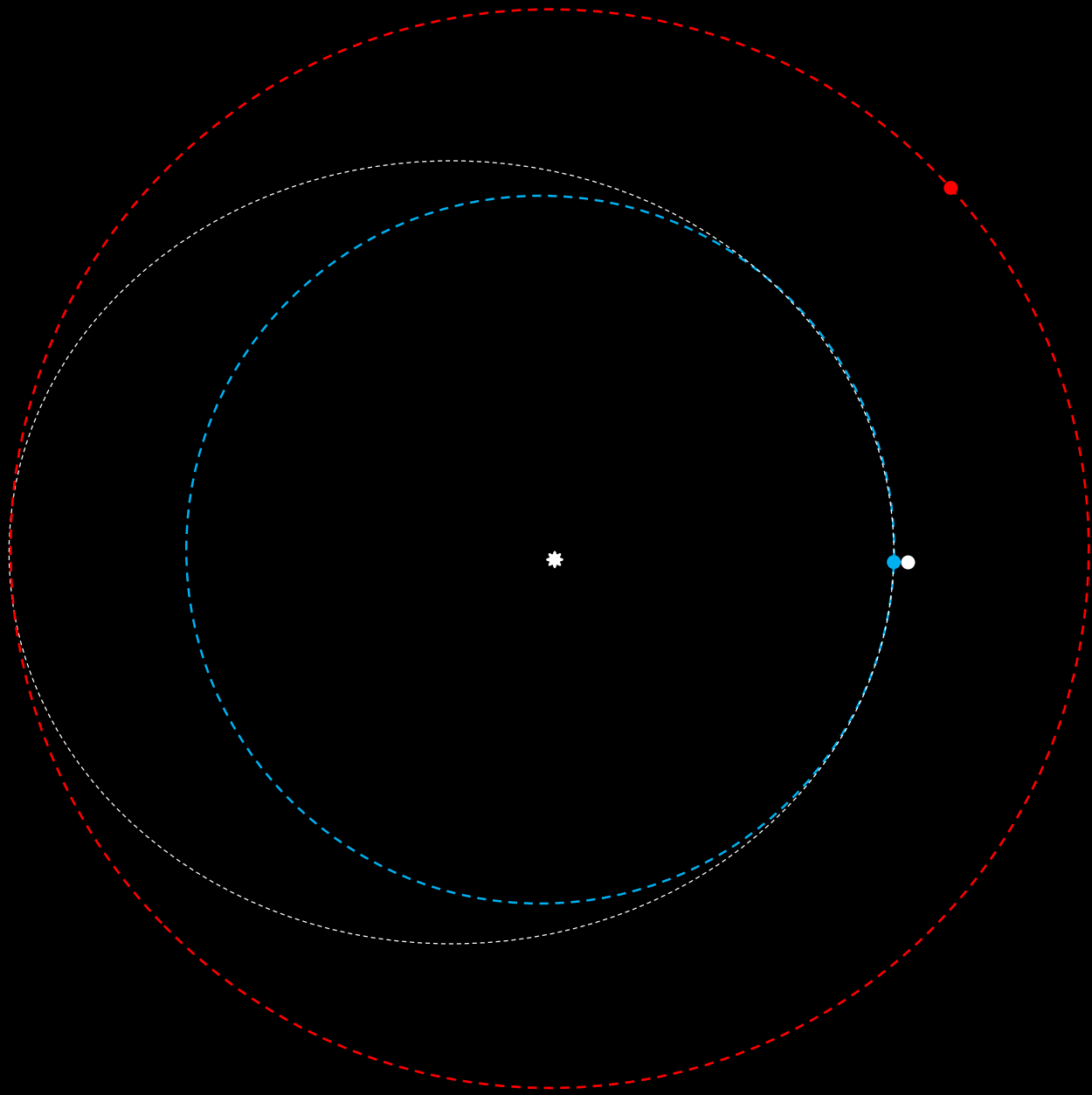


Month 16



Now we're dead.

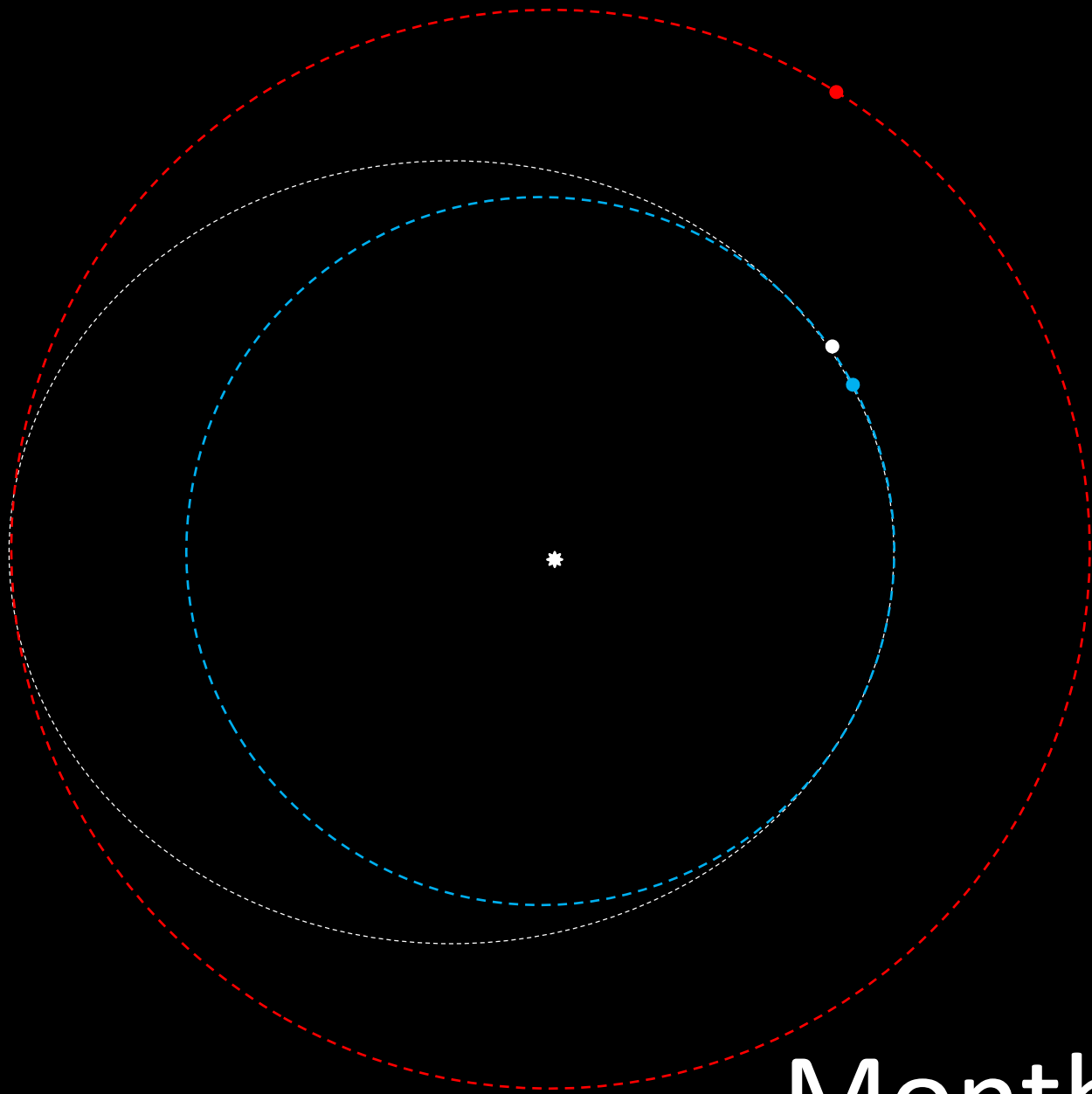
Month 17



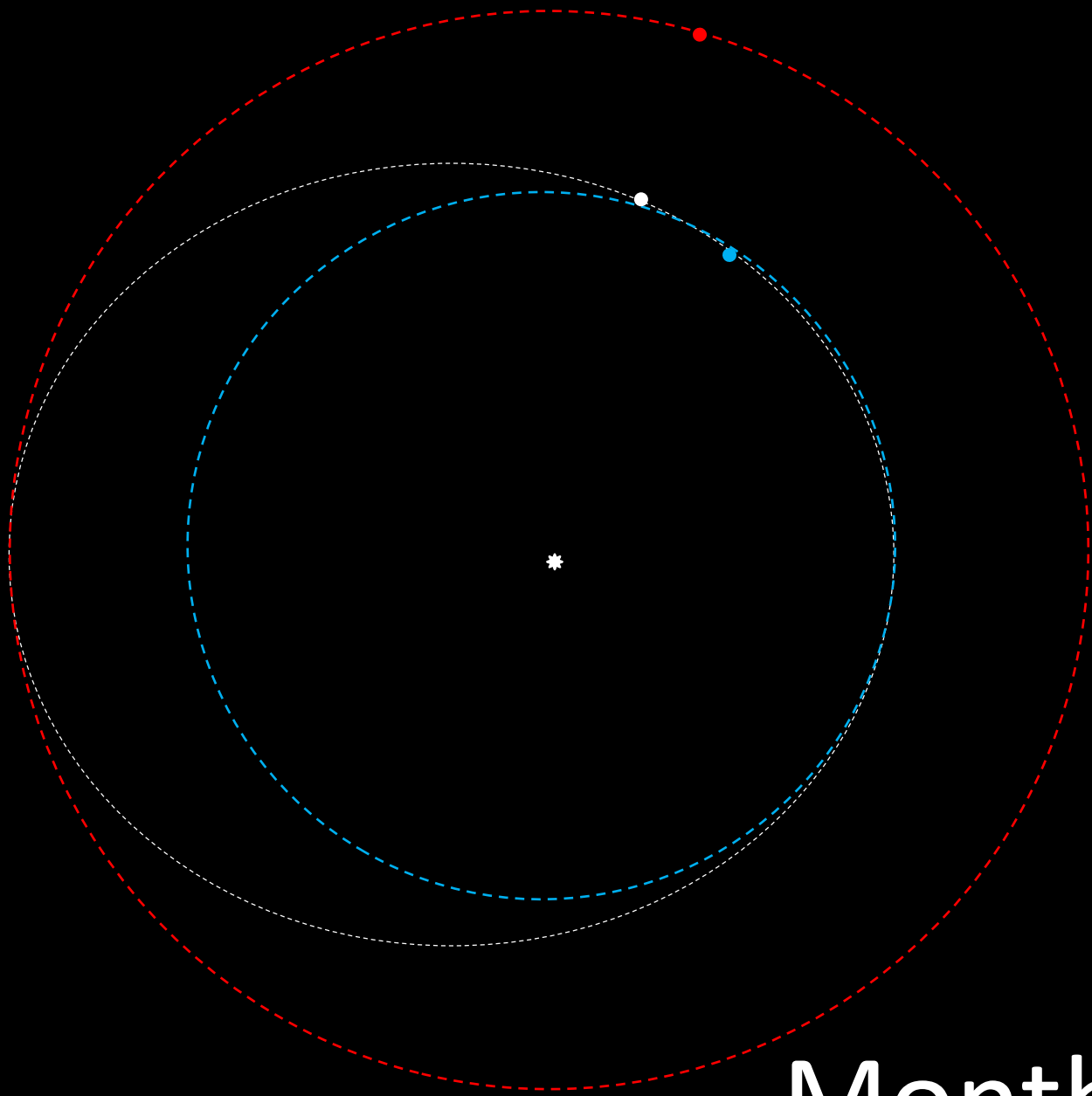


Go!

