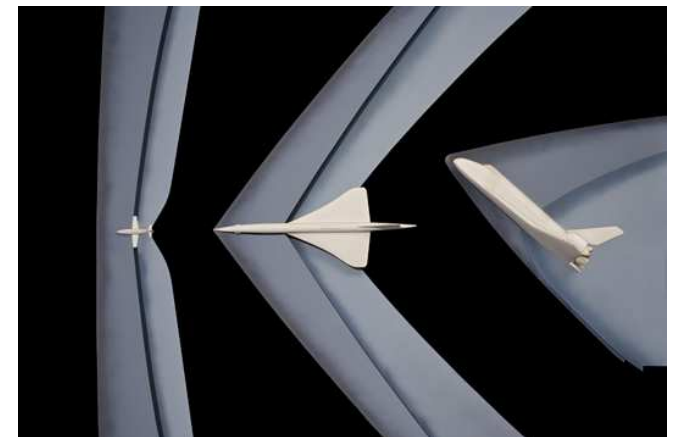
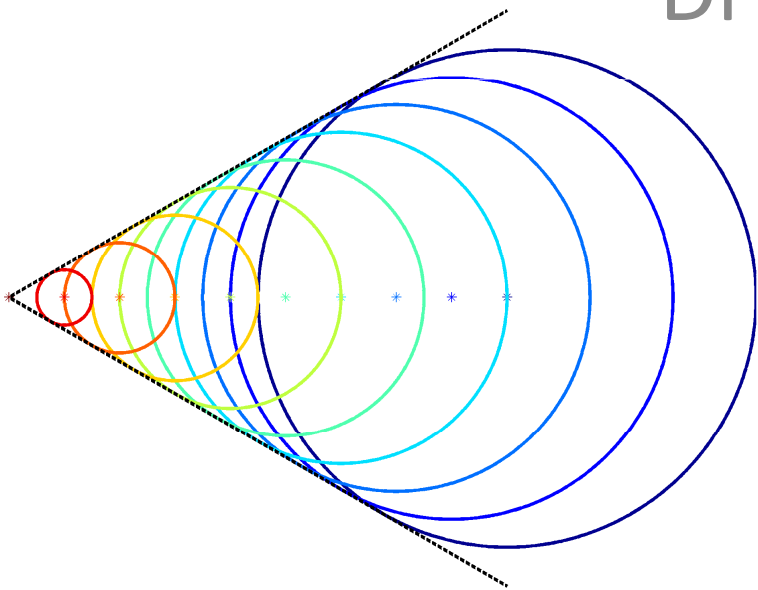


Mach's construction

Dr Andrew French