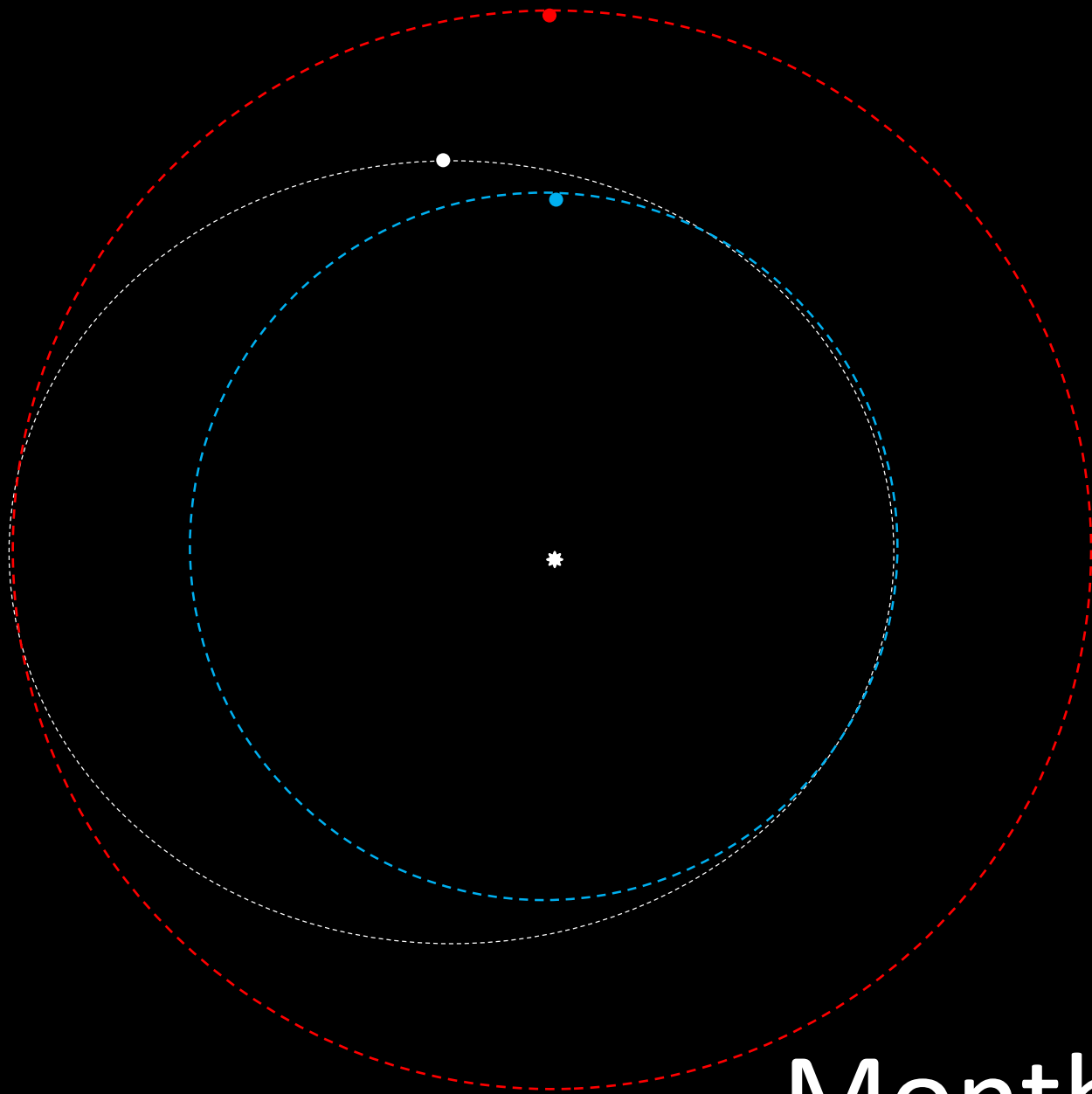
Month 0



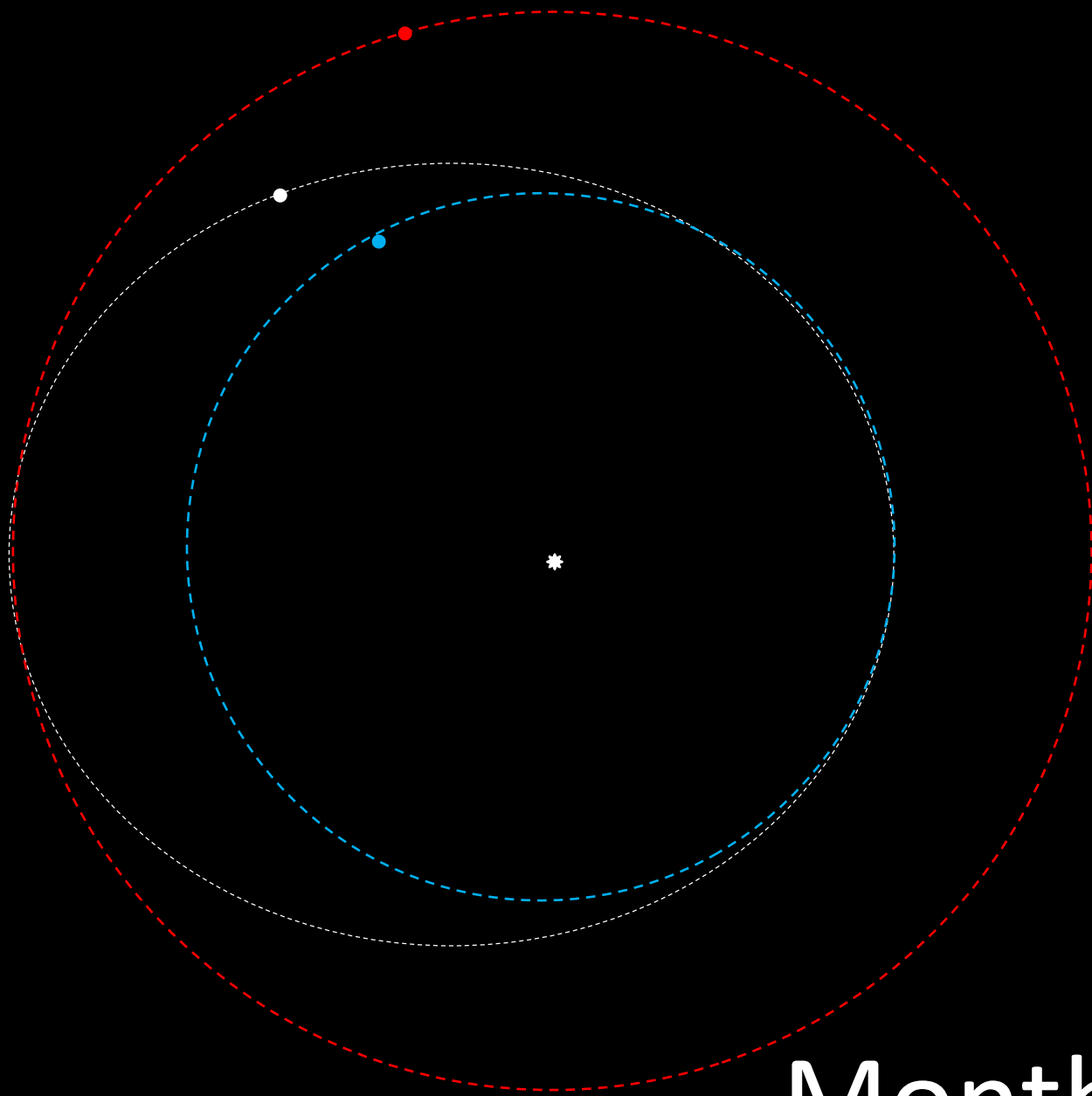
Month 1



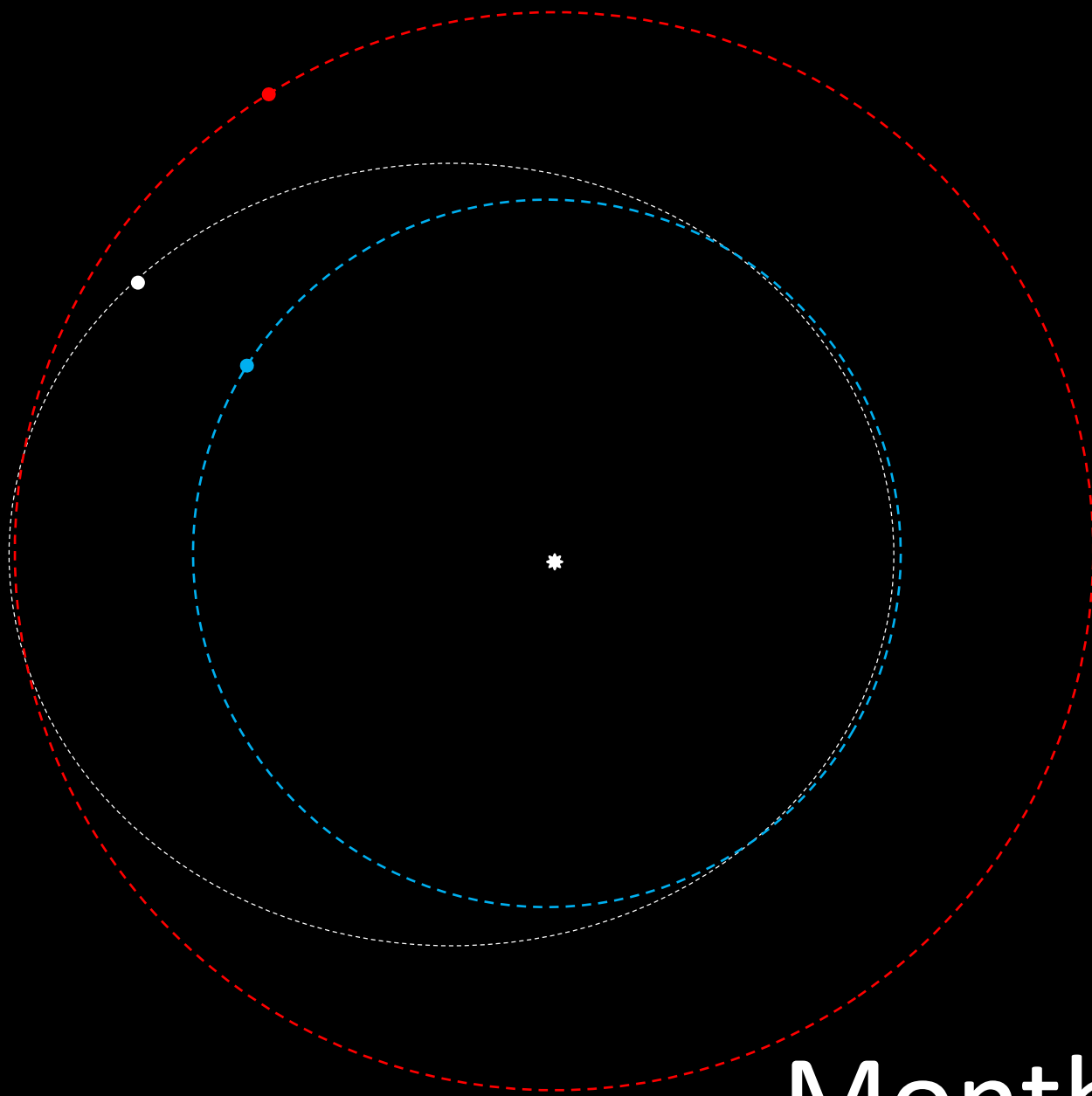
Month 2



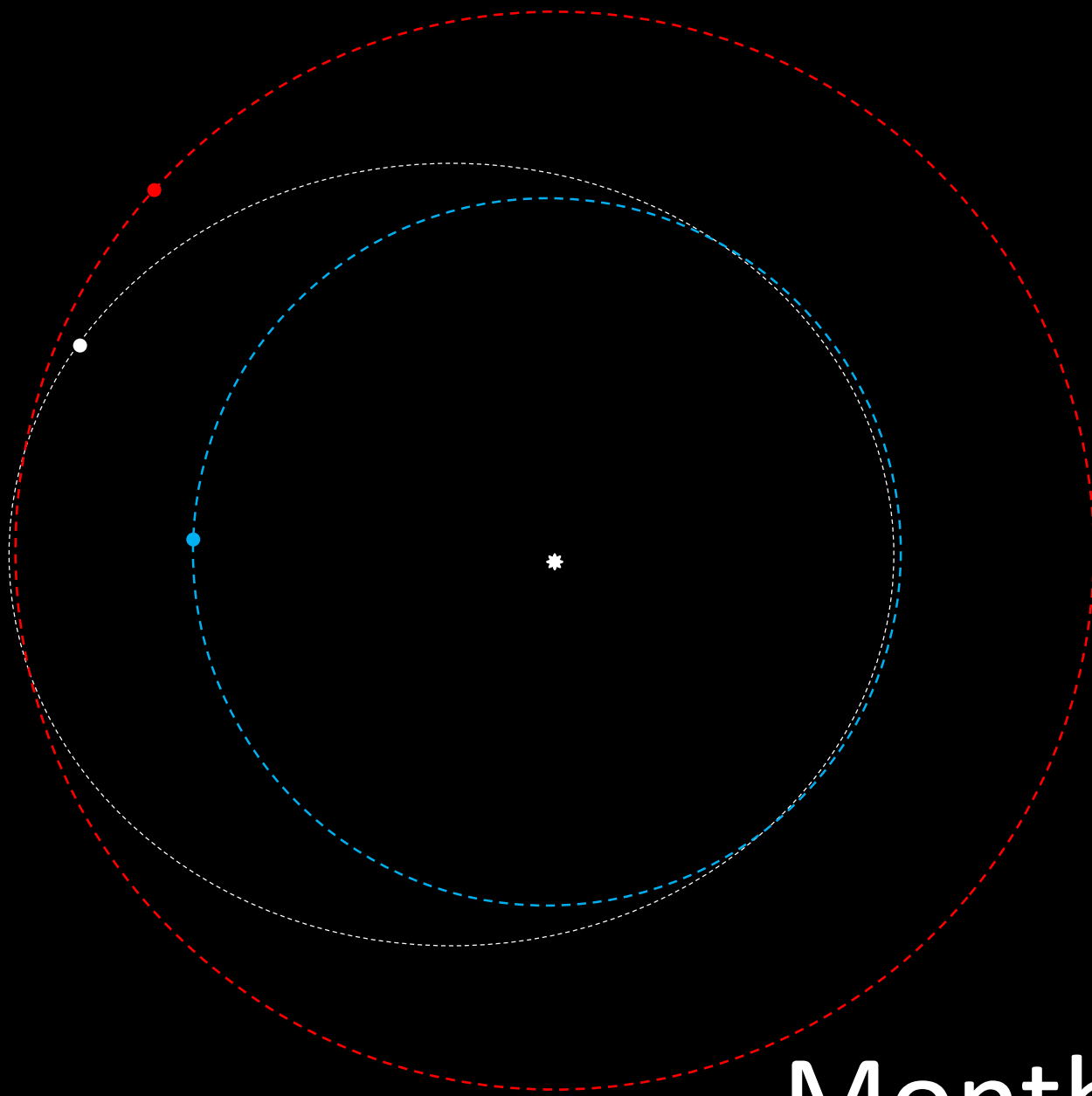
Month 3



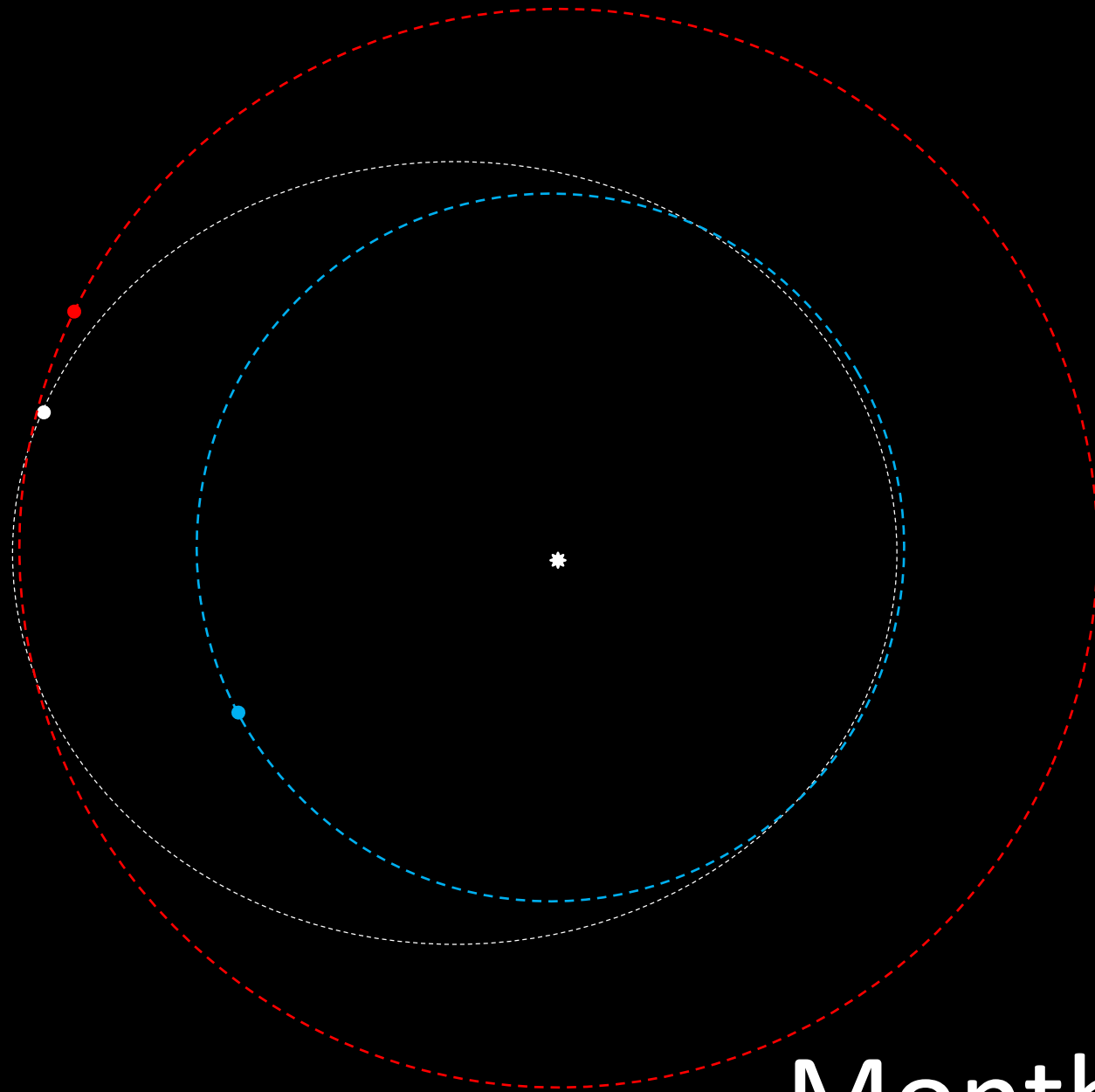
Month 4



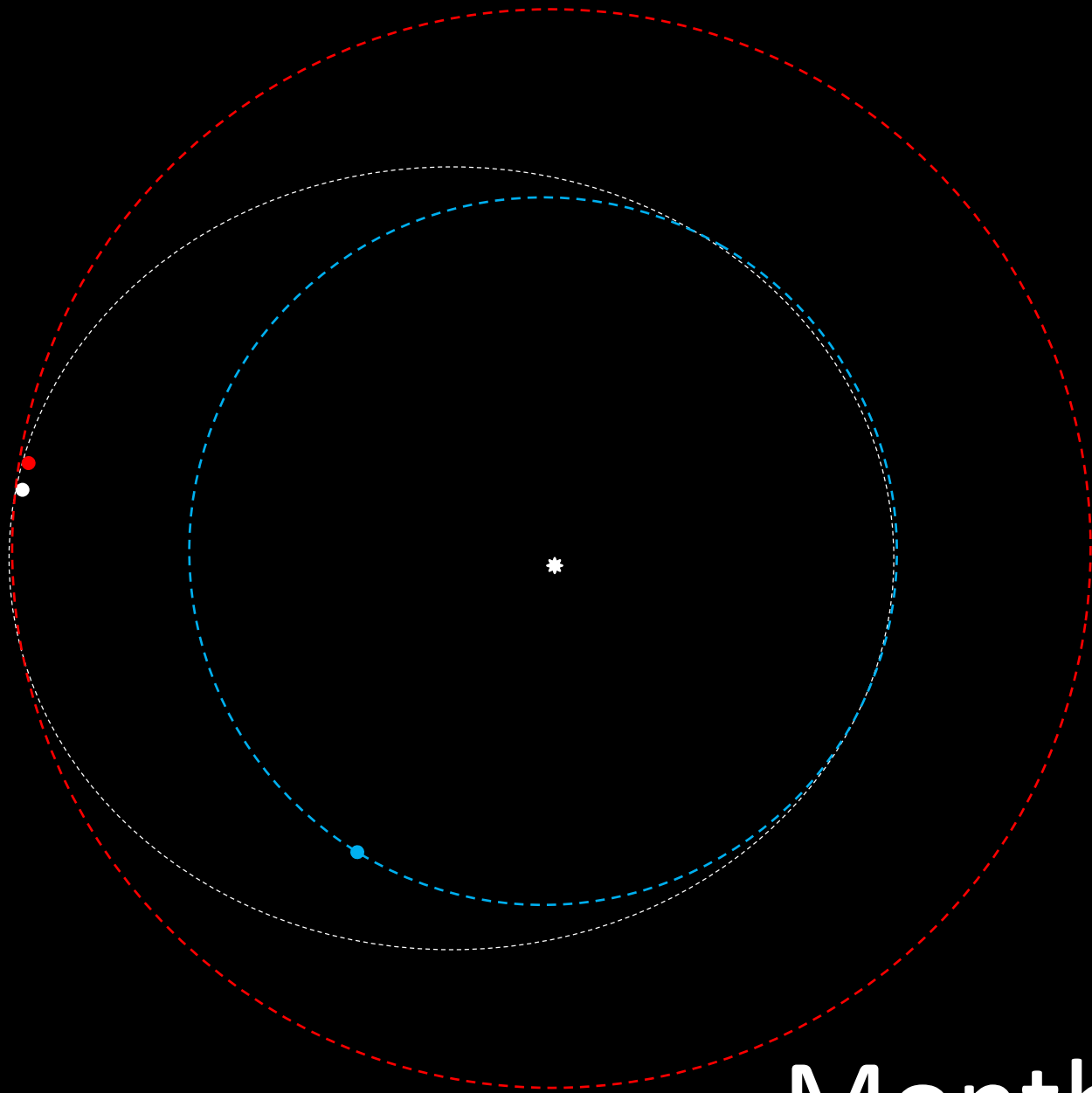
Month 5



Month 6



Month 7



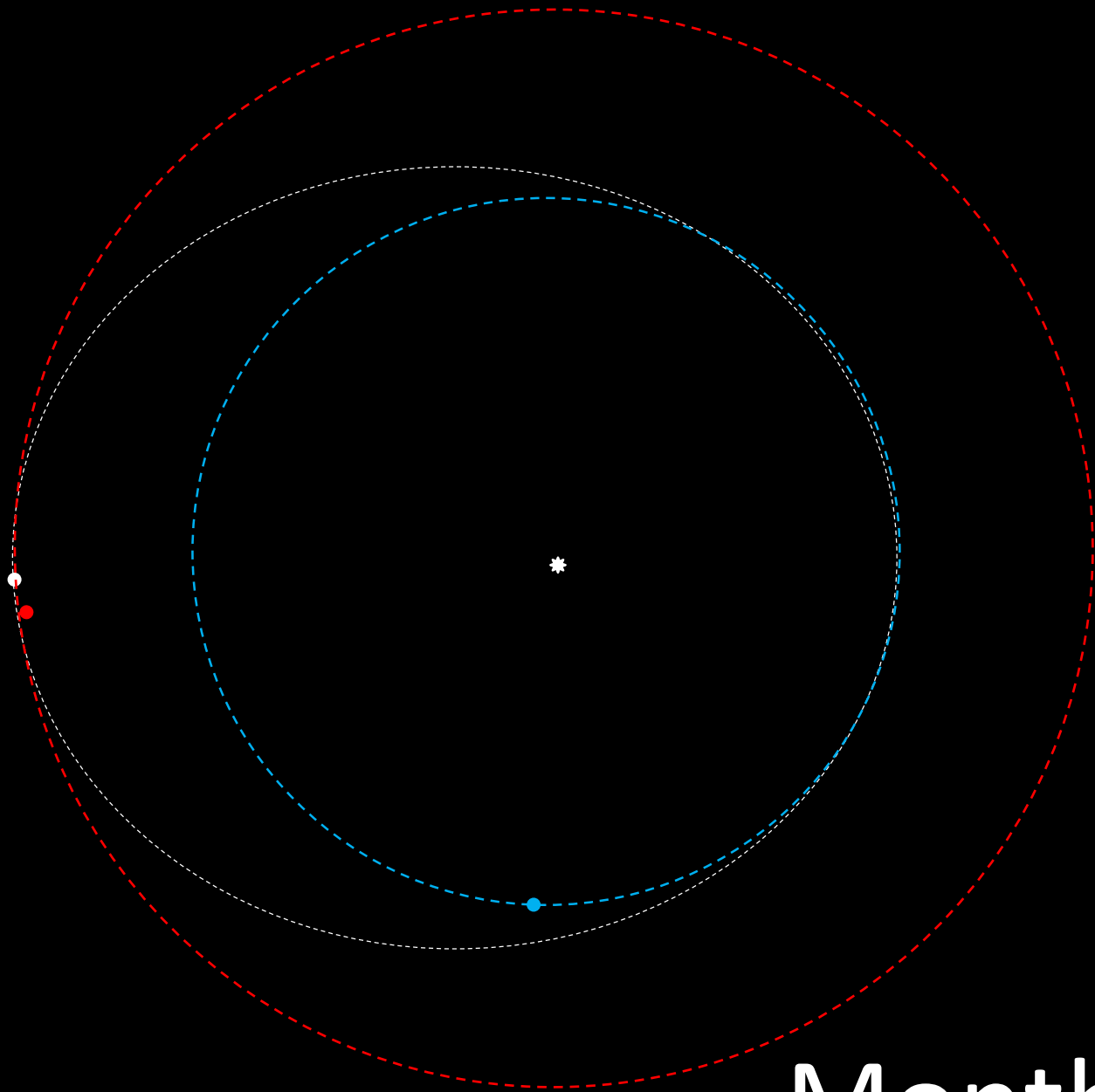
Month 8



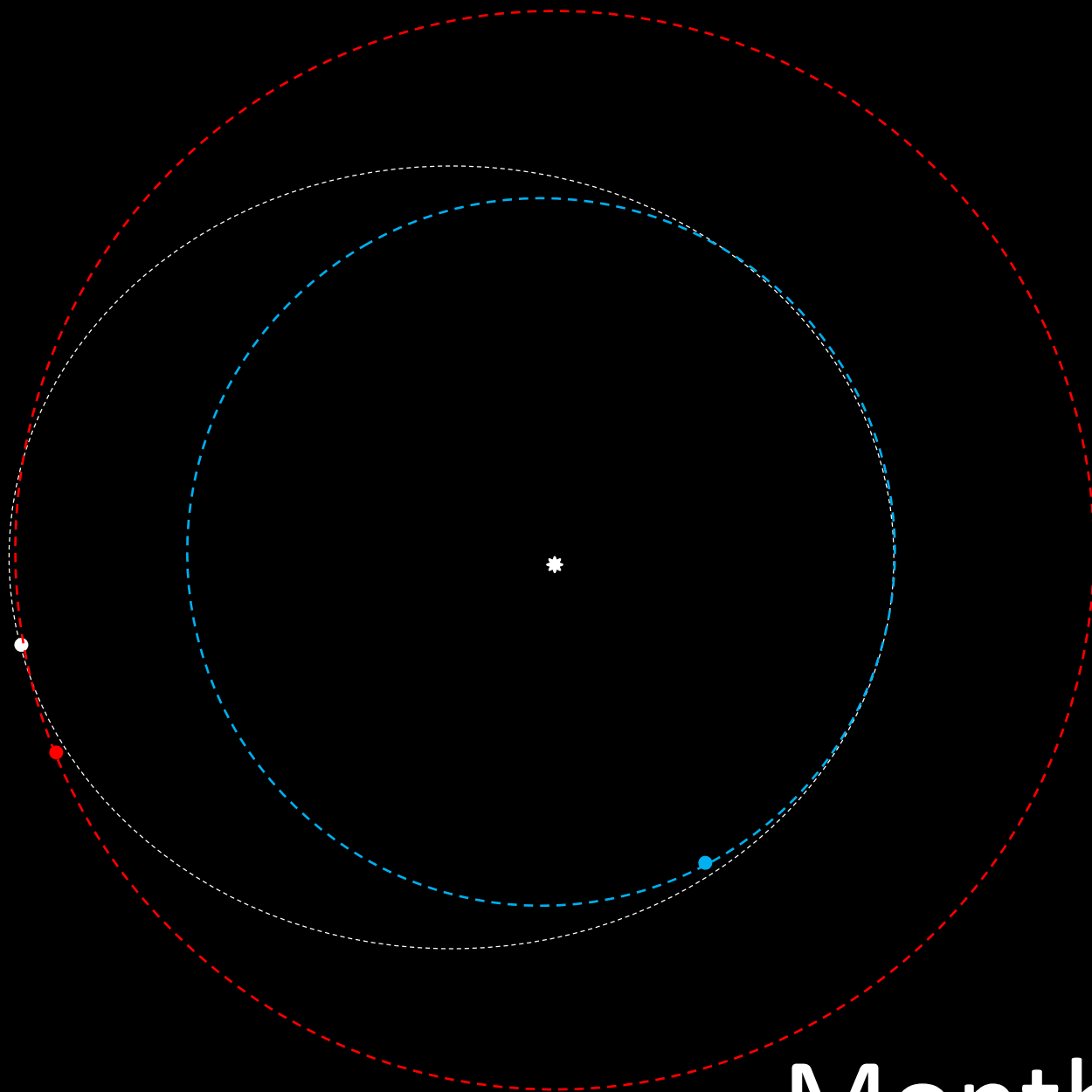
The diagram shows a central white asterisk representing a star. Two concentric dashed circles represent orbits: an inner cyan one and an outer red one. A white dot is on the red orbit at the 9 o'clock position, and a red dot is slightly to its right. A cyan dot is on the cyan orbit at the 6 o'clock position. A white asterisk is at the center of the orbits.

Now we're heroes!

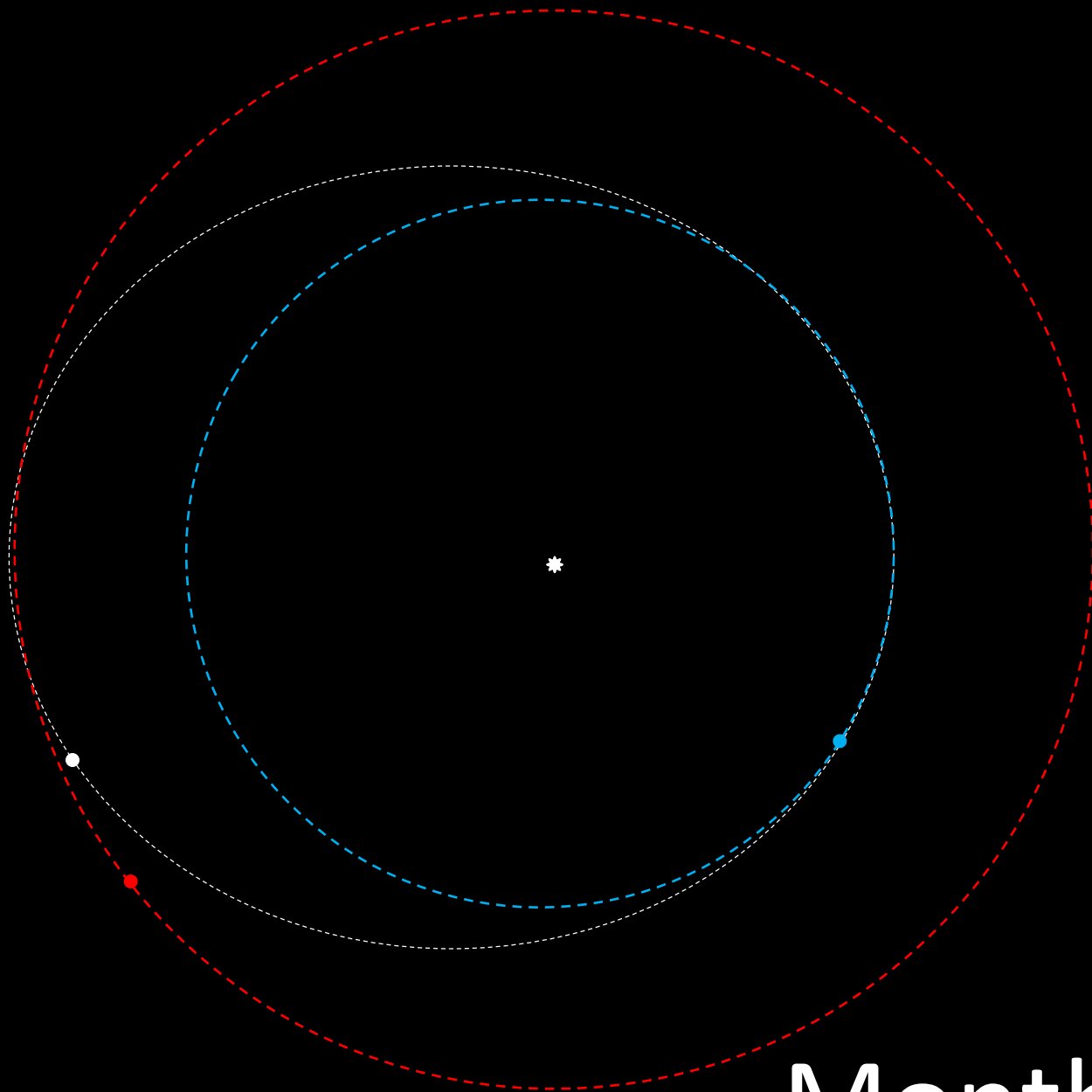
Month 8.5



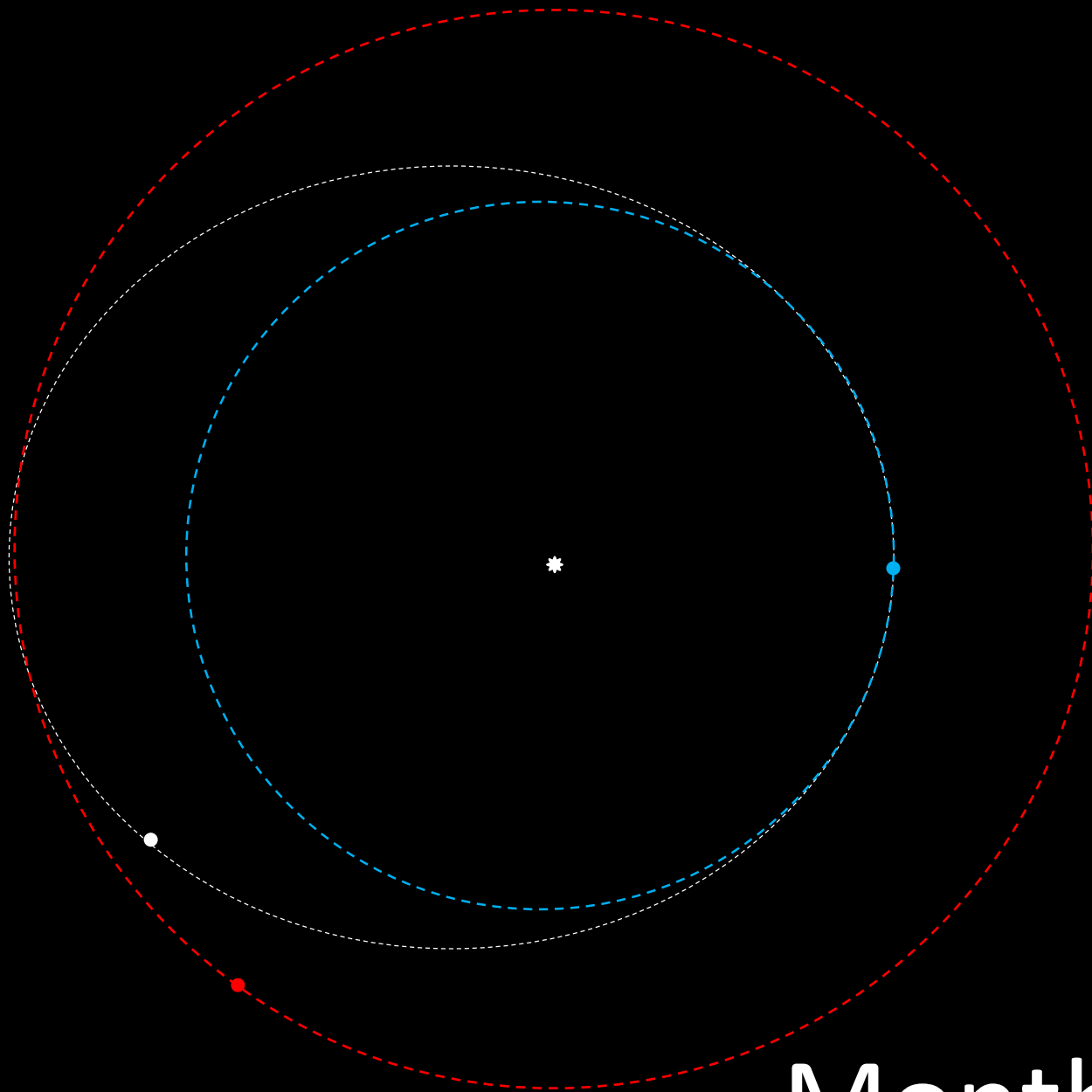
Month 9



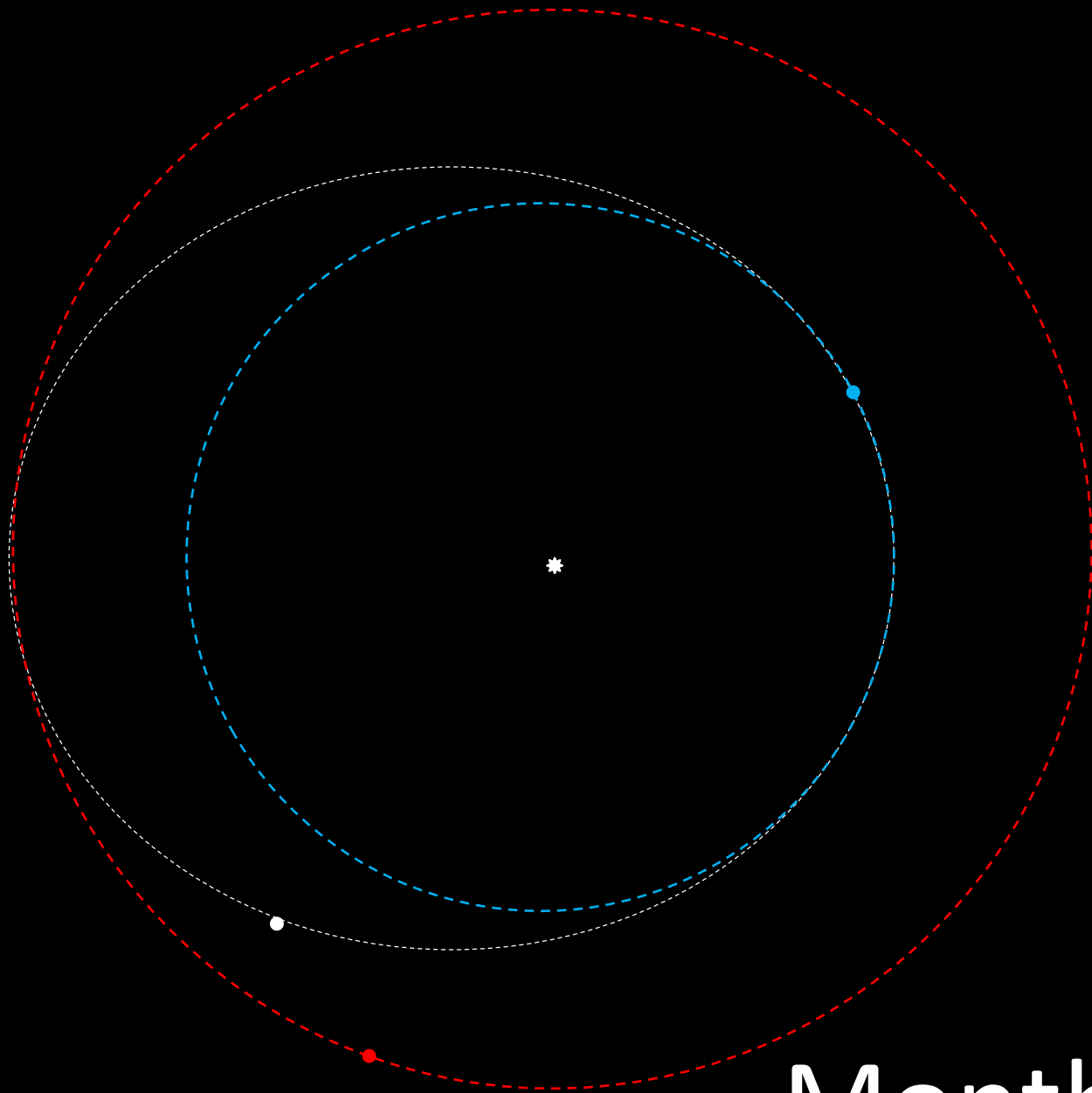
Month 10



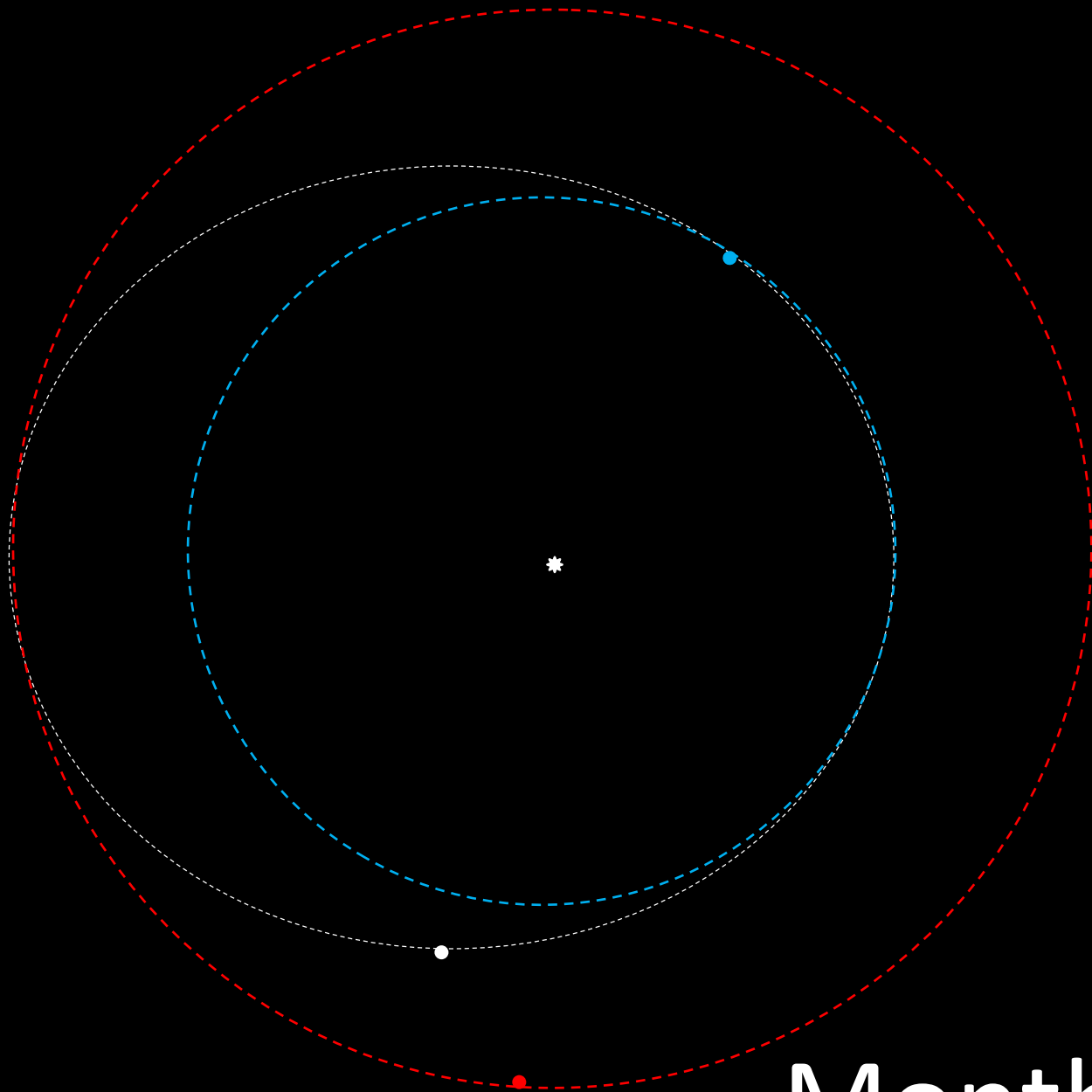
Month 11



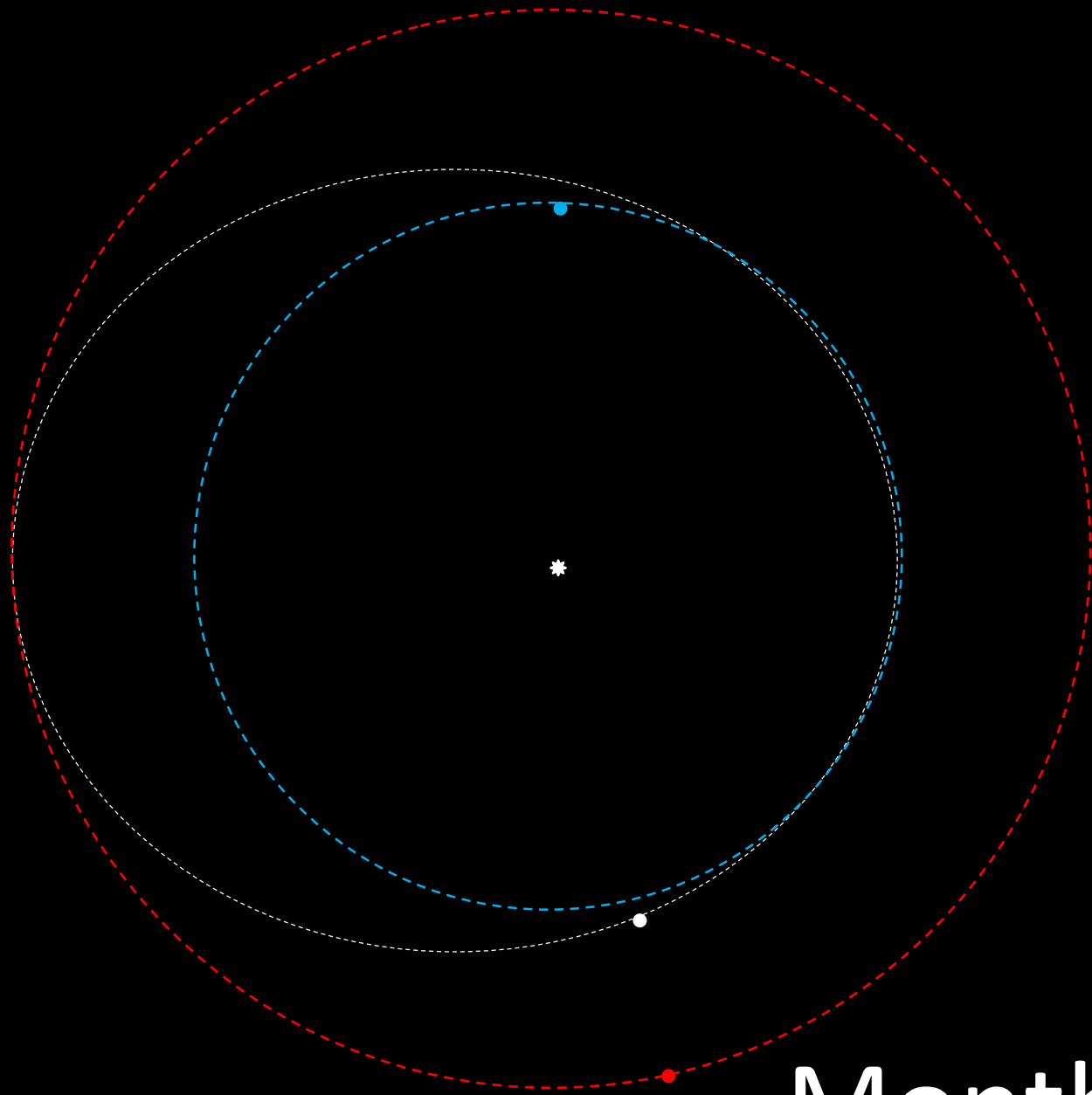
Month 12



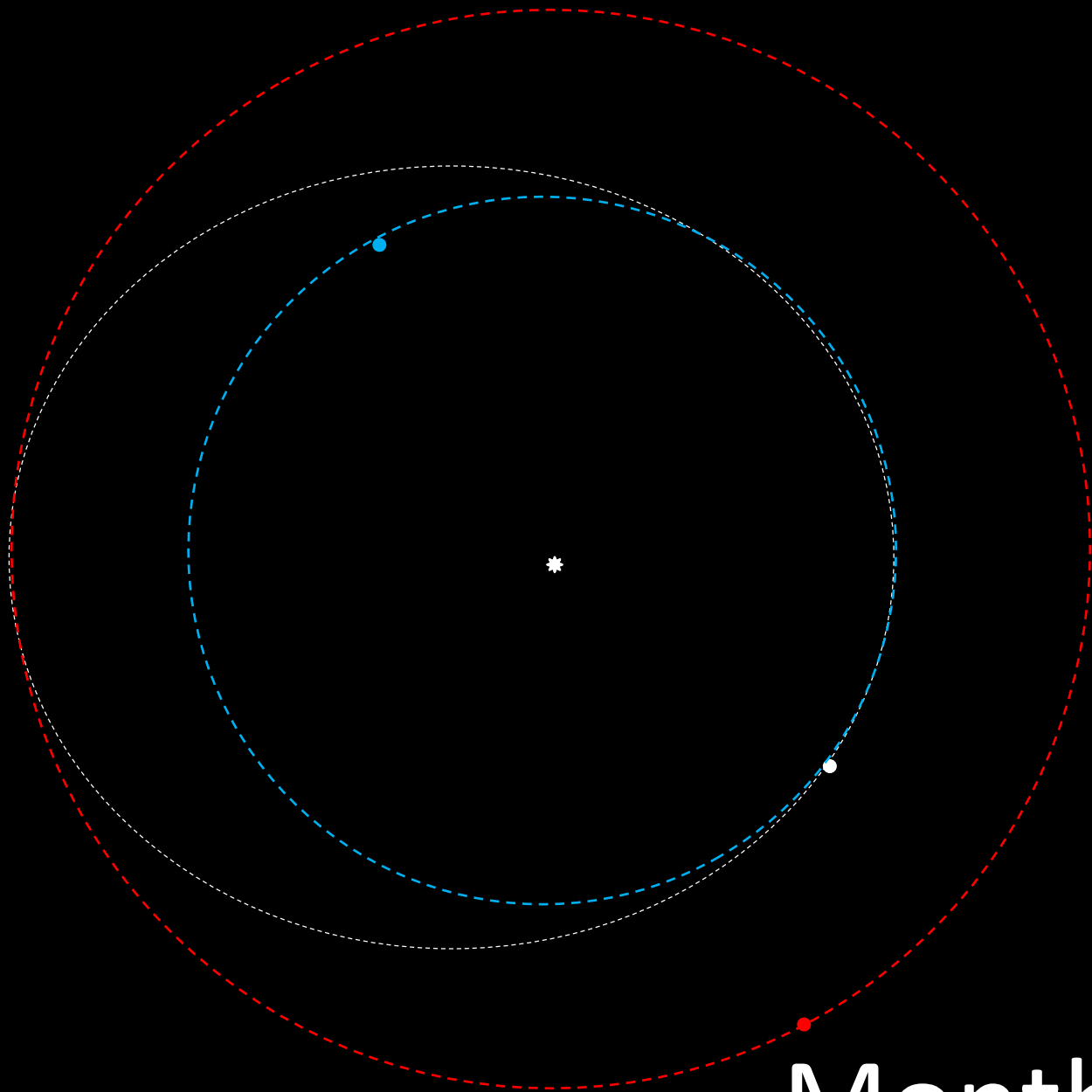
Month 13



Month 14



Month 15

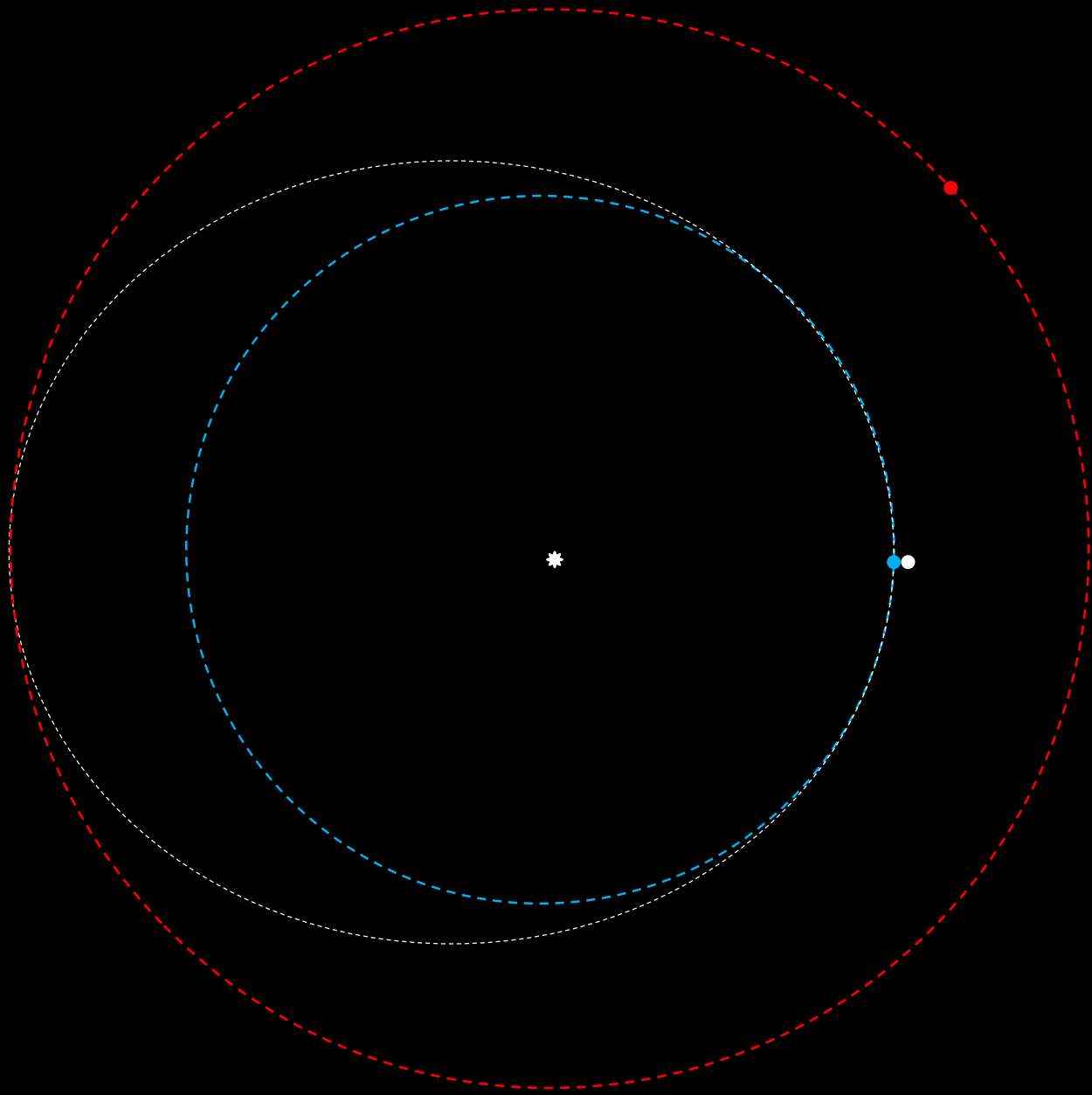


Month 16



Now we're dead heroes.

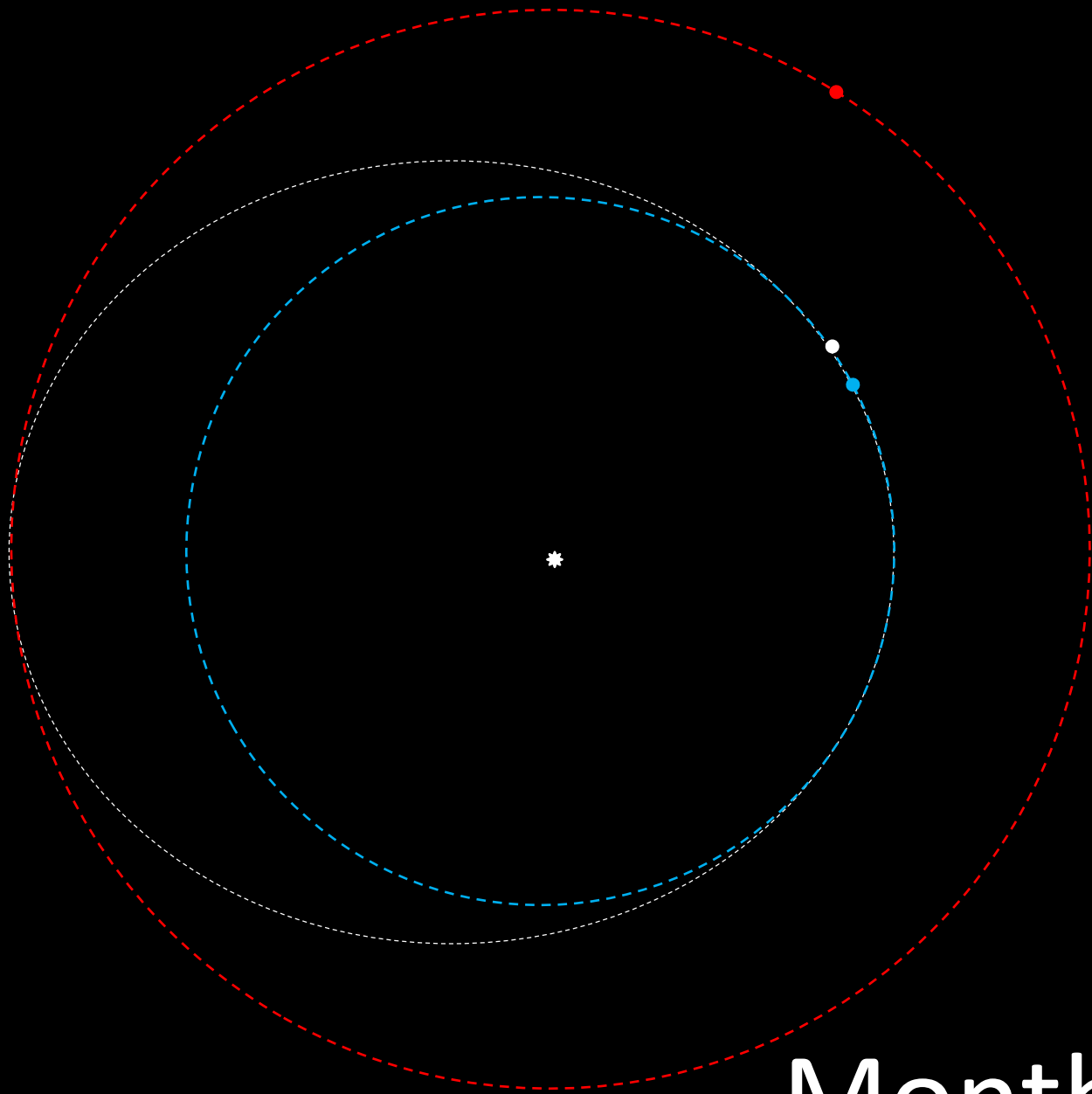
Month 17



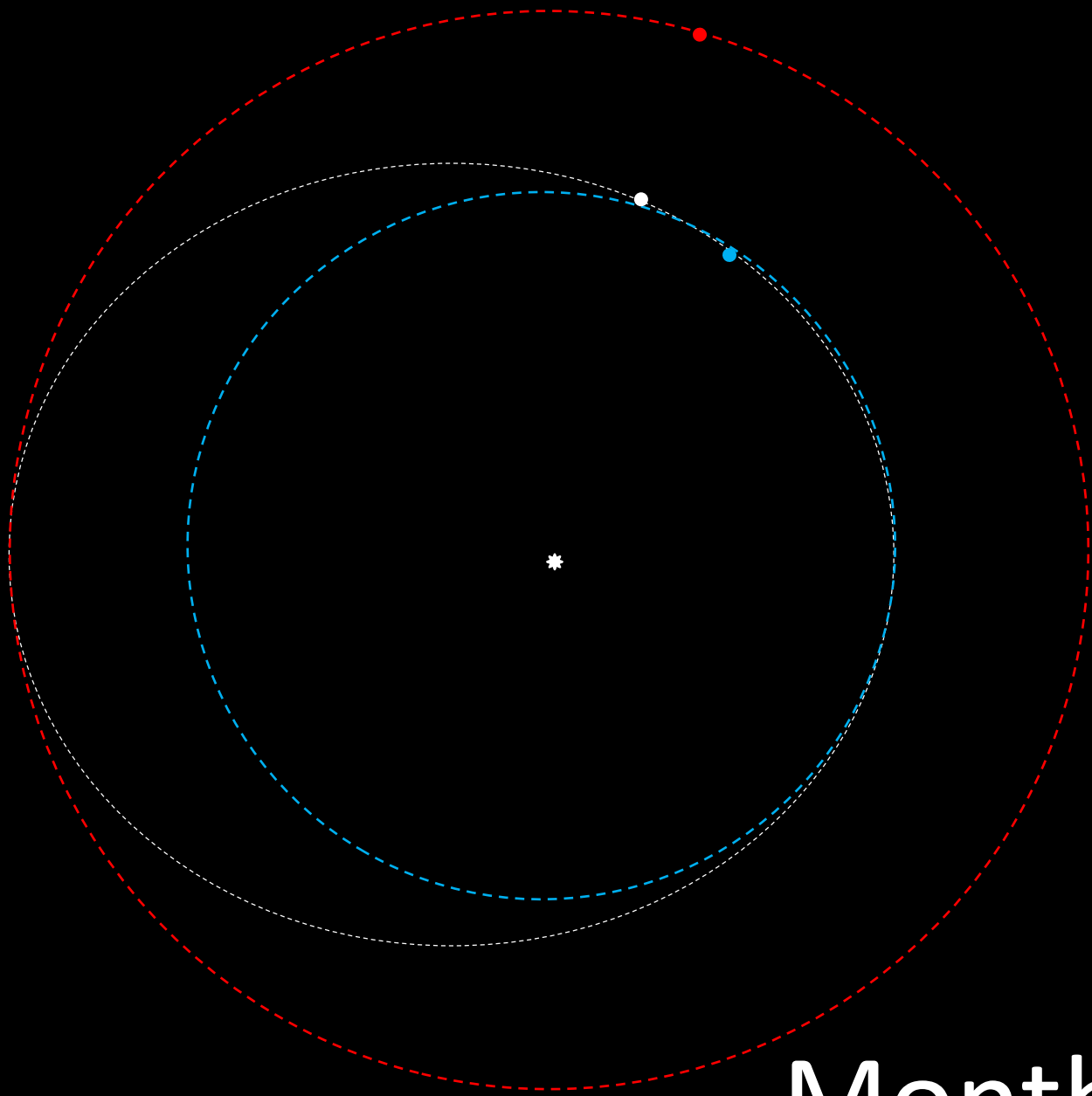


Go!

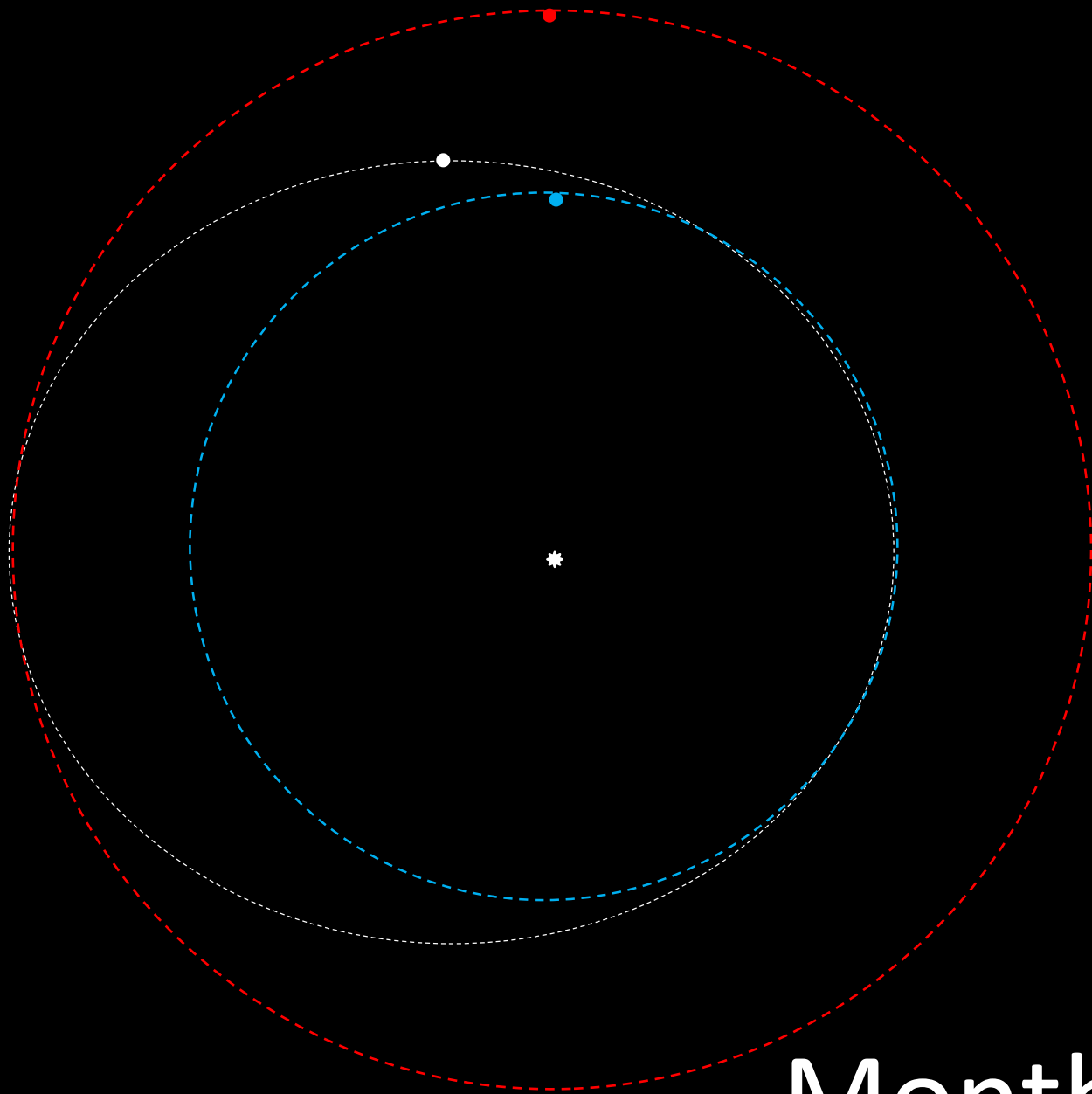
Month 0



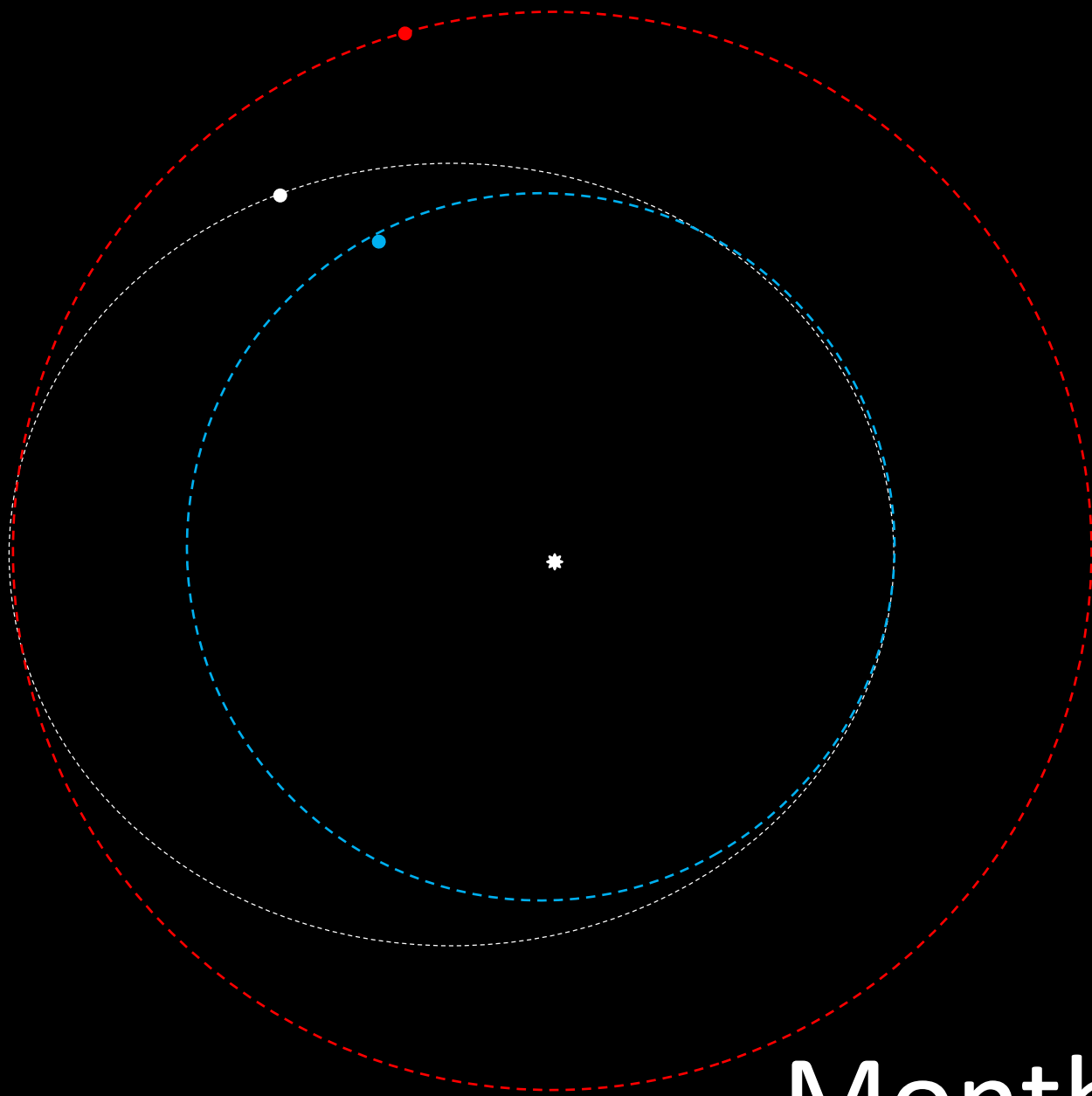
Month 1



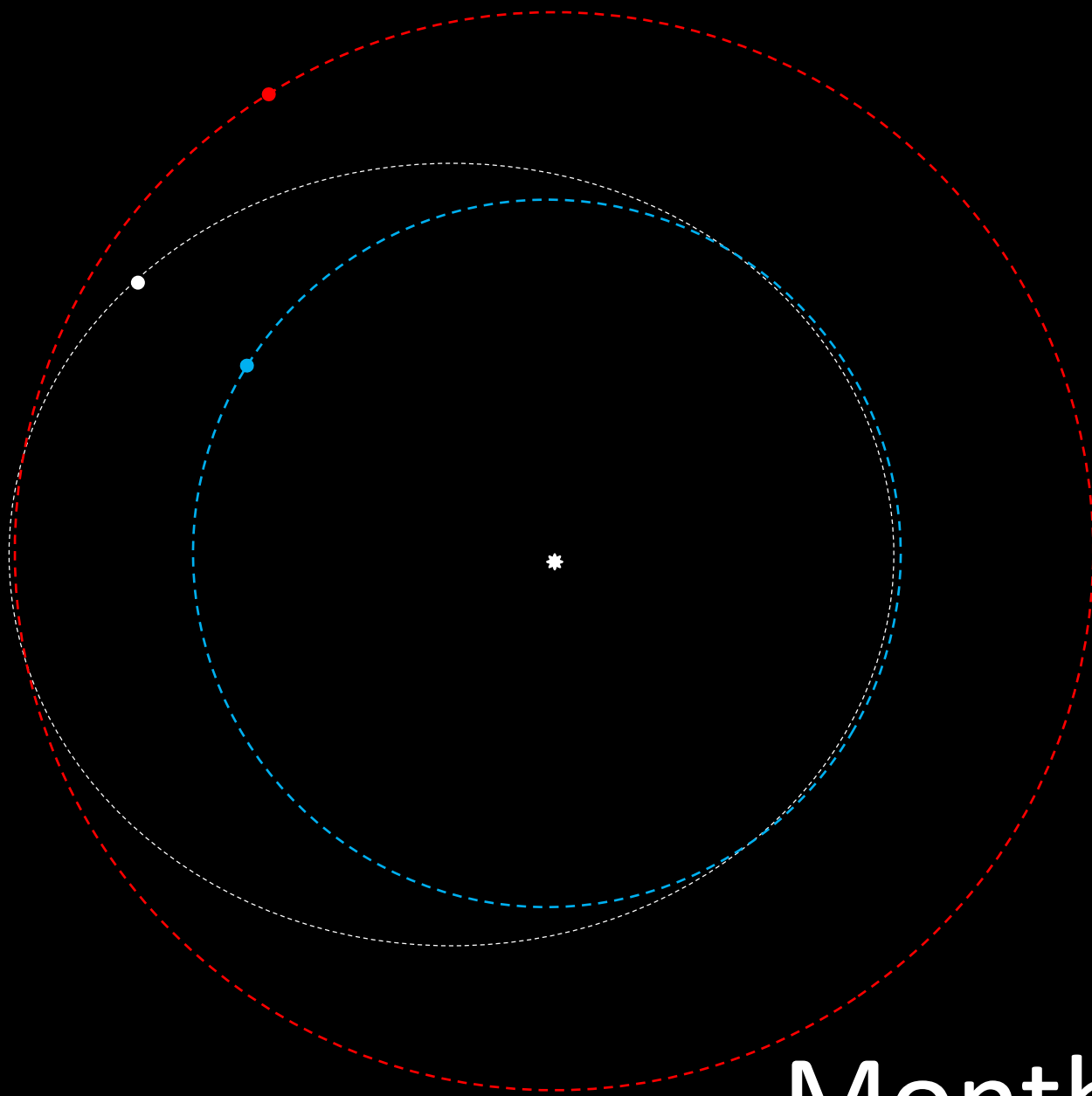
Month 2



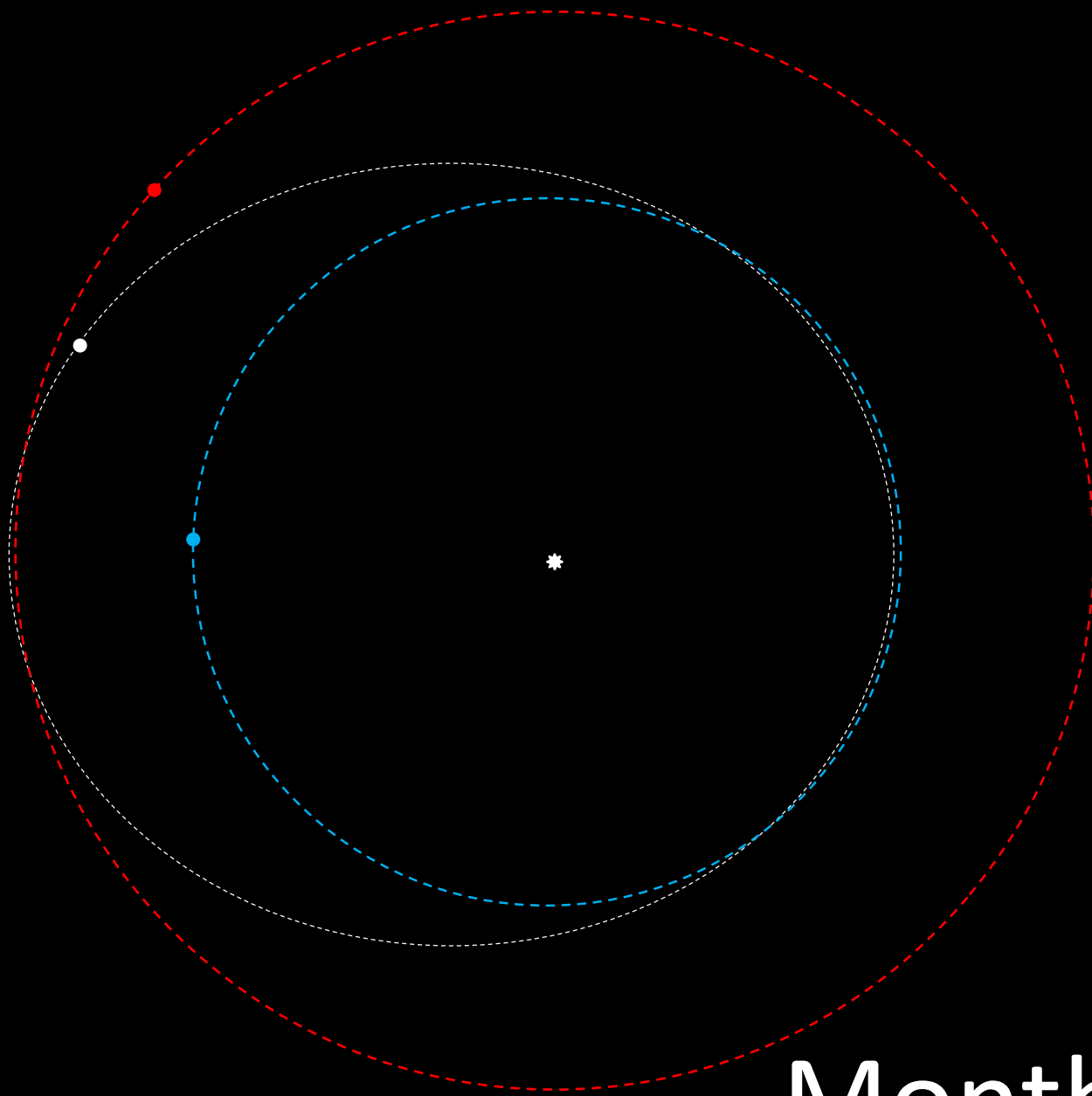
Month 3



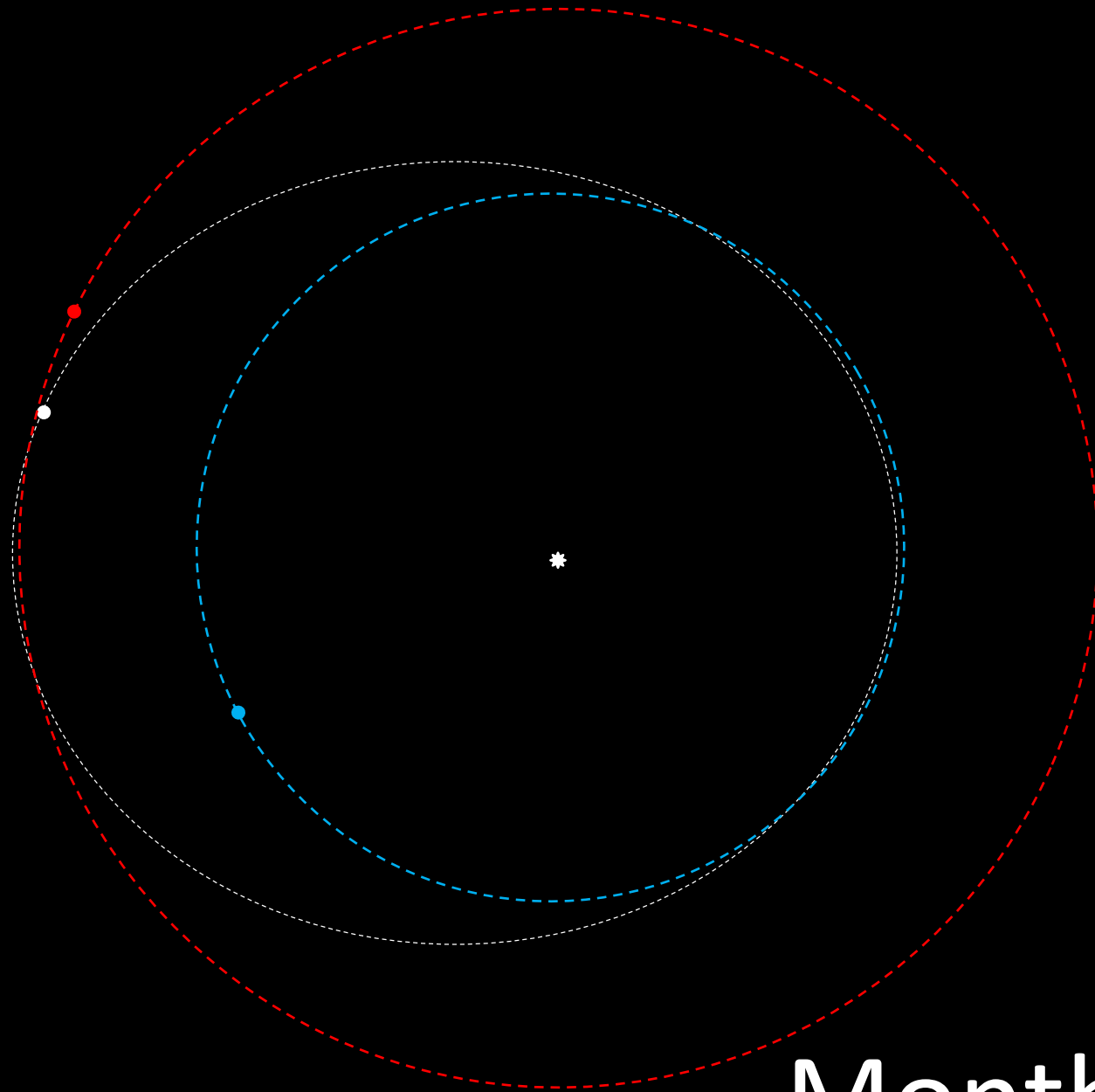
Month 4



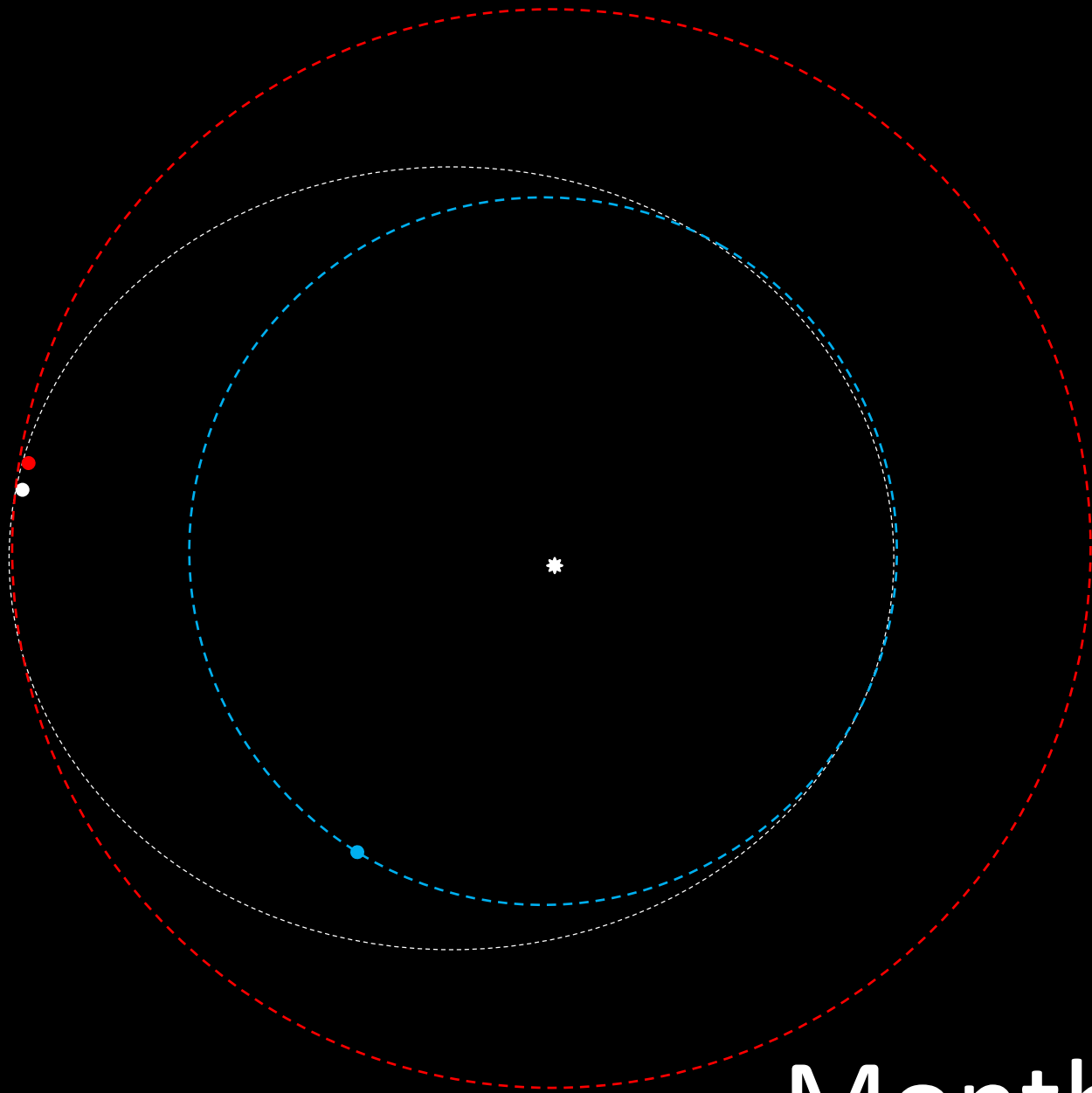
Month 5



Month 6



Month 7

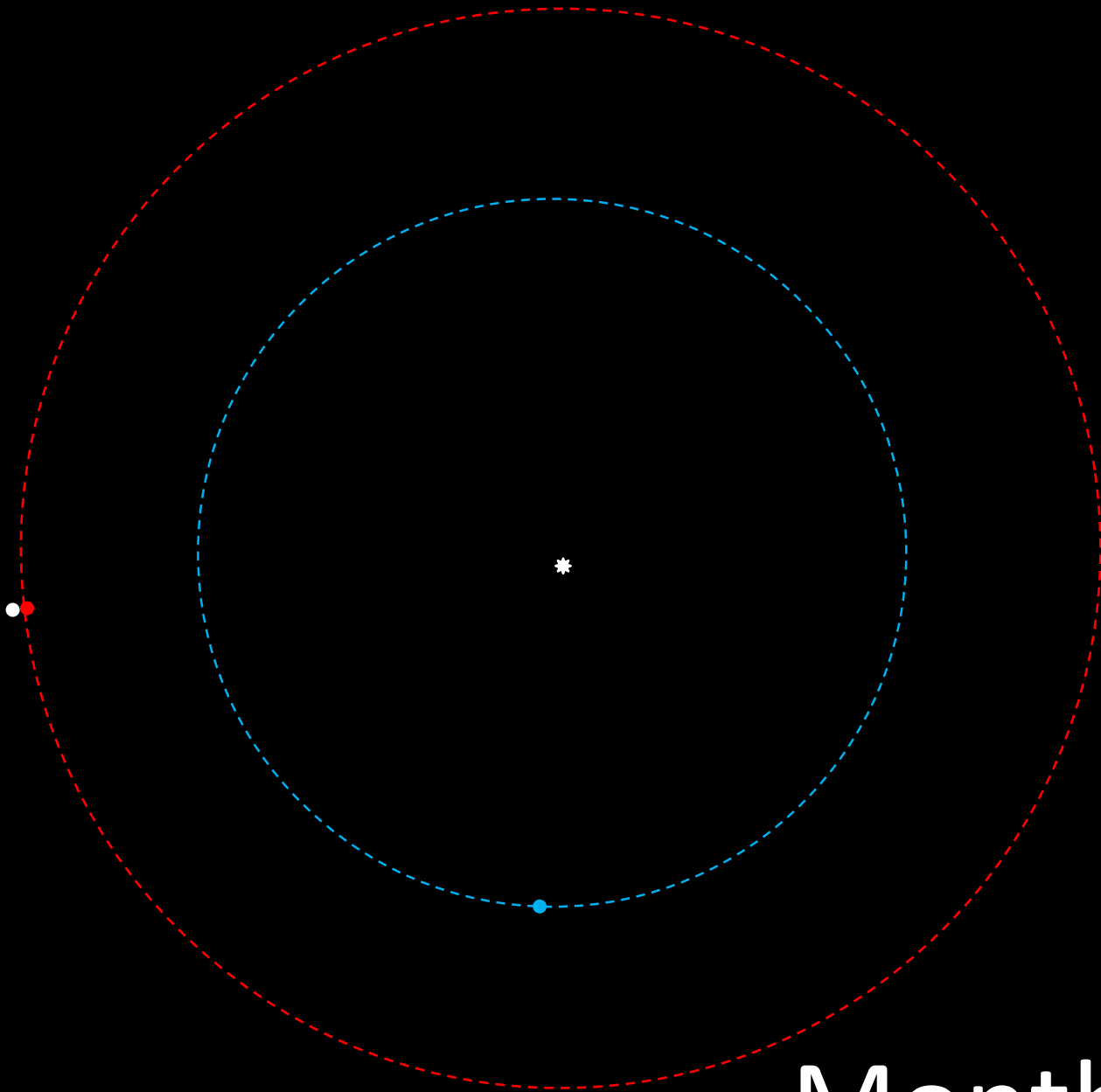


Month 8

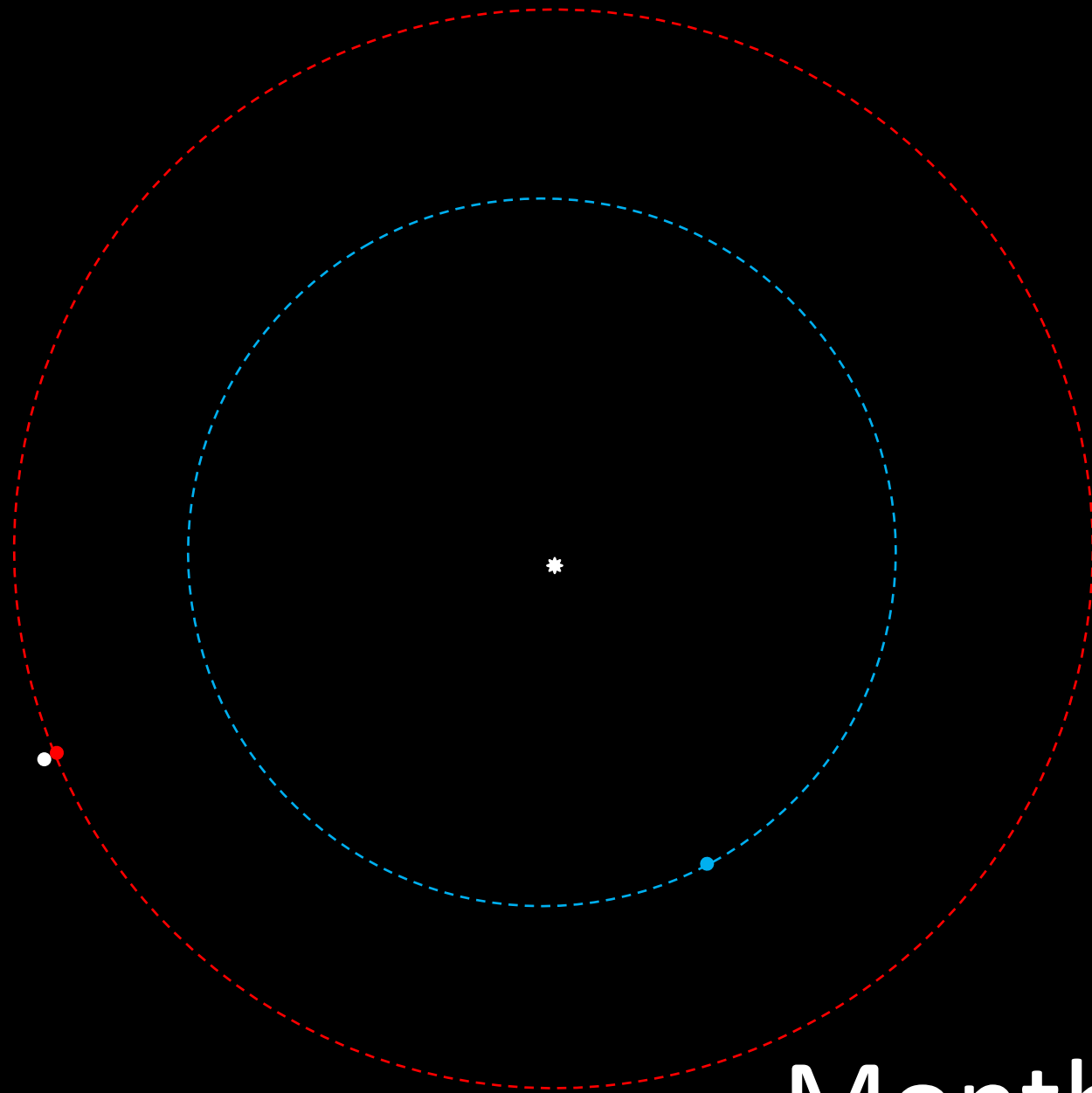


We made it!

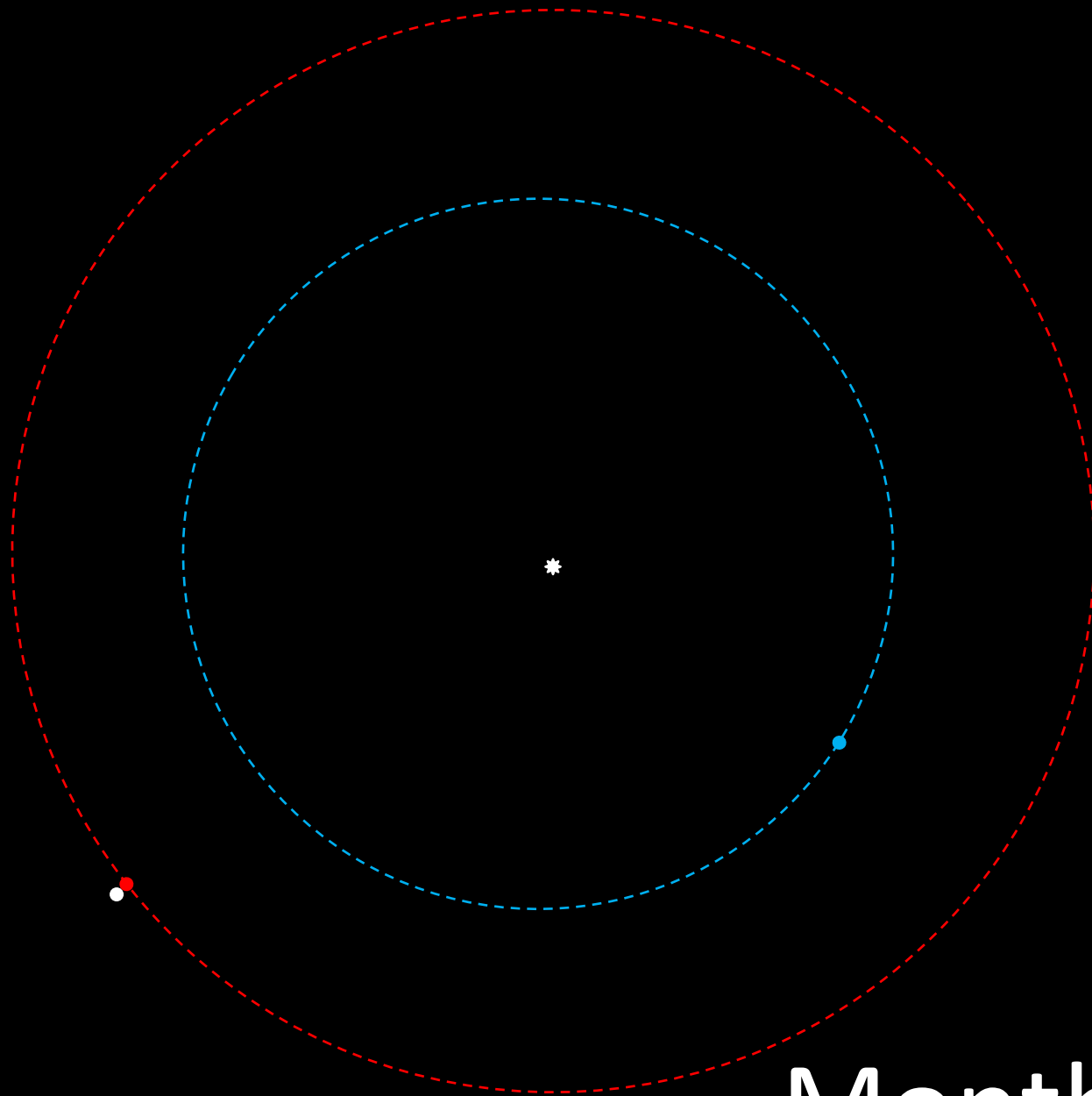
Month 8.5



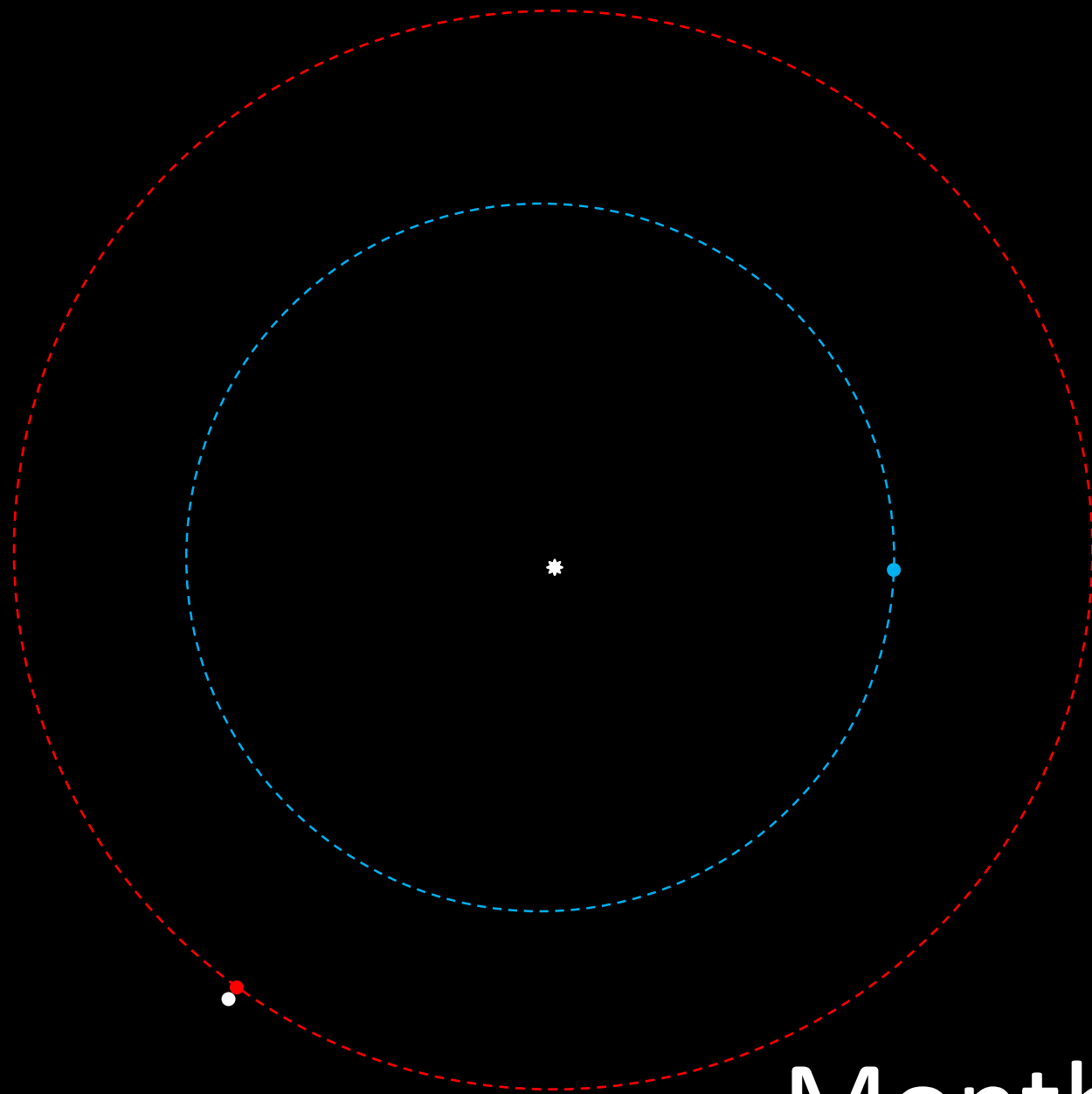
Month 9



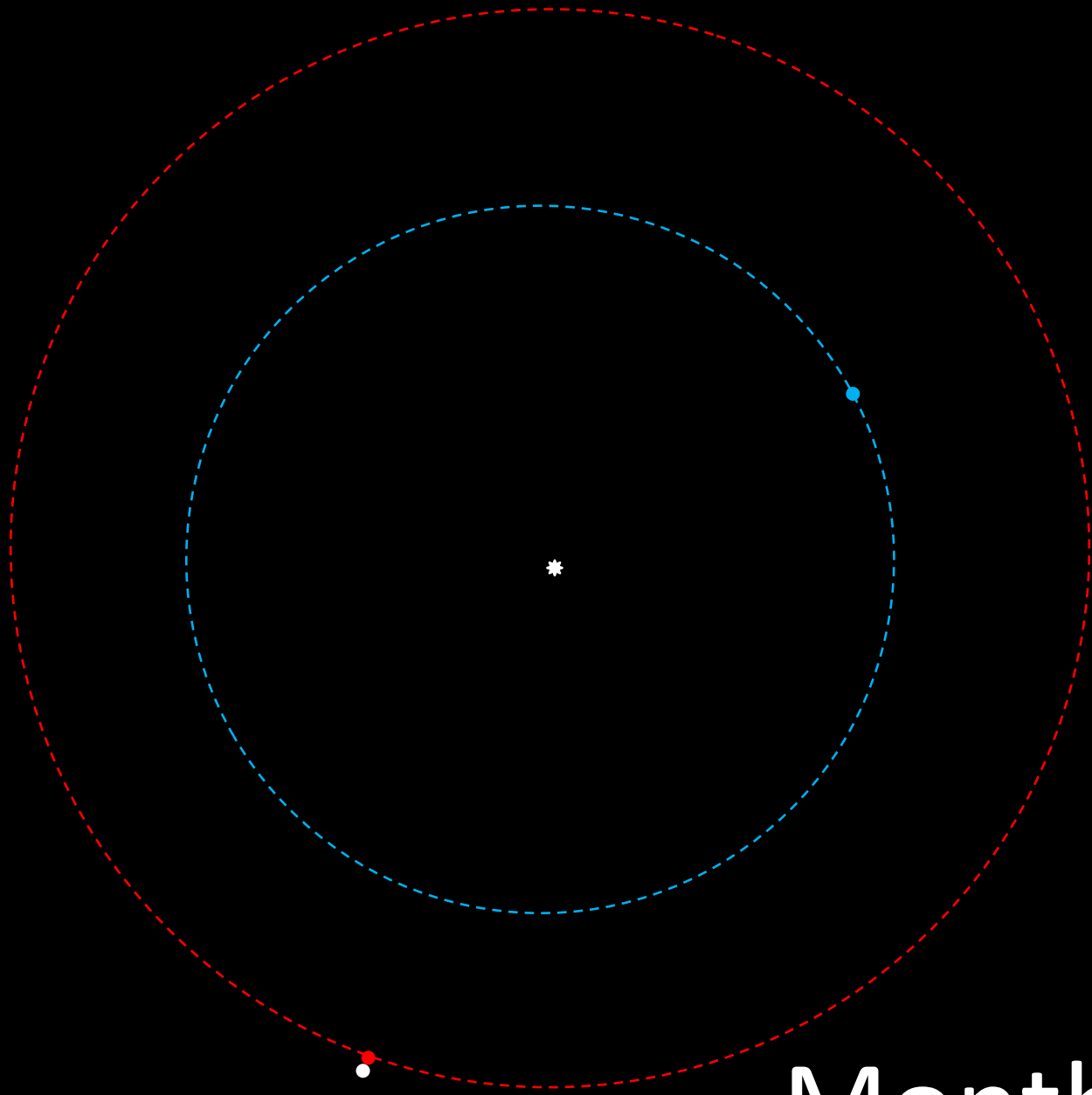
Month 10



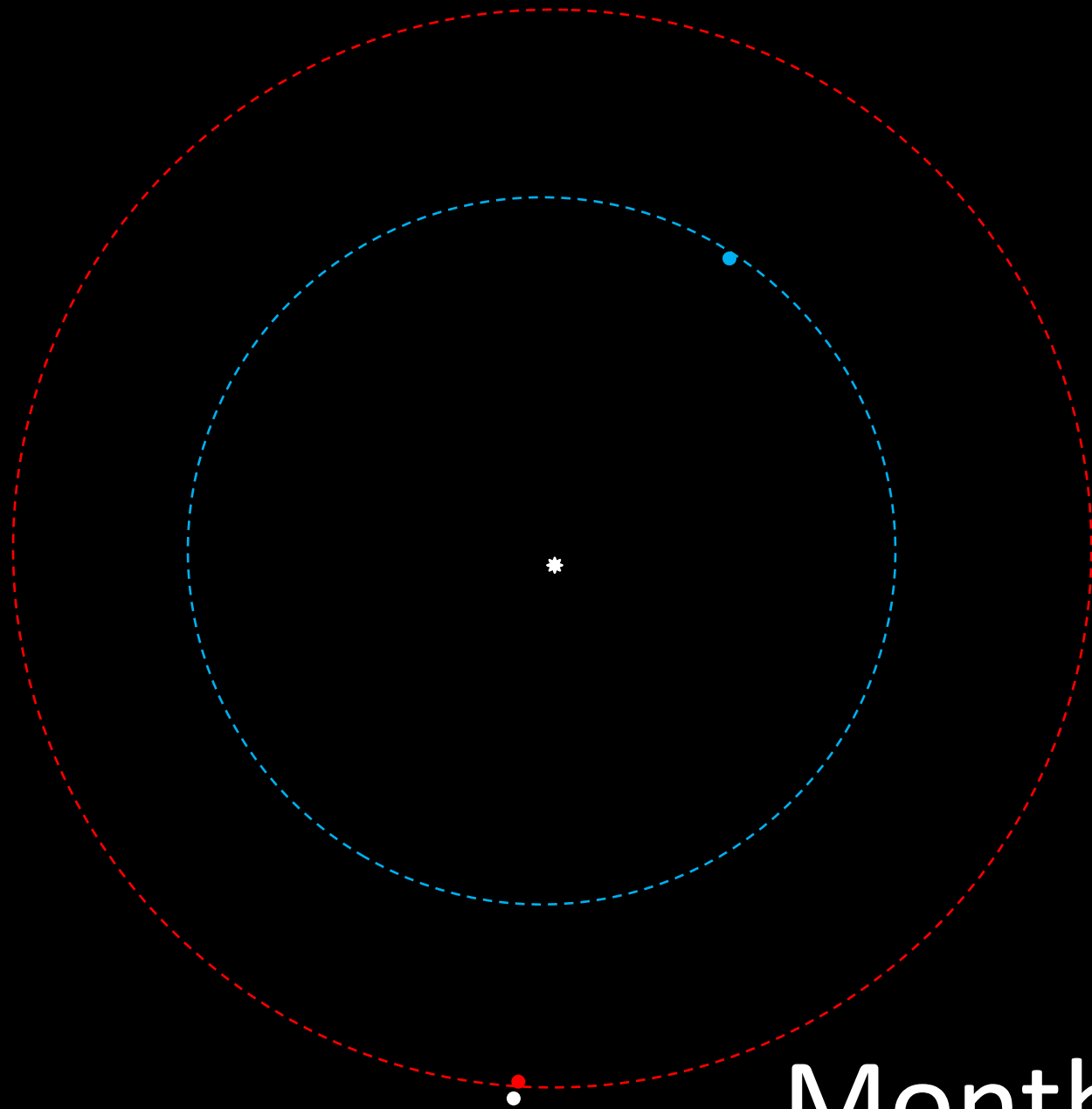
Month 11



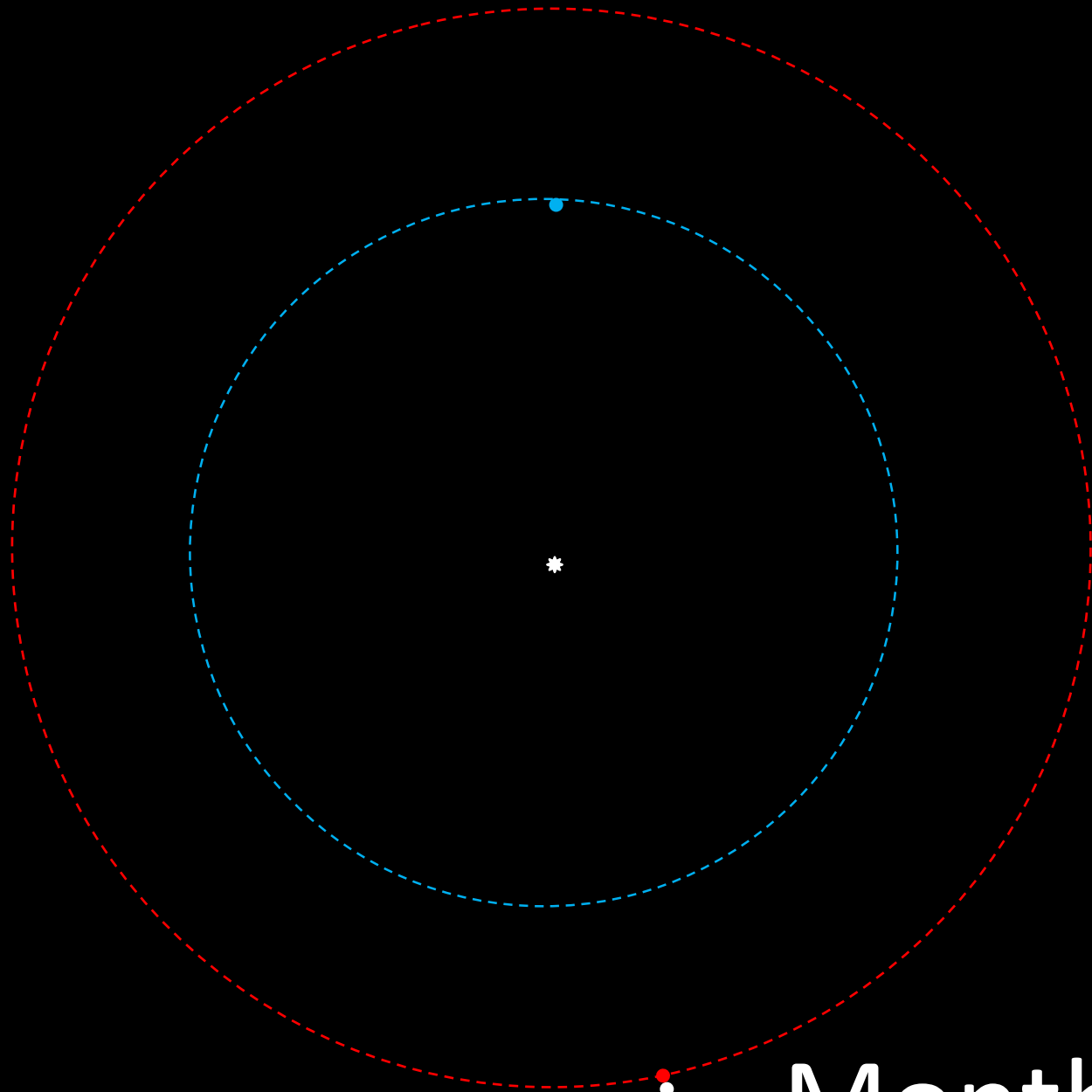
Month 12



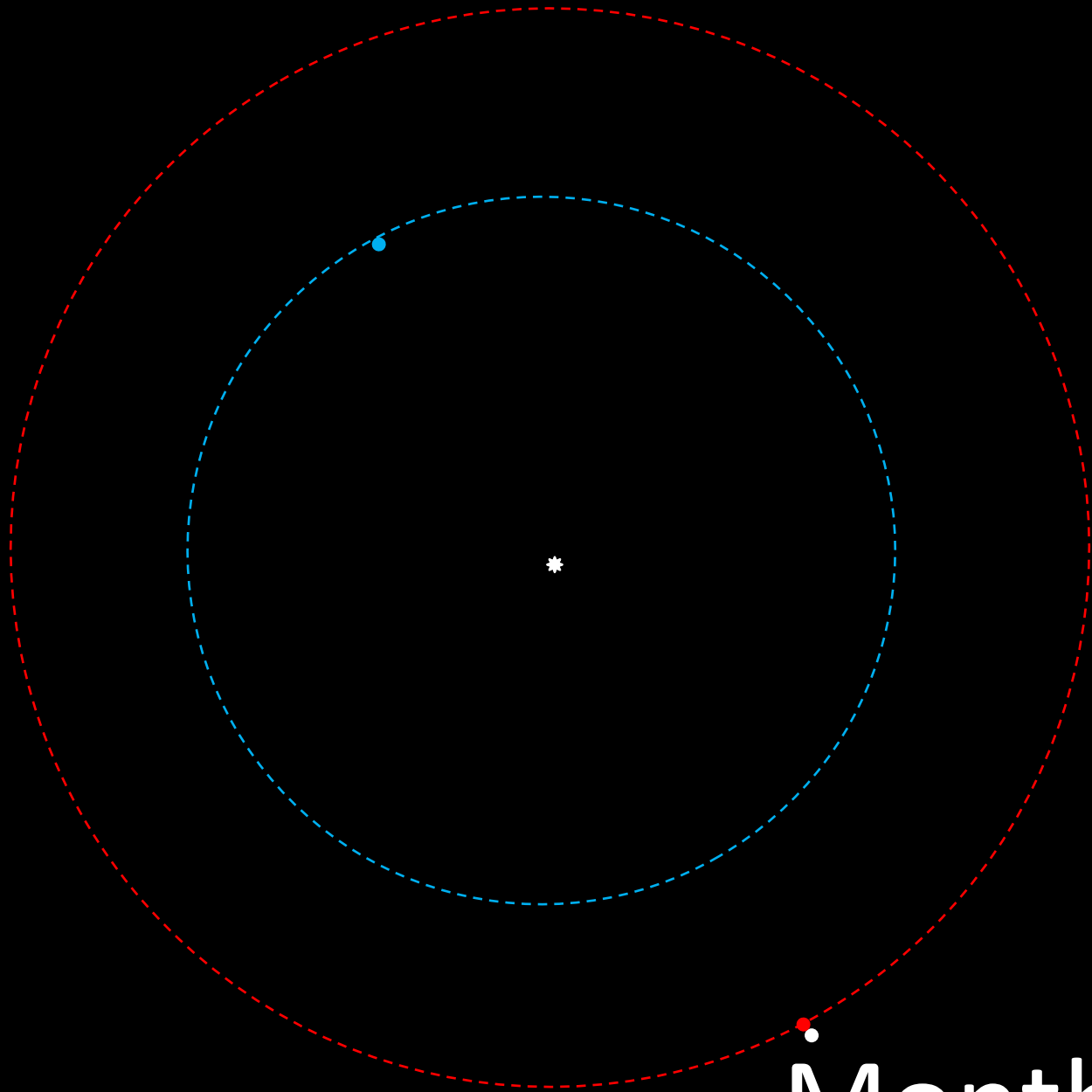
Month 13



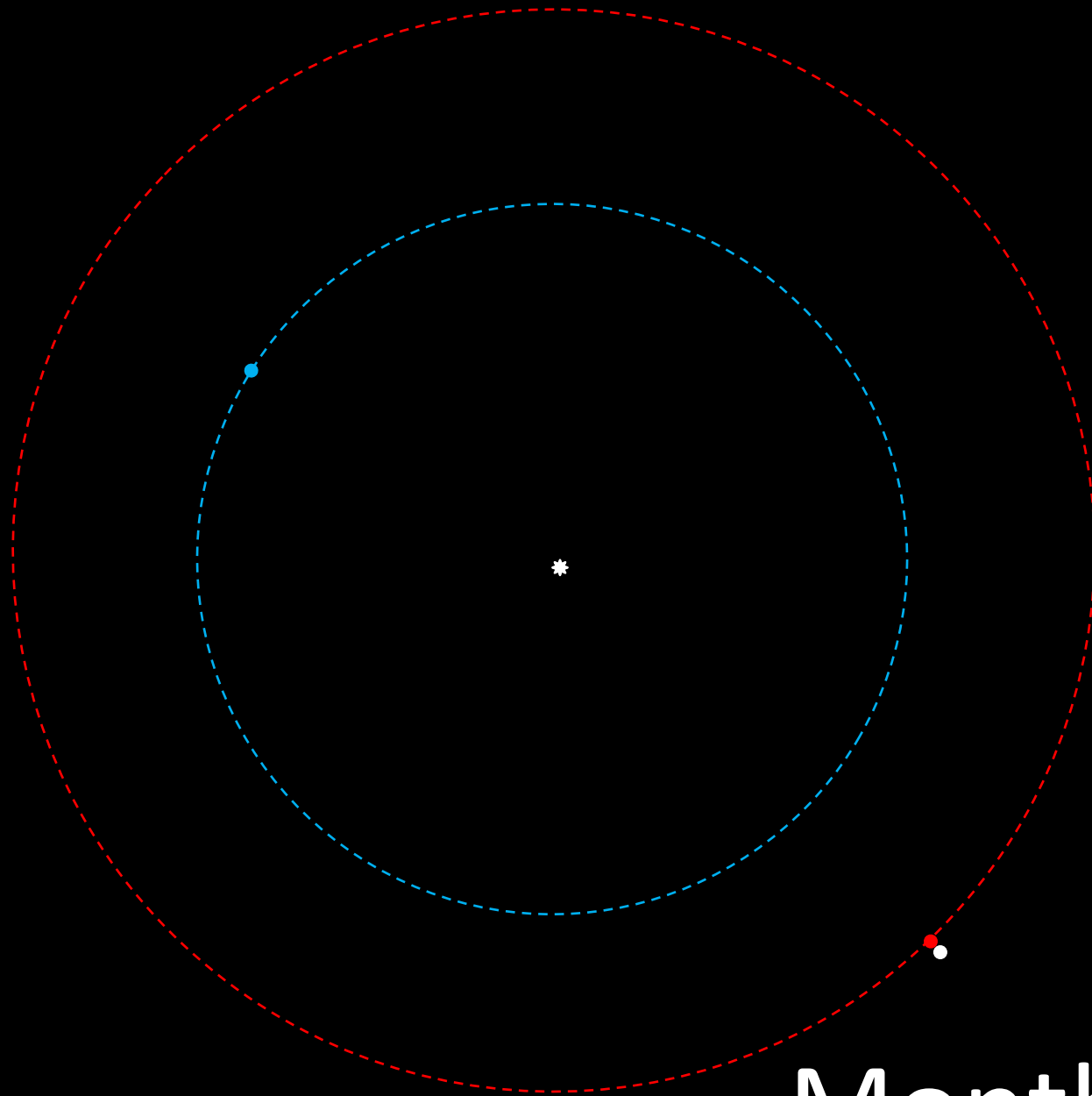
Month 14



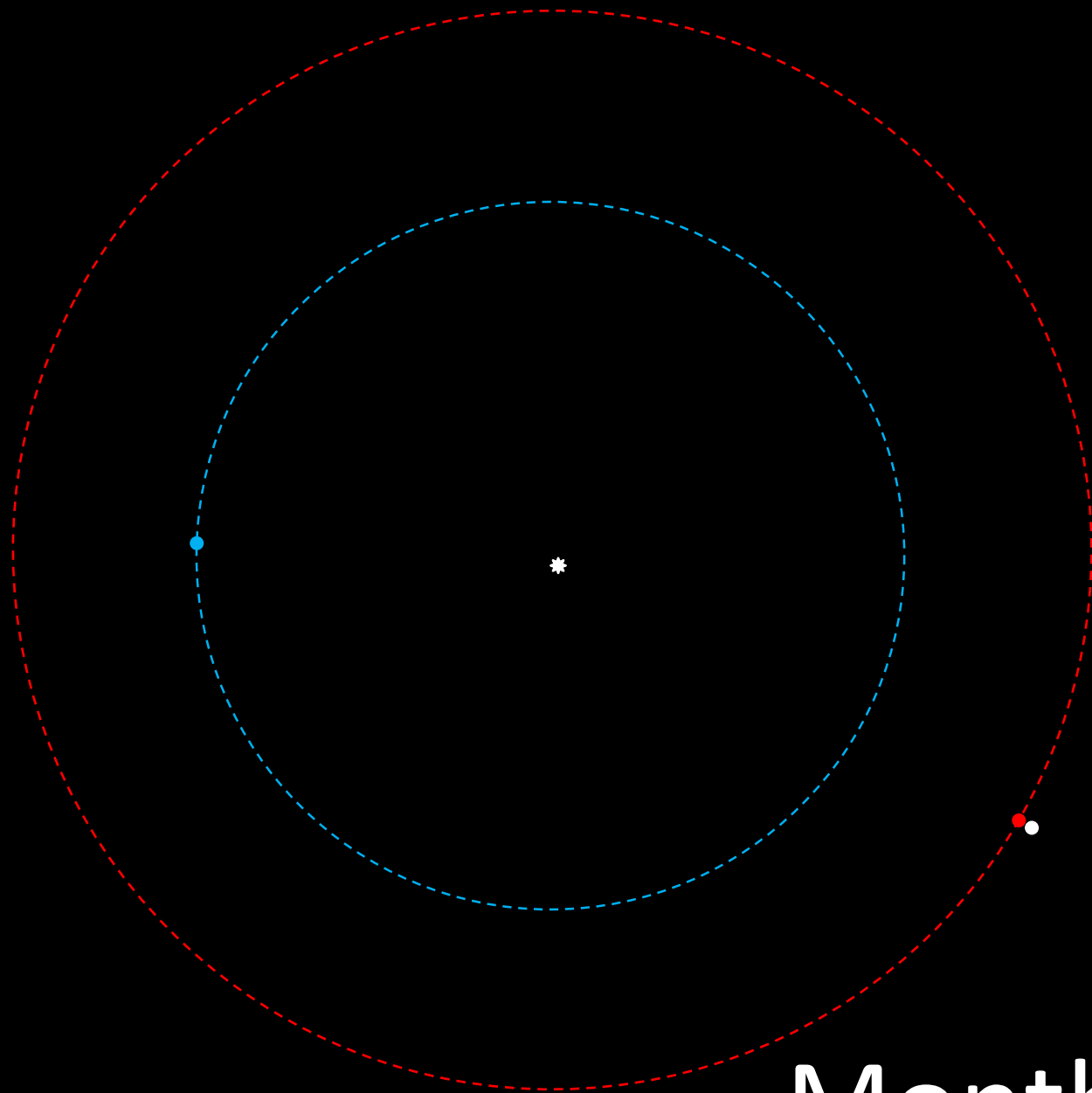
Month 15



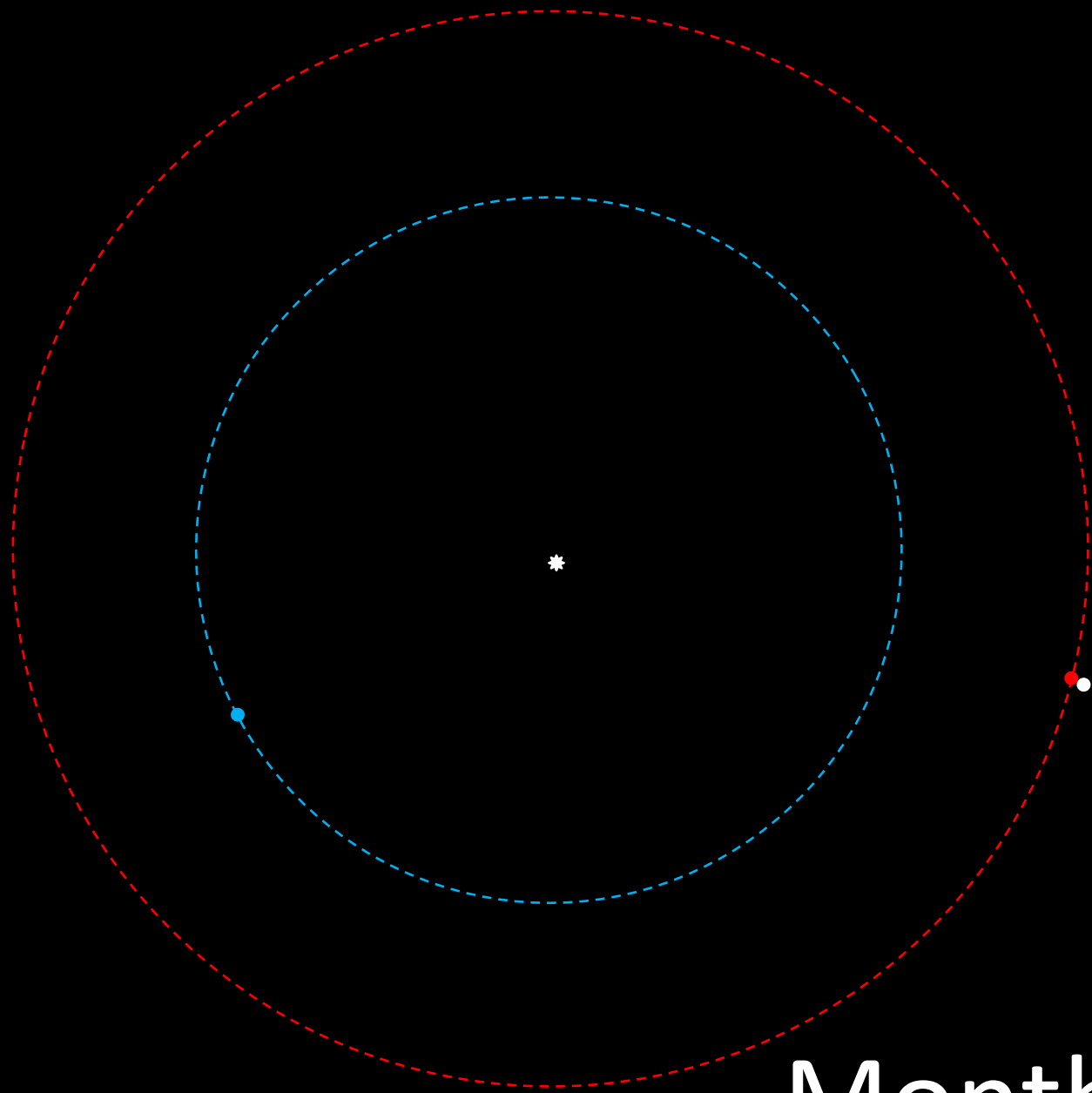
Month 16



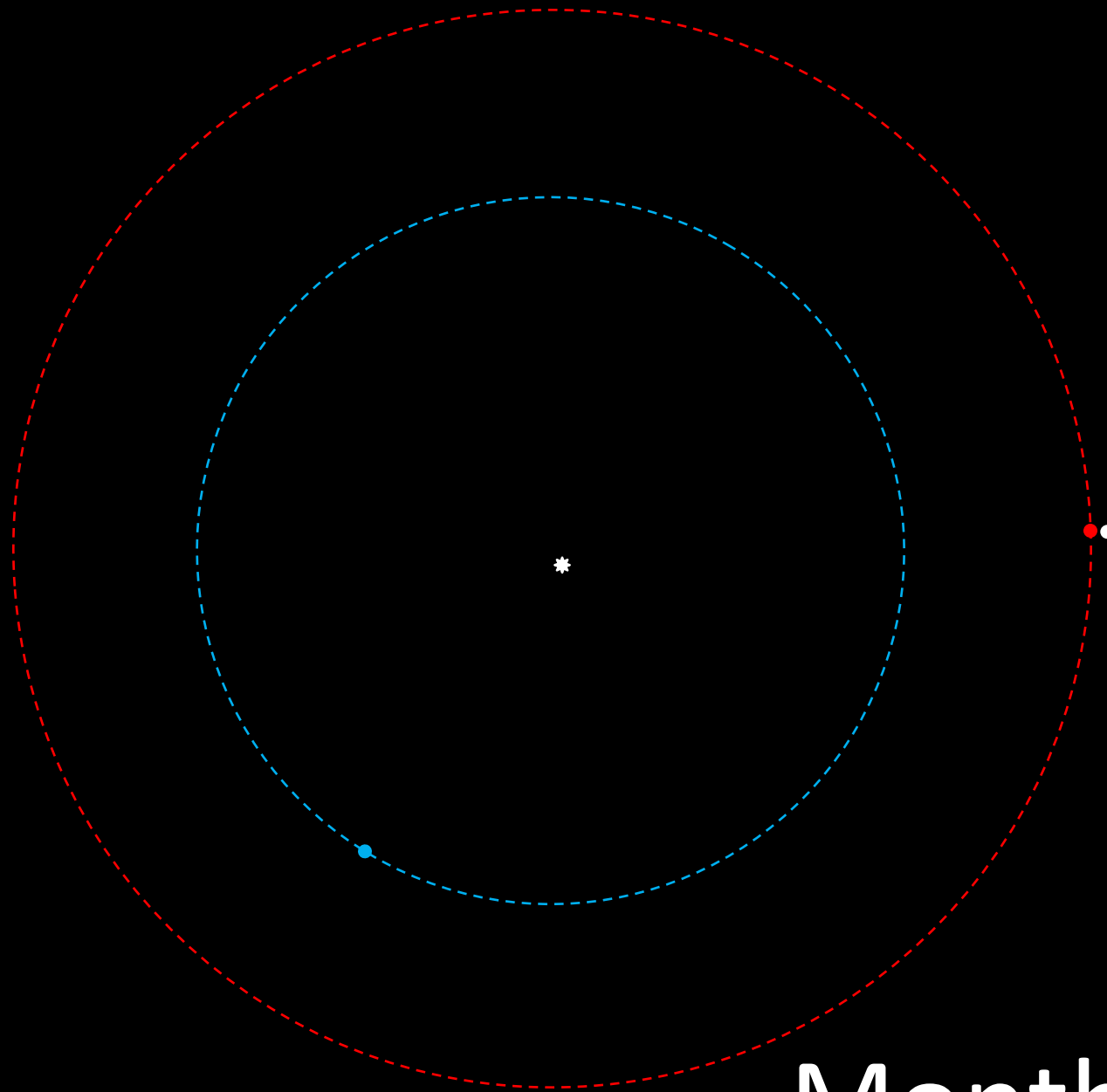
Month 17



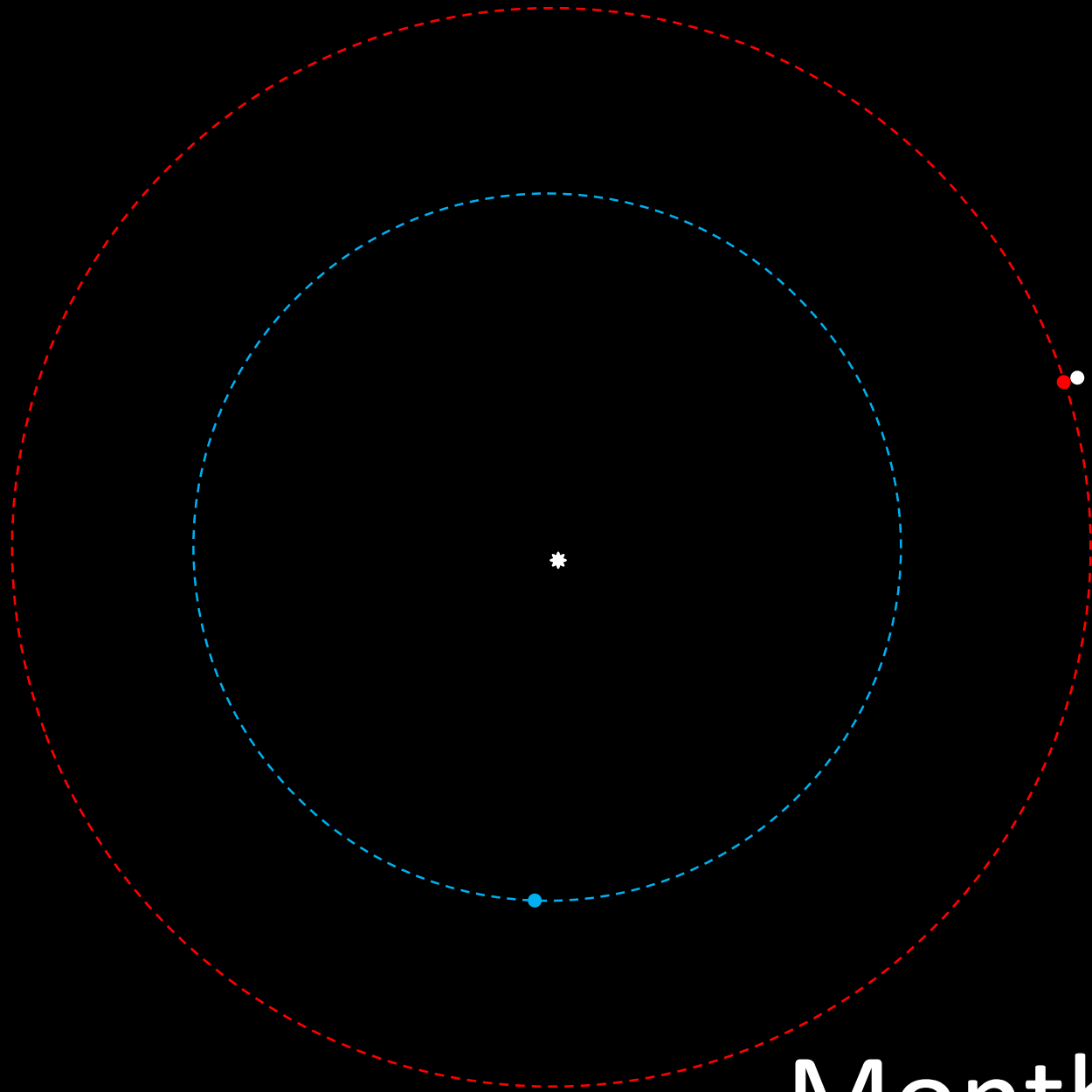
Month 18



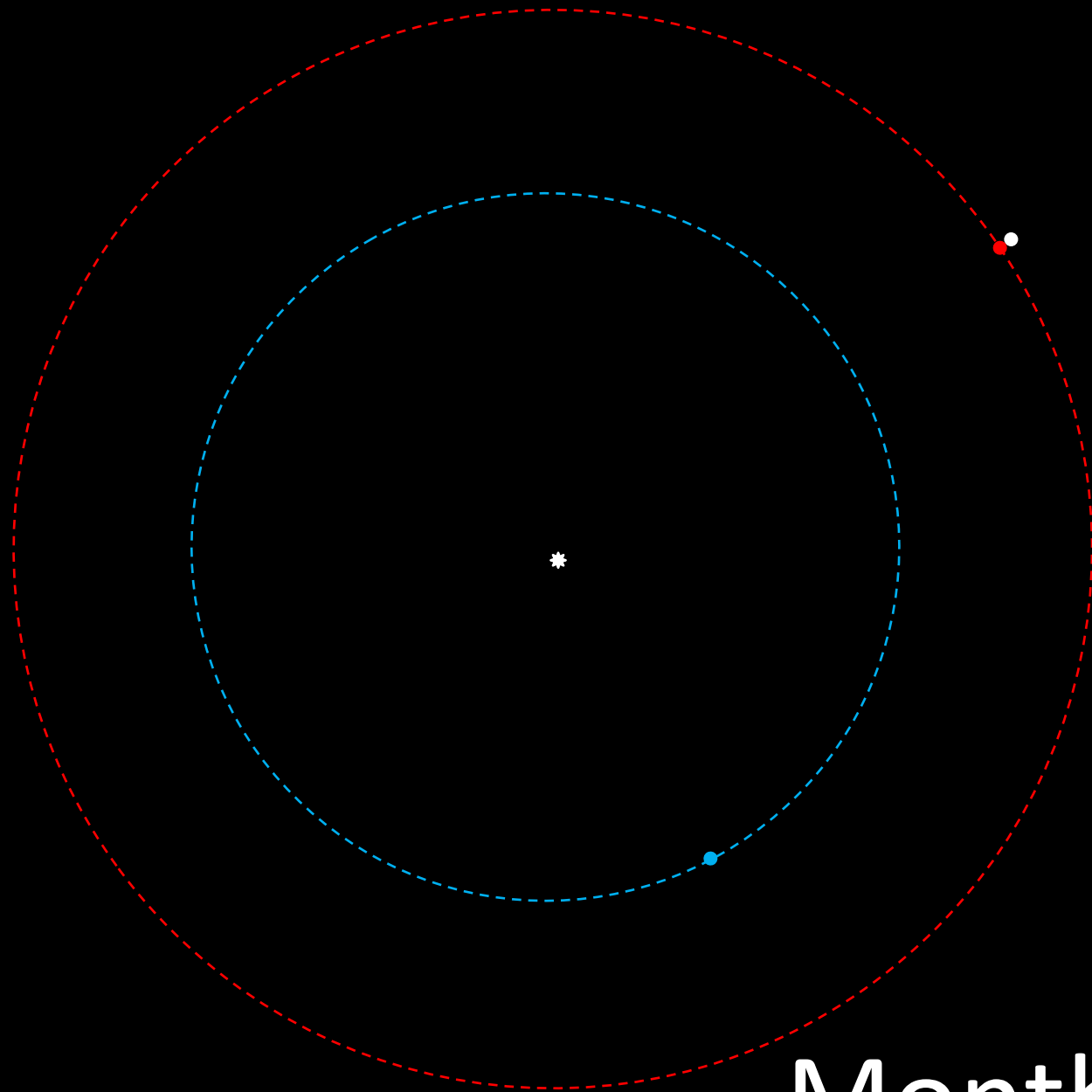
Month 19



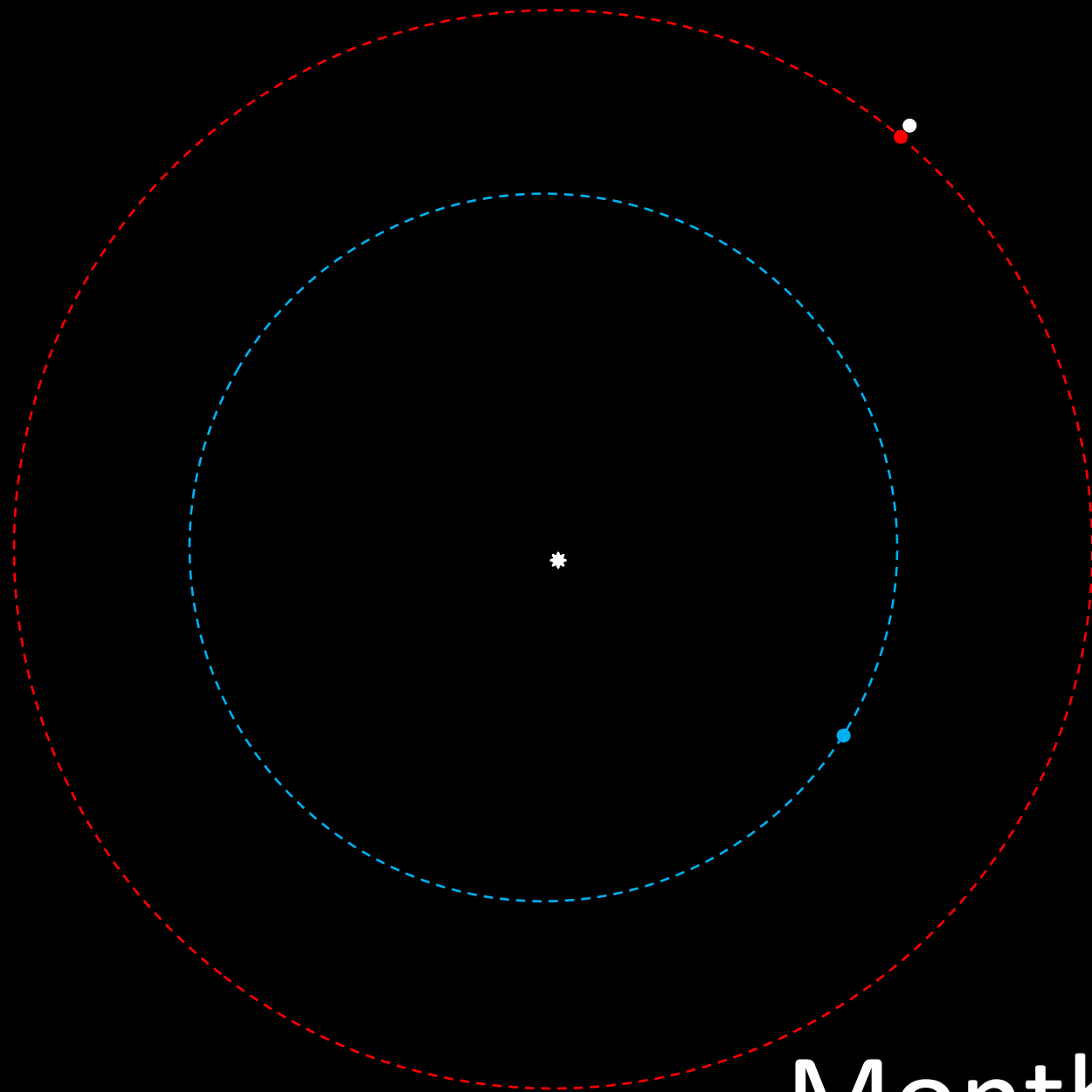
Month 20



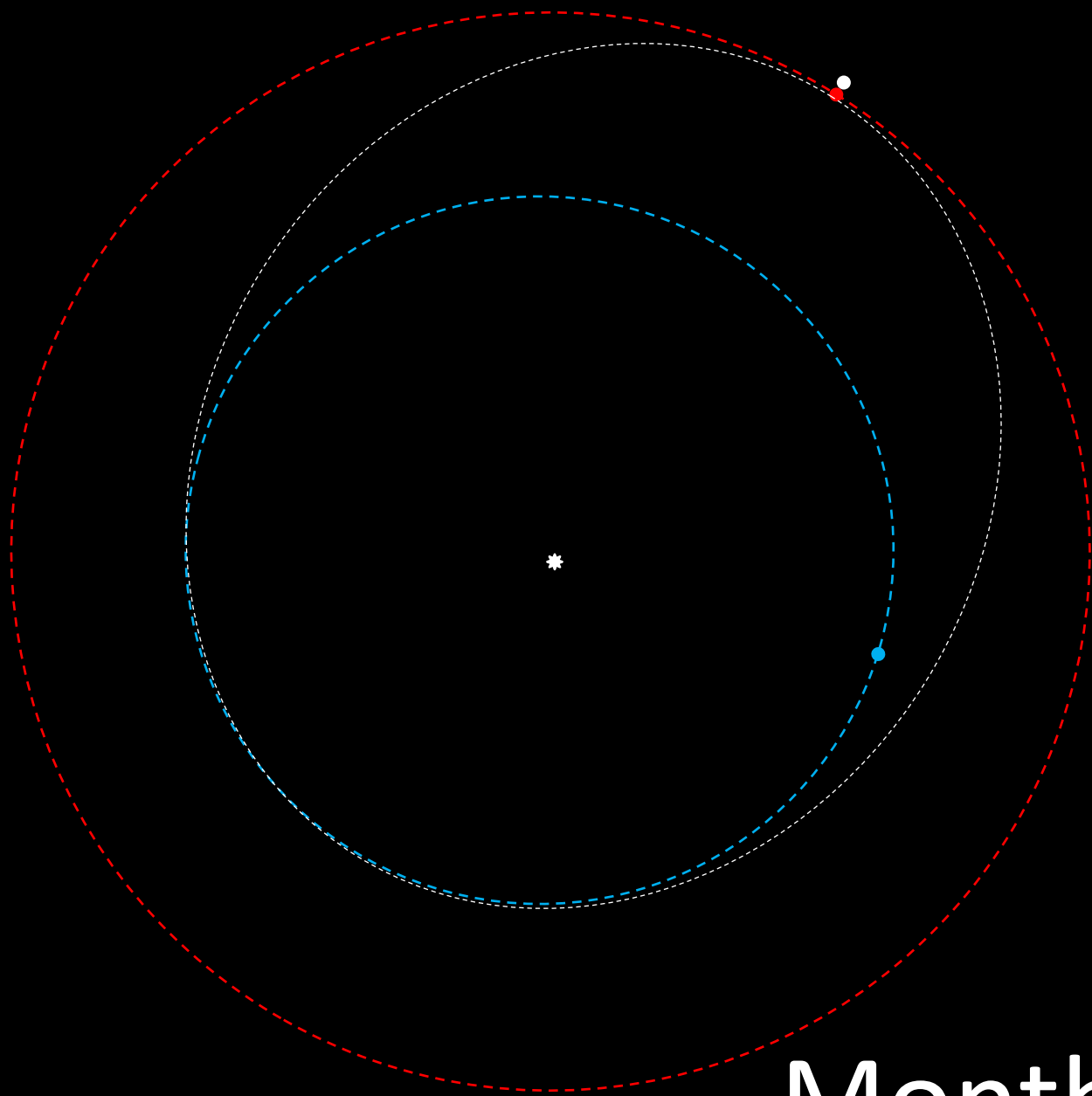
Month 21



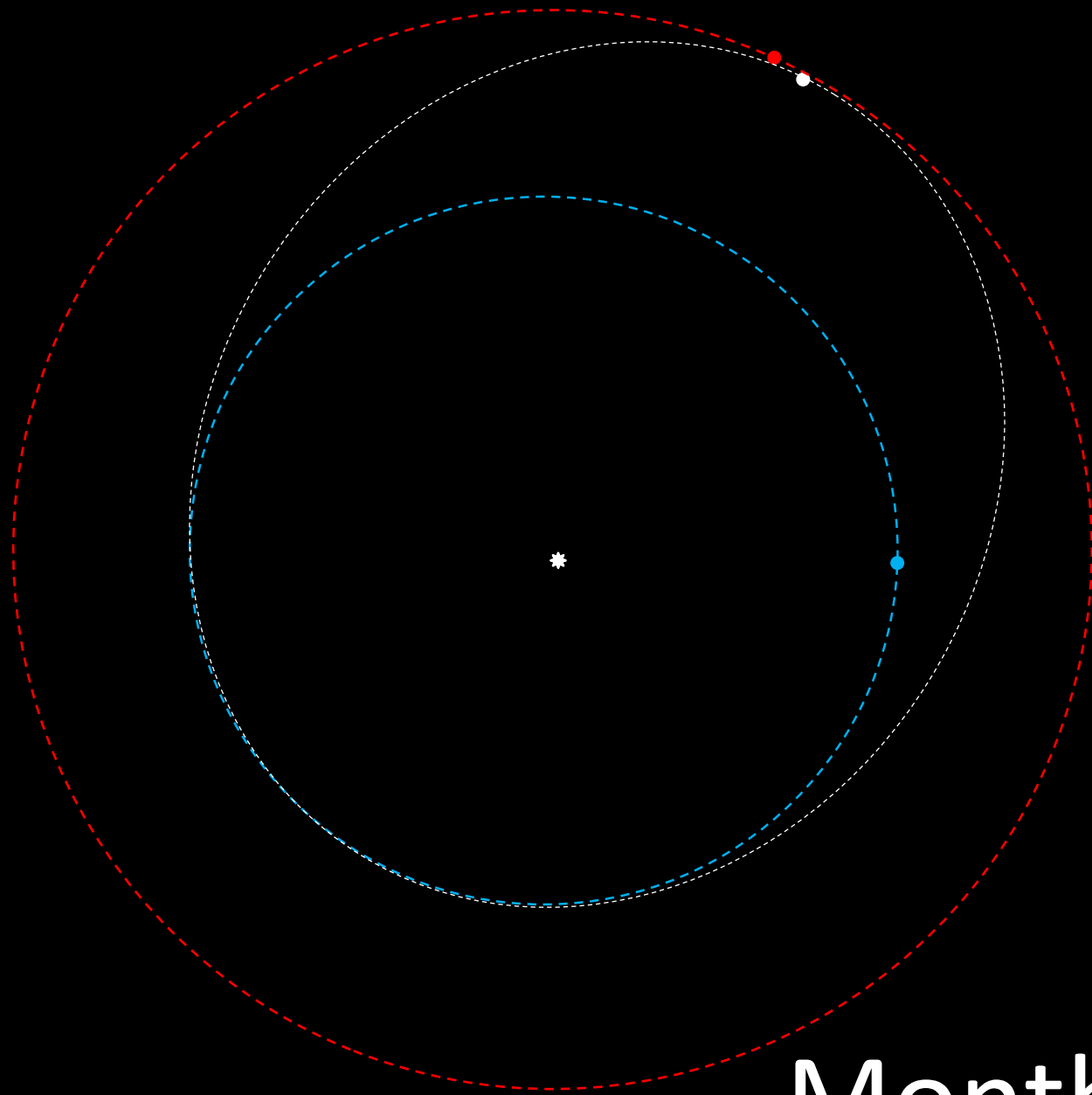
Month 22



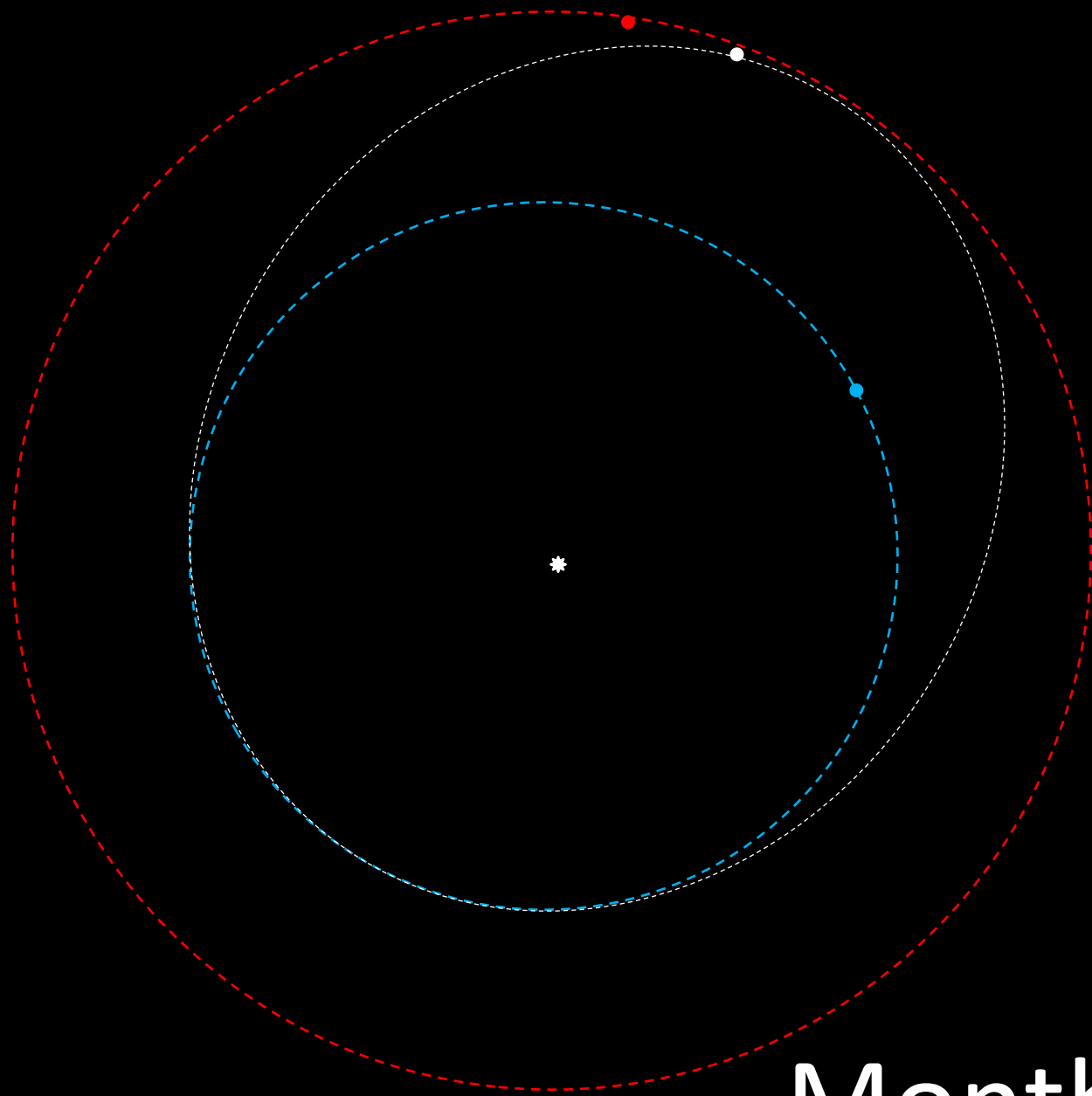
Month 23



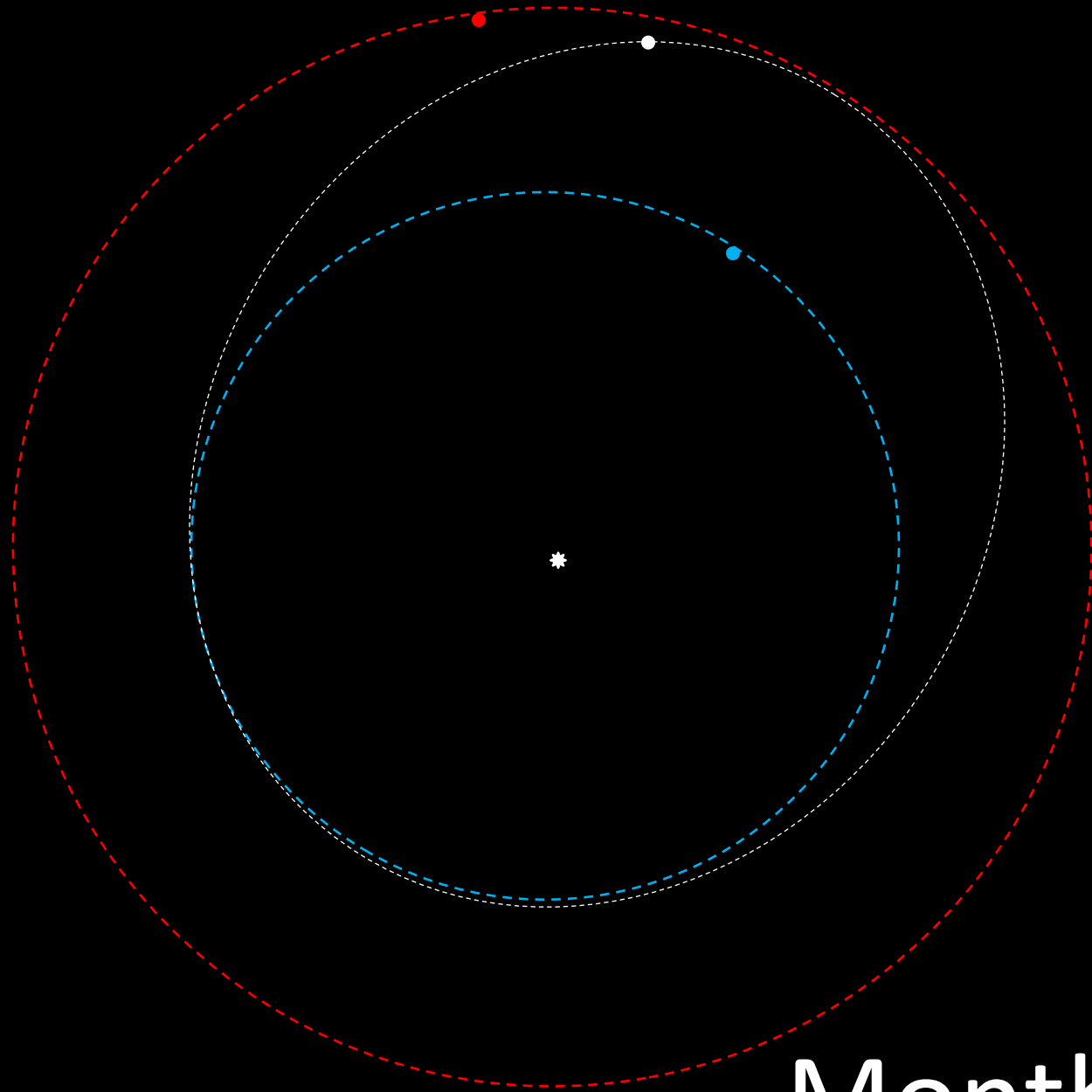
Month 23.5



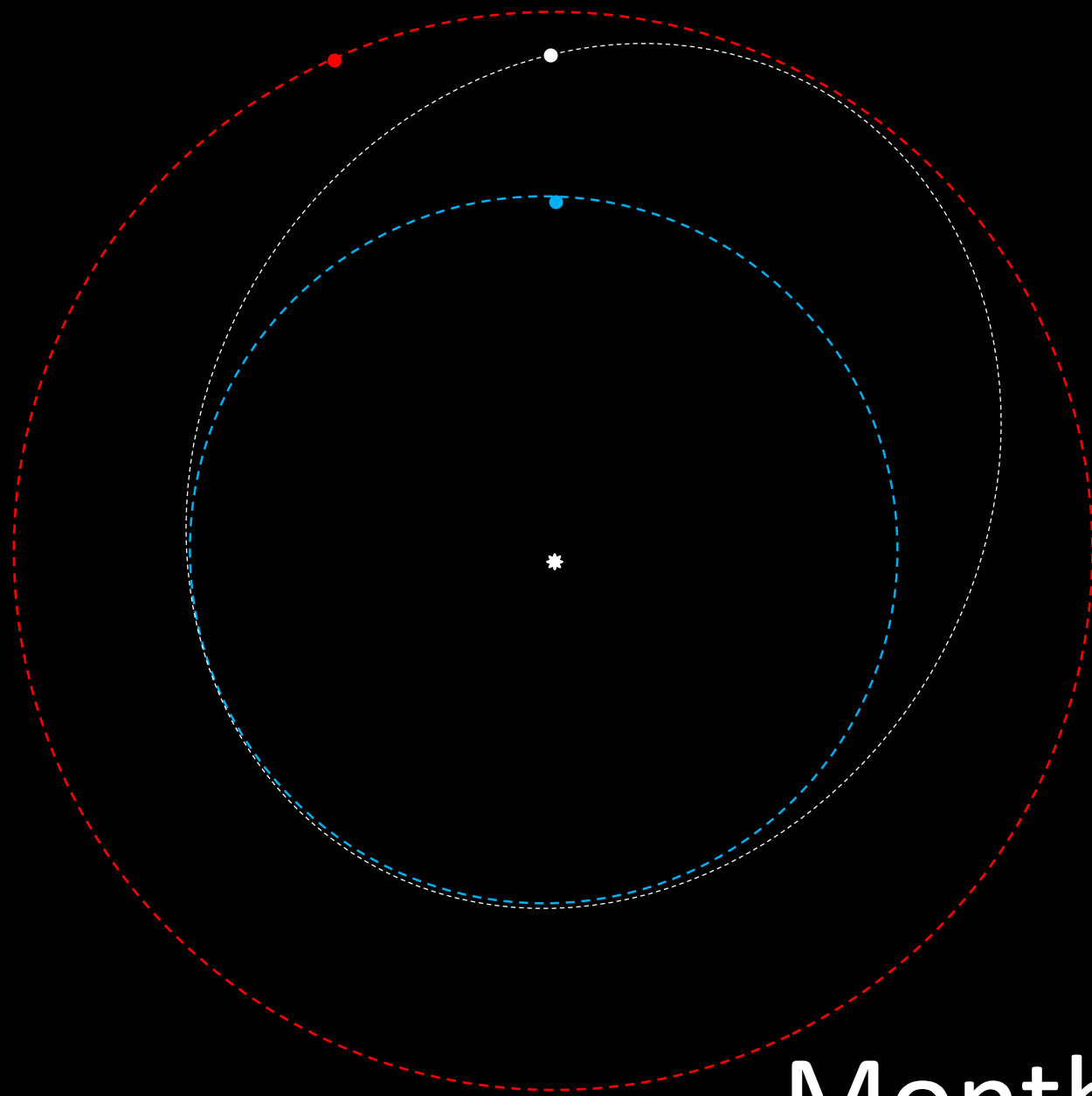
Month 24



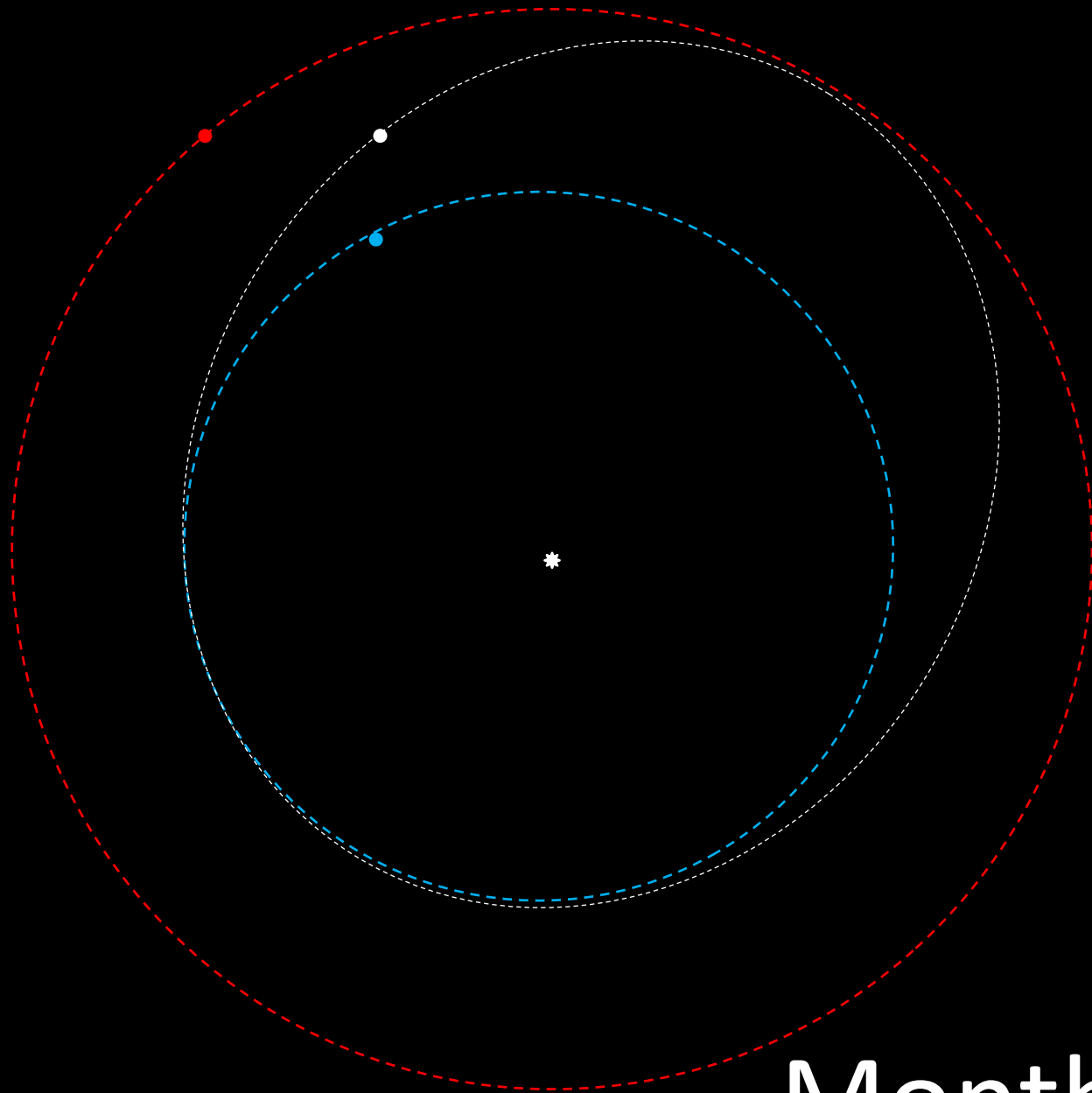
Month 25



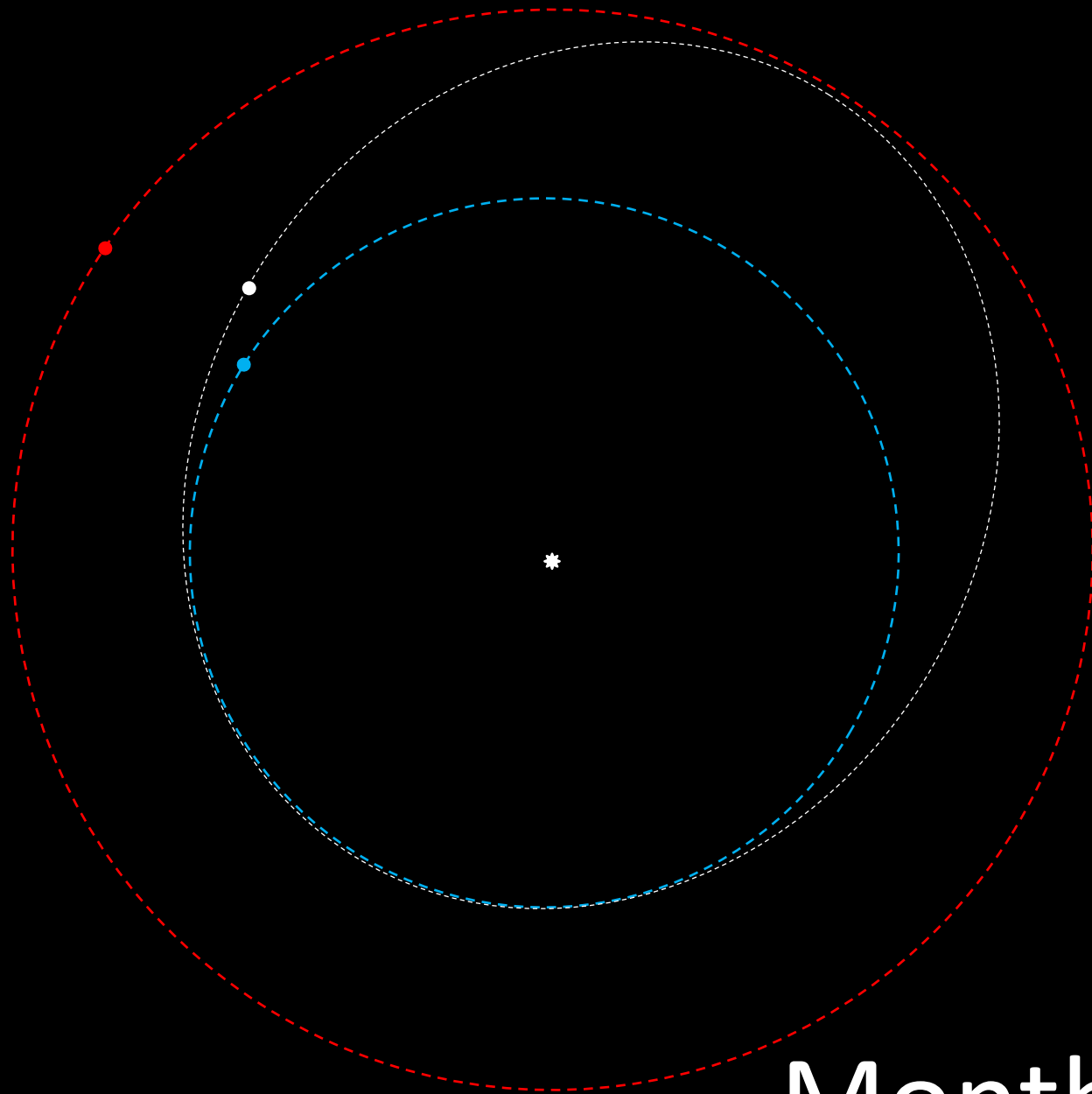
Month 26



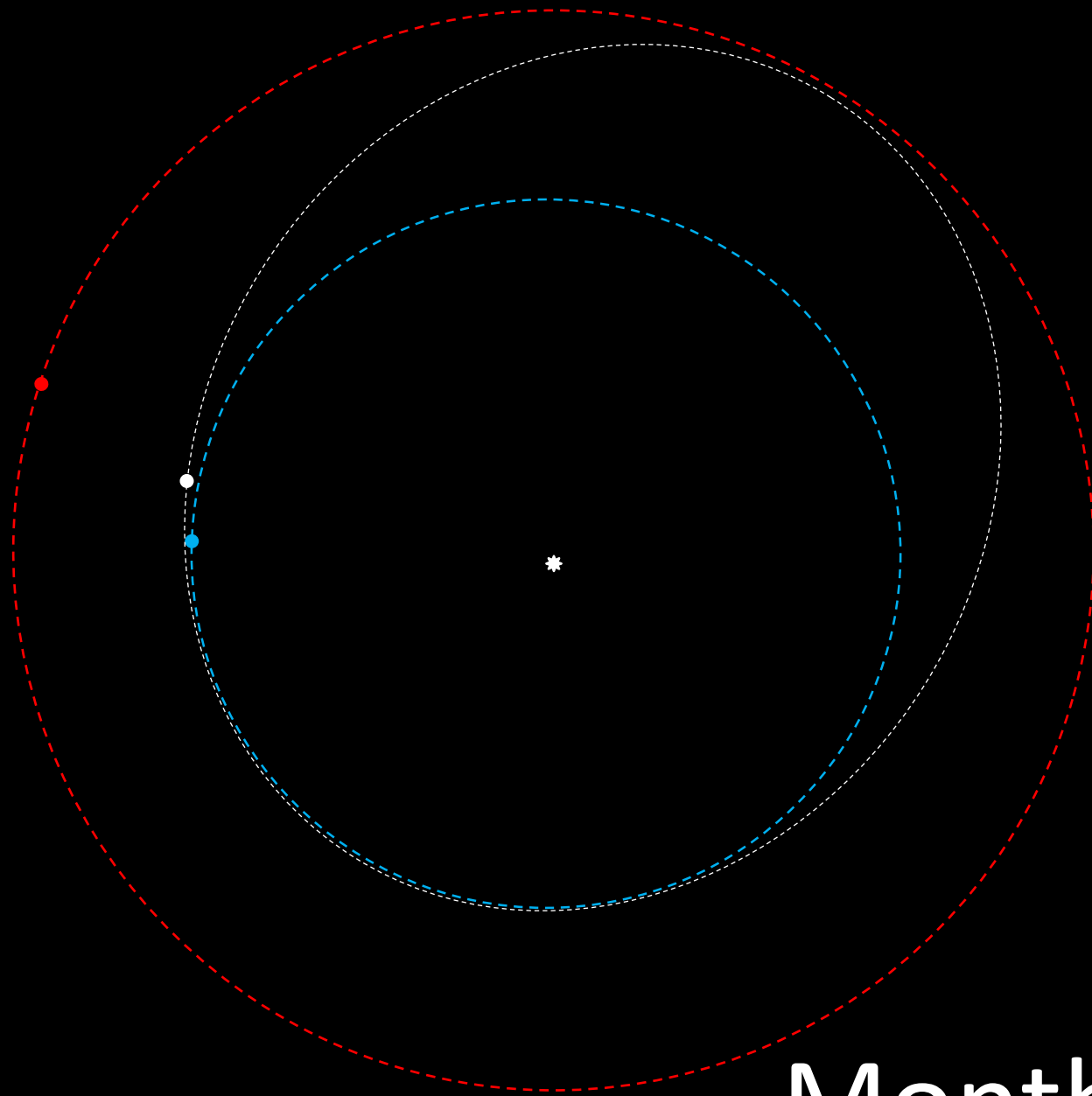
Month 27



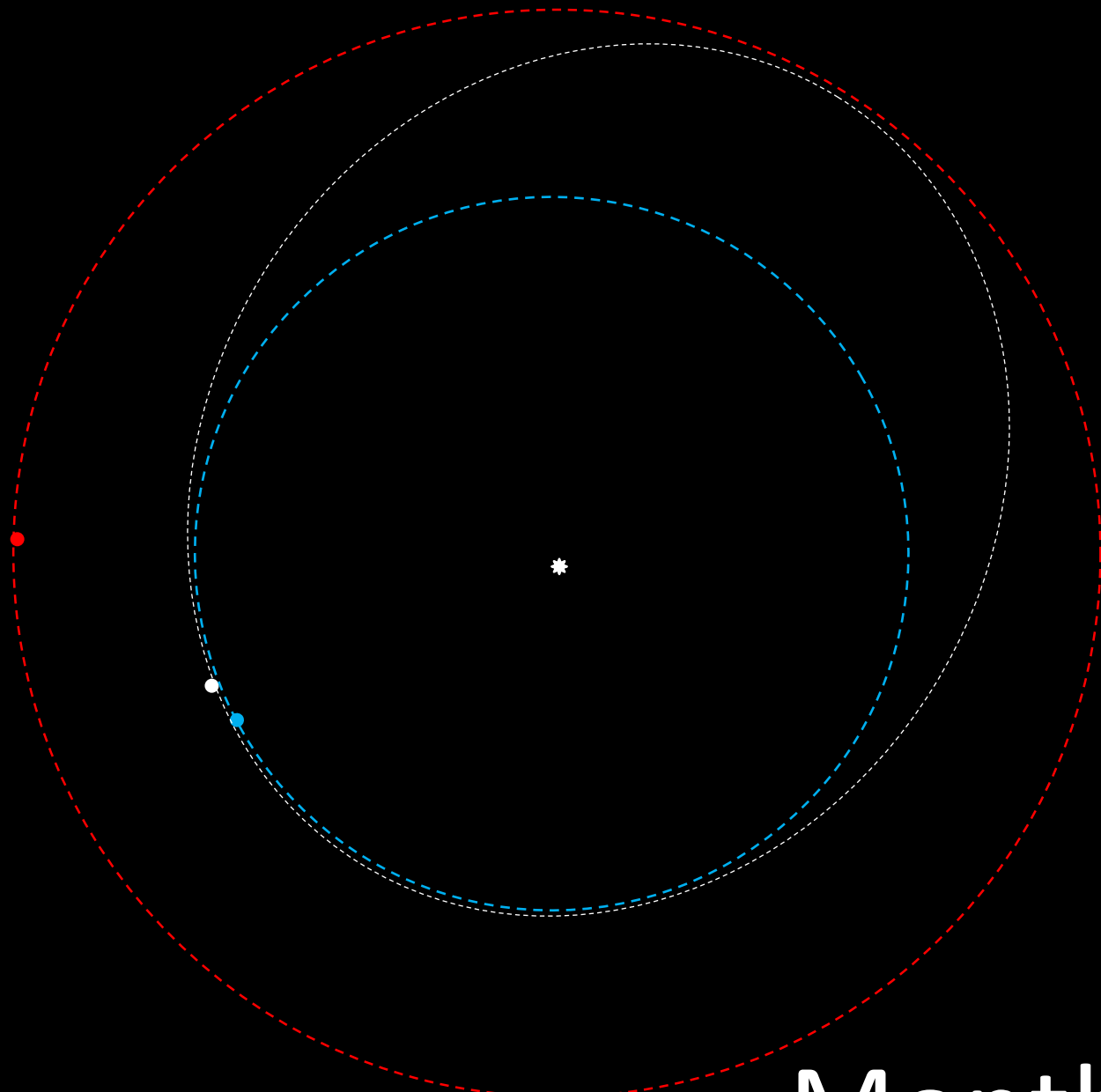
Month 28



Month 29



Month 30



Month 31



Safely home at last!

Month 32

?



+



+



+



×9,150

×1,180

×280



420 tons



×9,150



×1,180



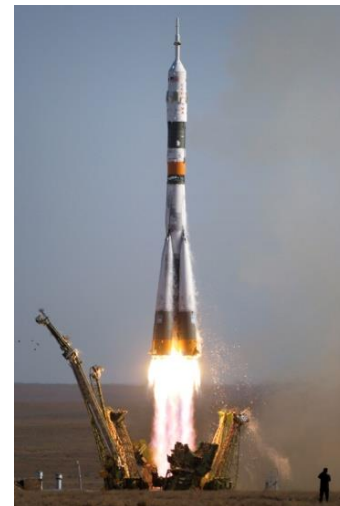
×280



+



+



×27

×2

×2



420 tons



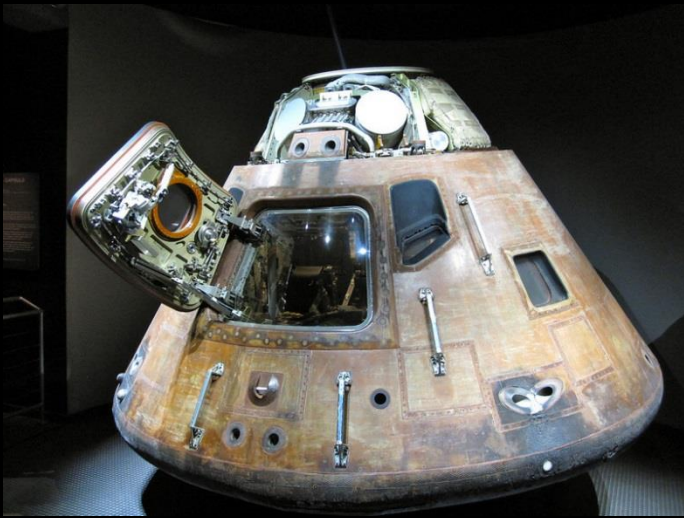
RECYCLE





100 tons

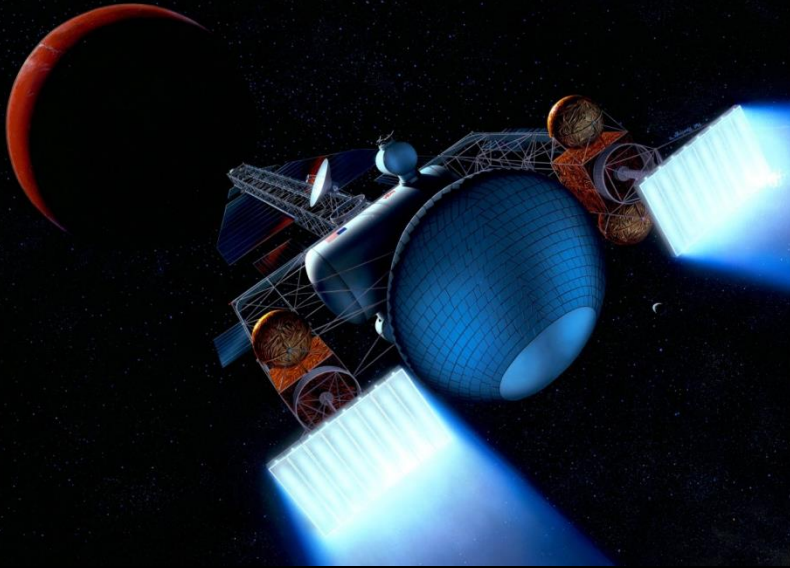




6 tons



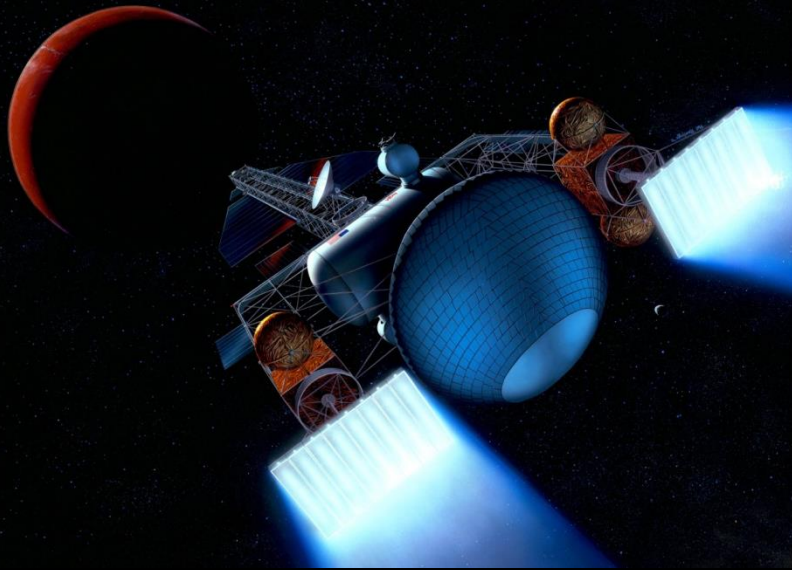
3,350 tons



100 tons



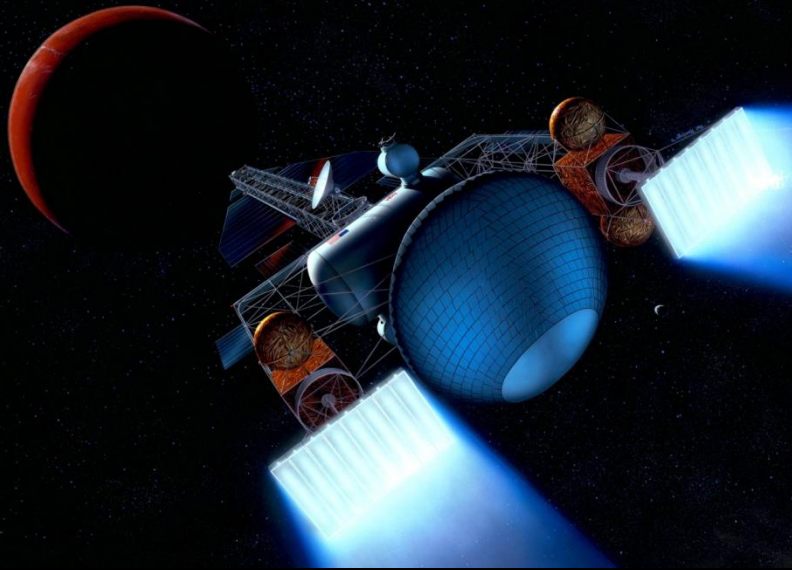
85,000 tons



100 tons



85,000 tons

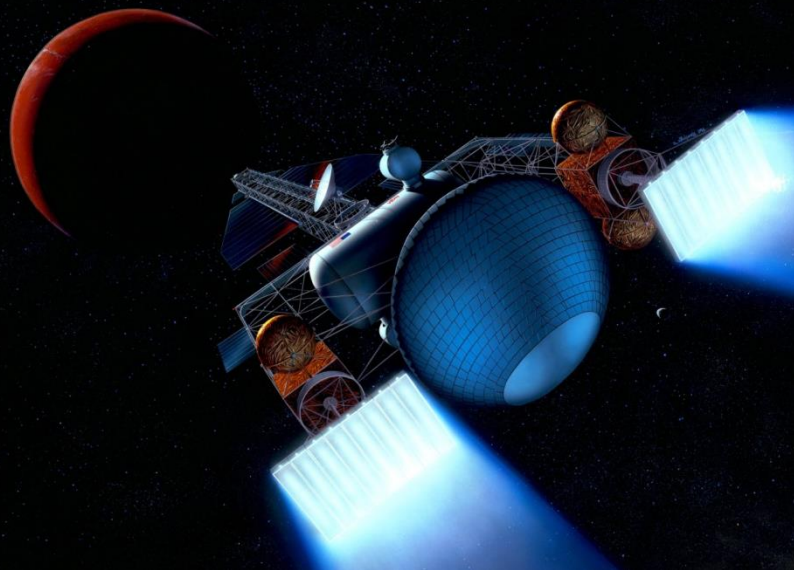


100 tons



× 39

85,000 tons

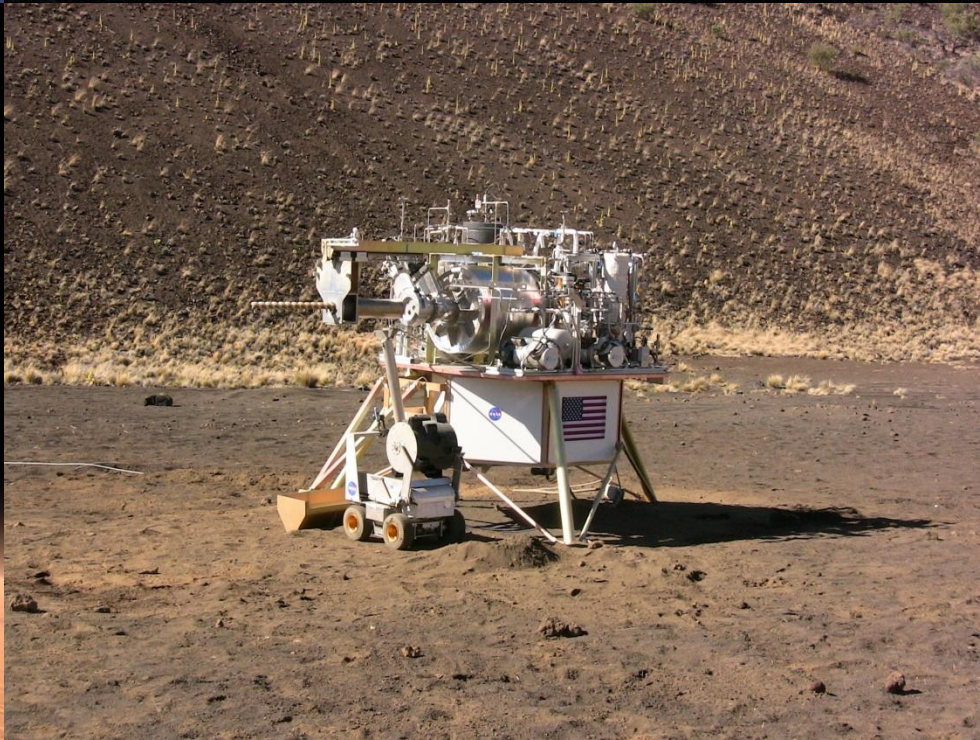
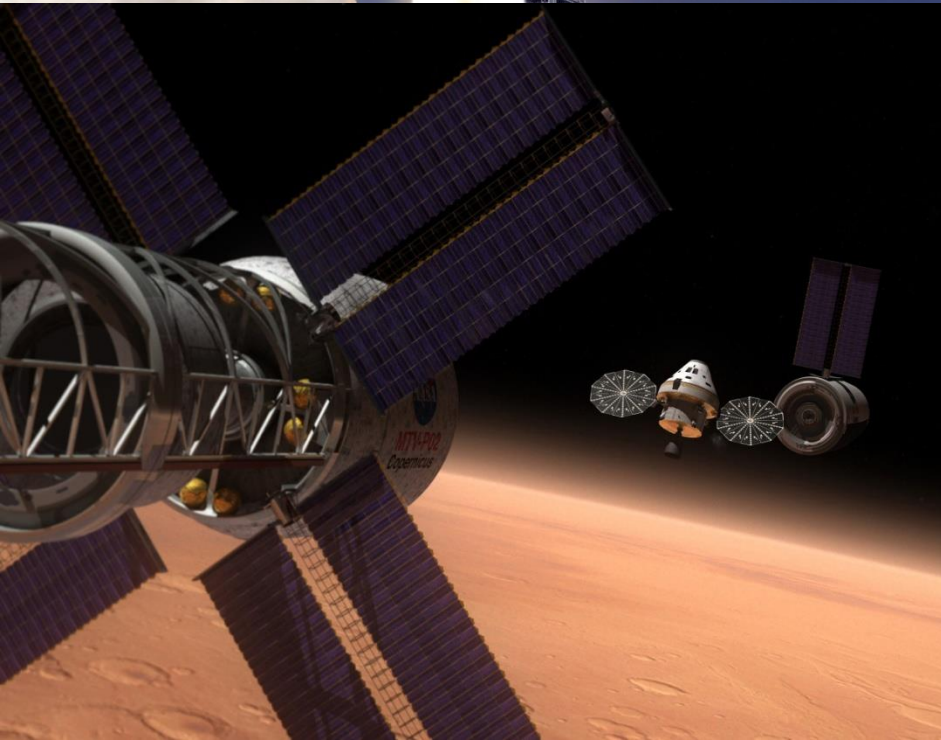
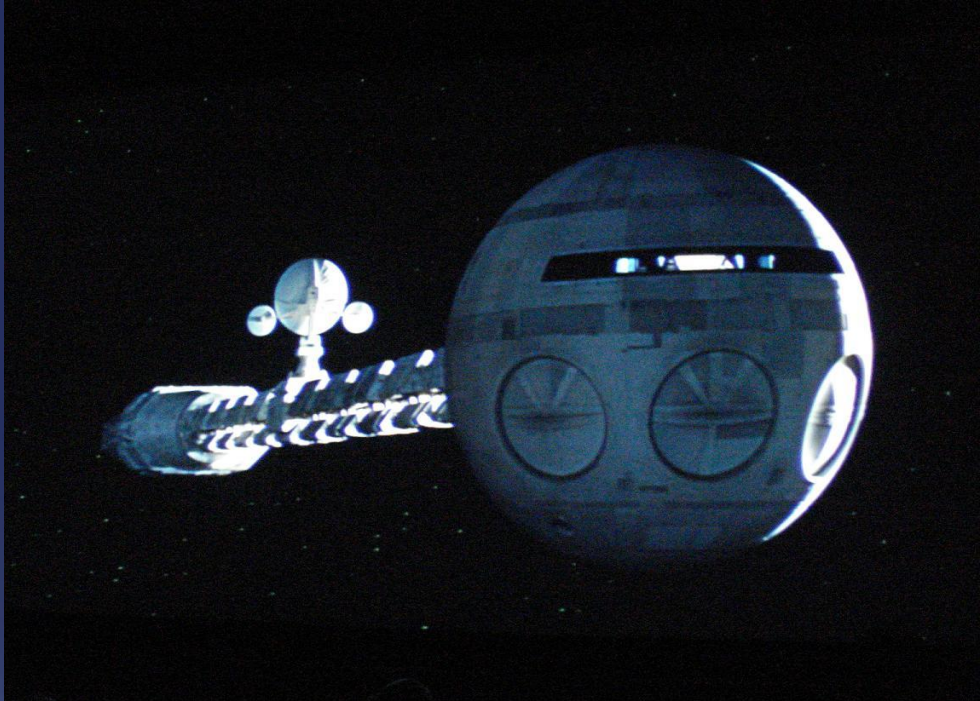


100 tons



× 25

85,000 tons

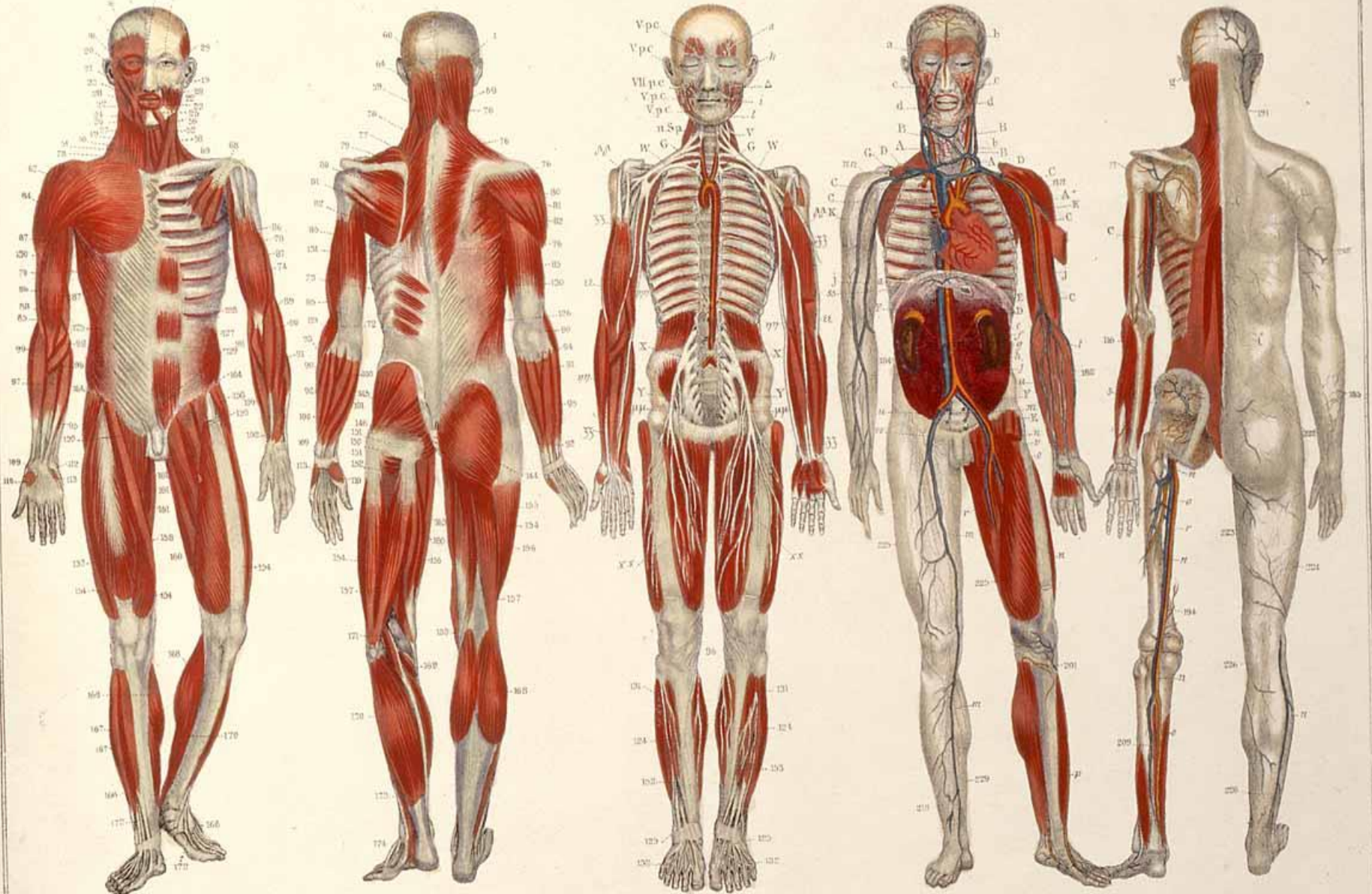


RECAPITULATION.

Myography.

Neurography.

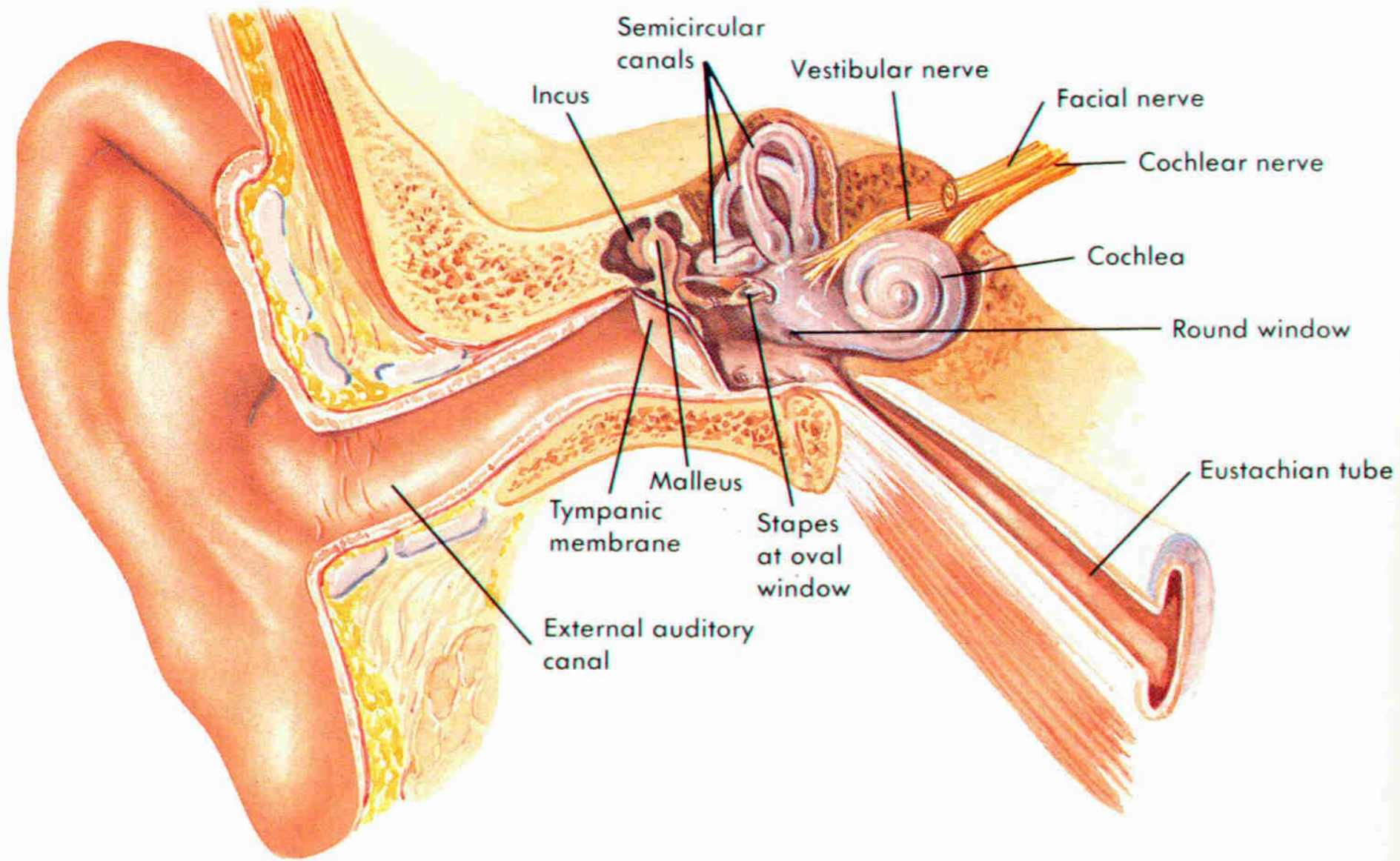
Angeography.



LISTEN HERE. I'D SMASH YOUR
FACE... ONLY YOU'RE SO SKINNY YOU
MIGHT DRY UP AND BLOW AWAY.

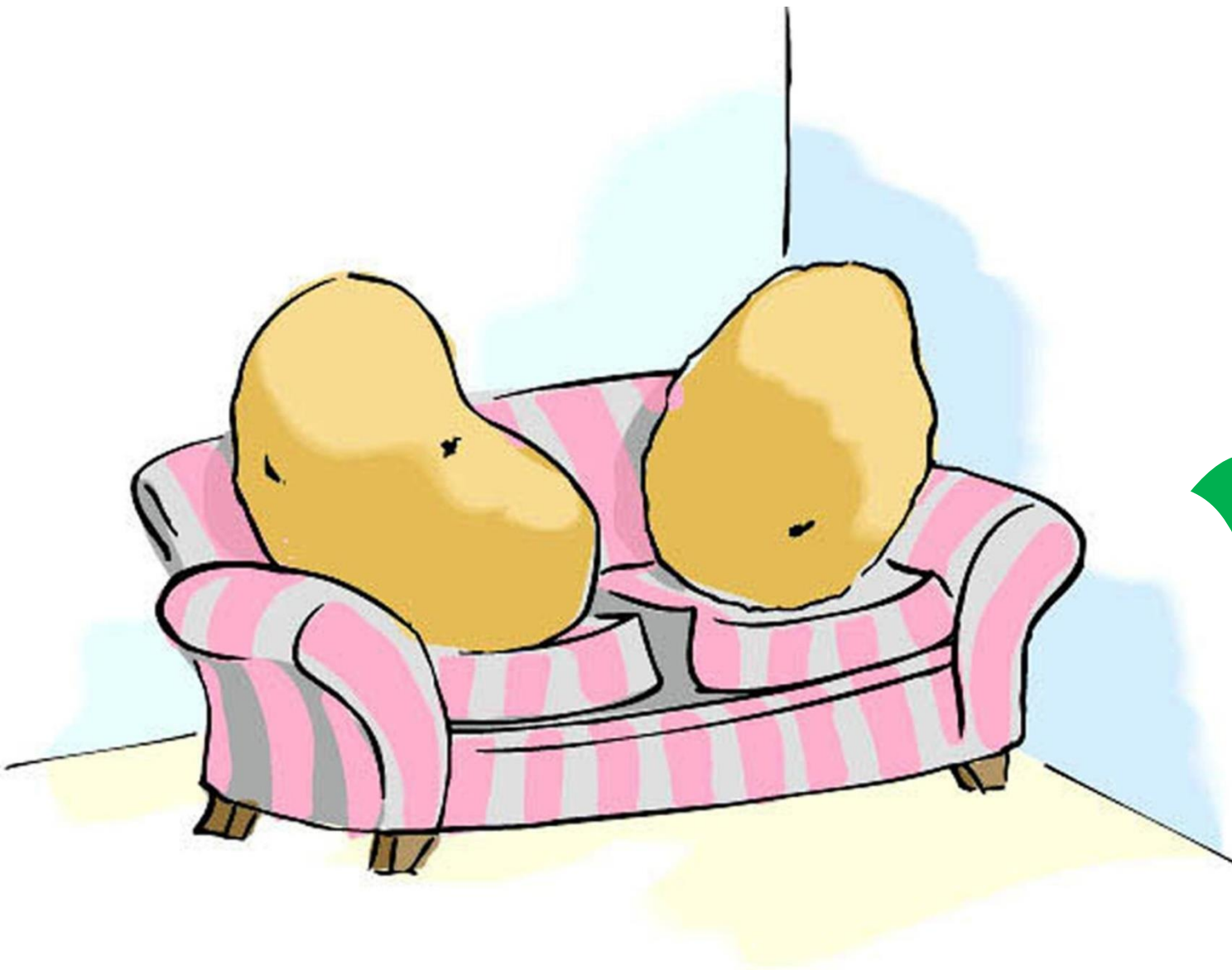


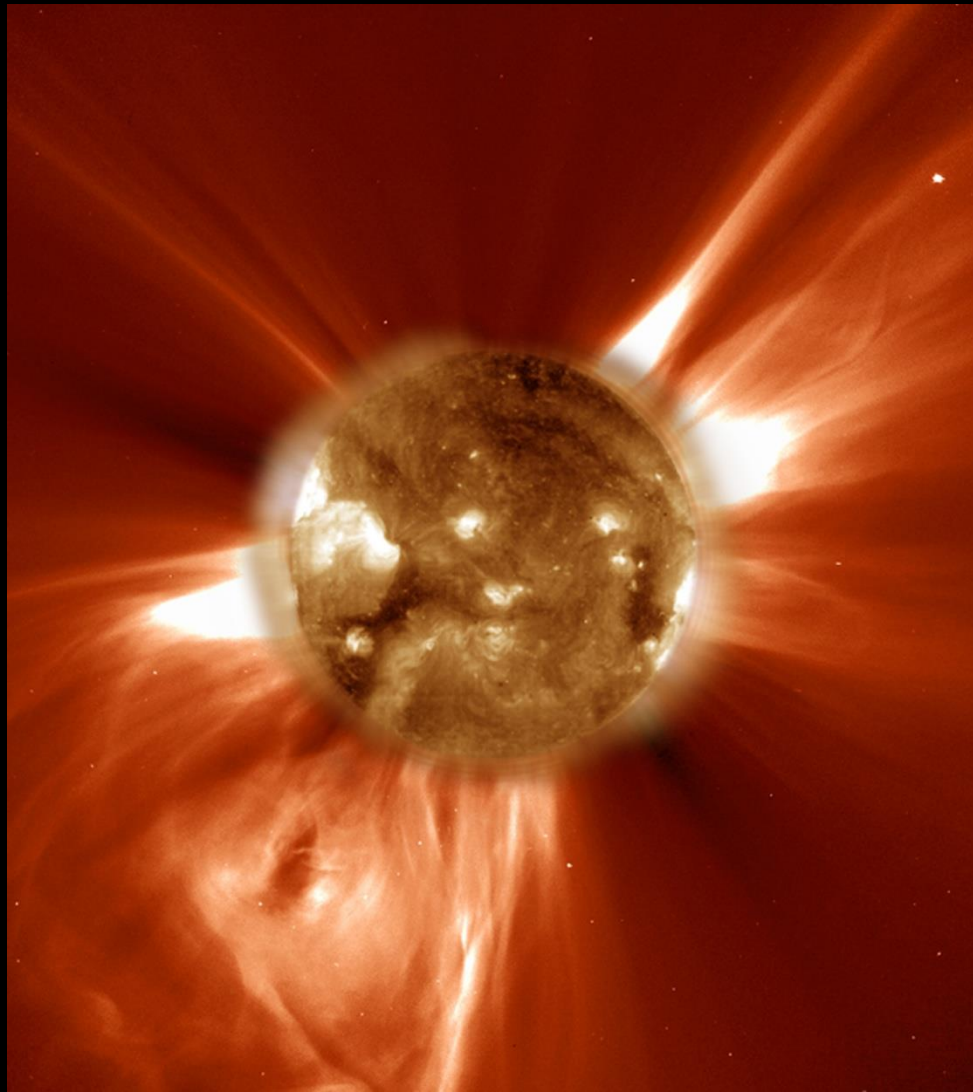




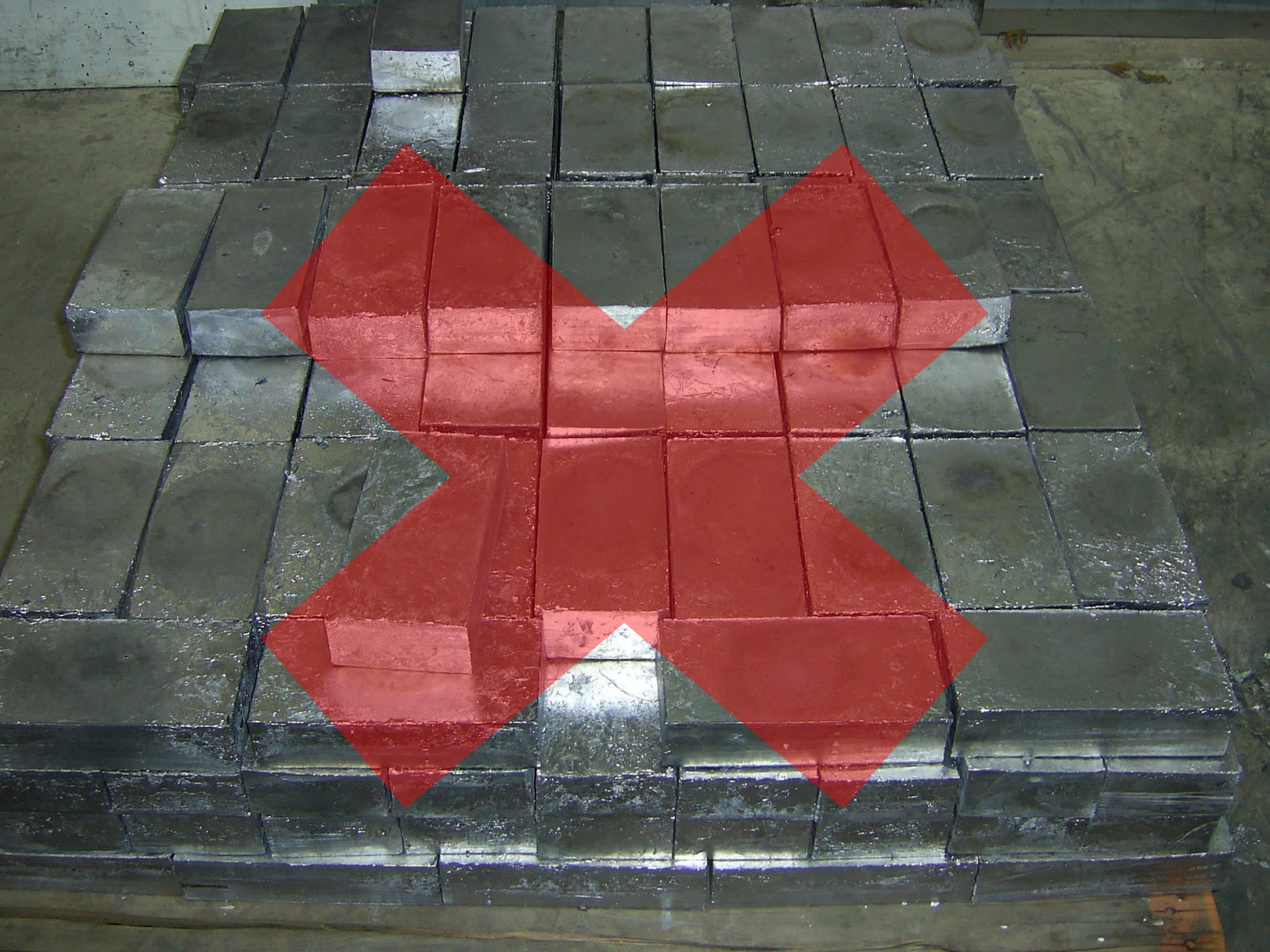
HEARING

GROSS ANATOMY OF THE EAR—FRONTAL SECTION

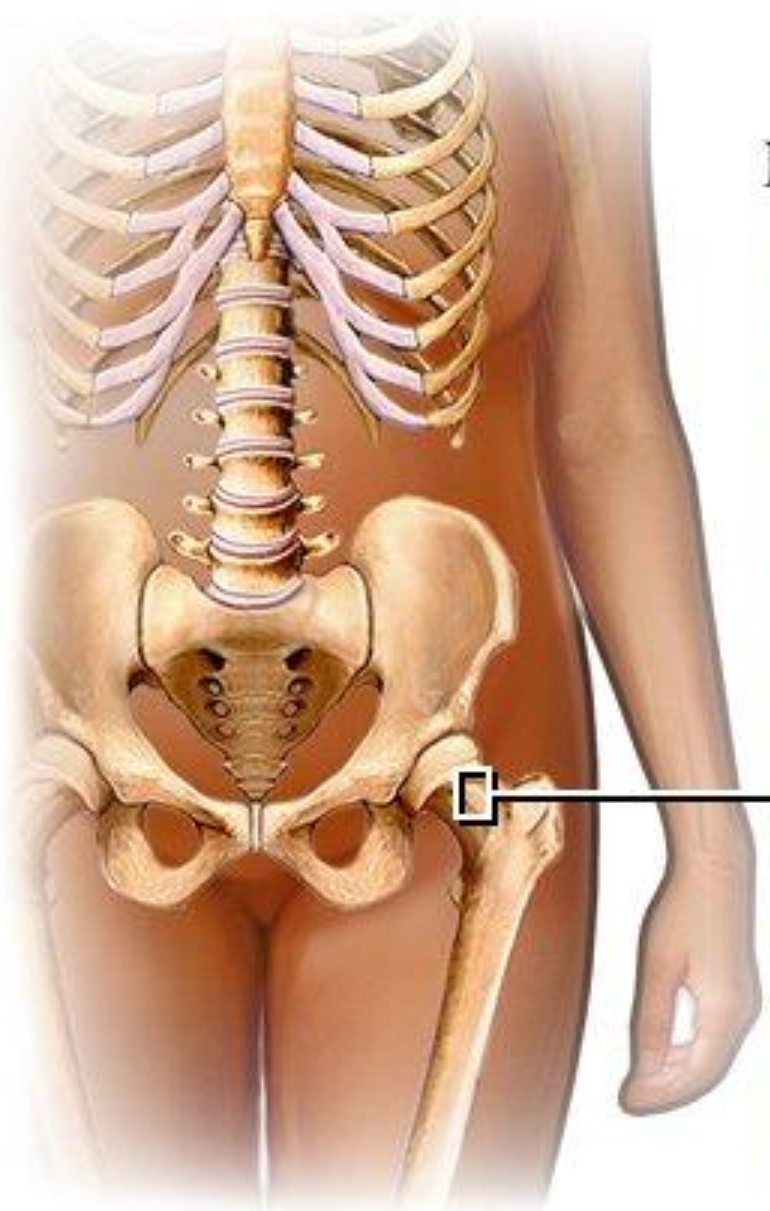




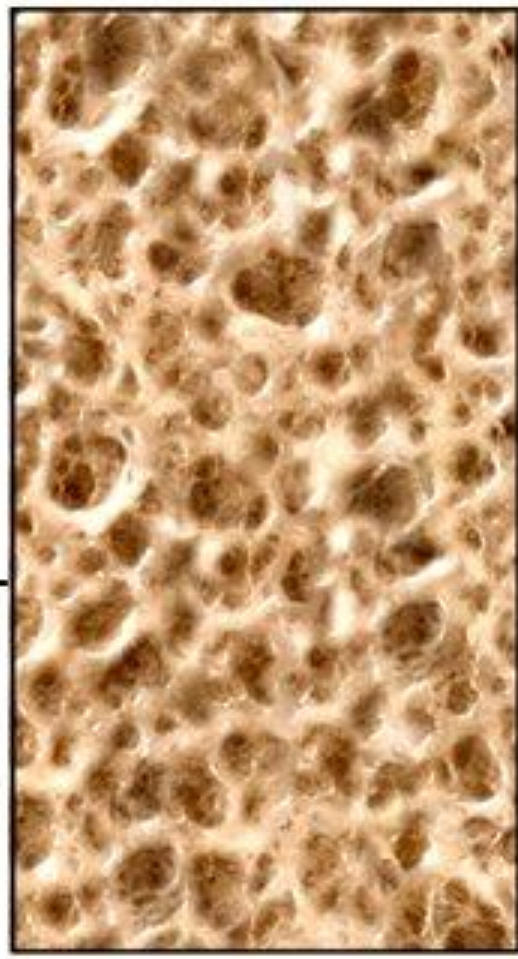




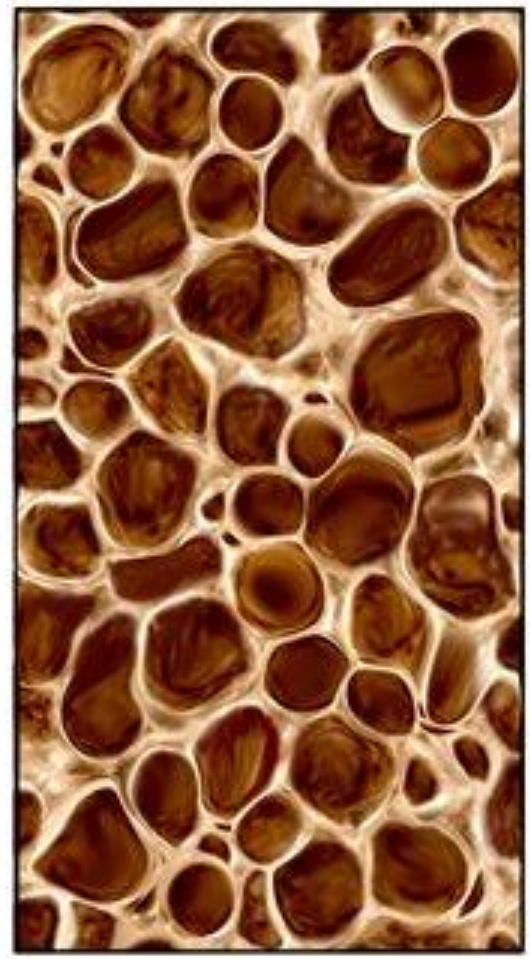




Normal bone matrix



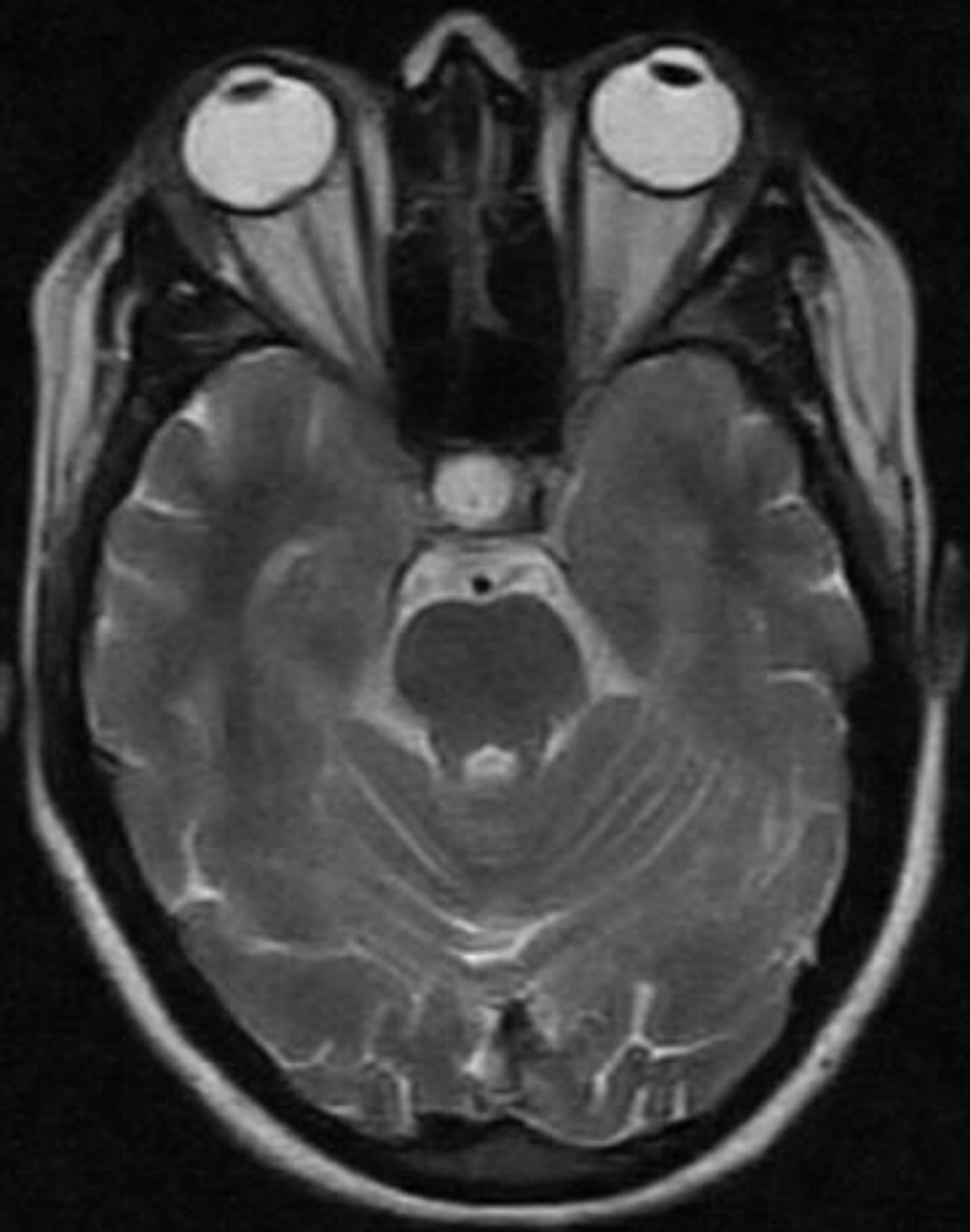
Osteoporosis





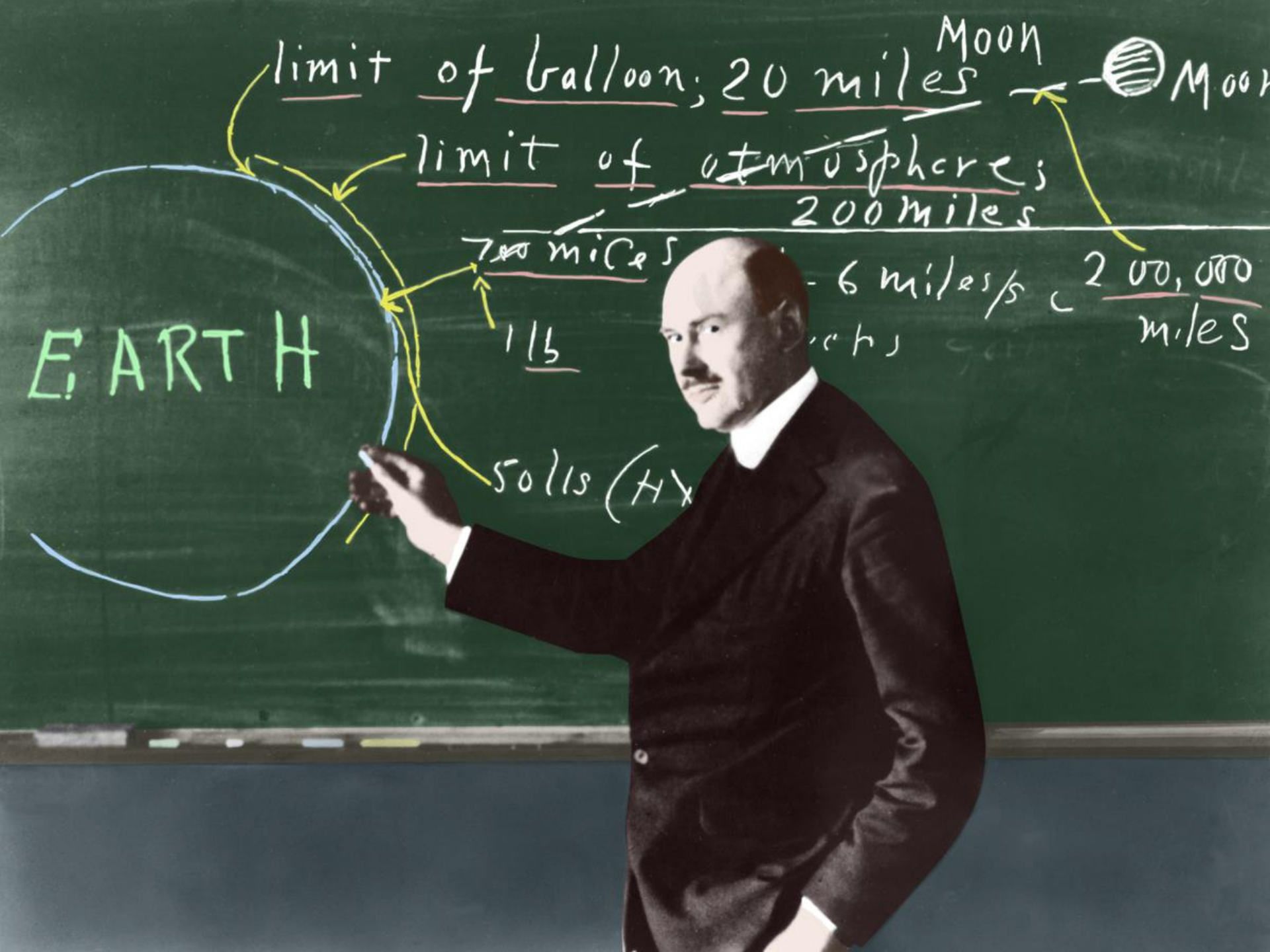






?!





EARTH

limit of balloon; 20 miles

limit of atmosphere; 200 miles

MOON



MOON

700 miles

6 miles/s

200,000 miles

115

50115 (HX)

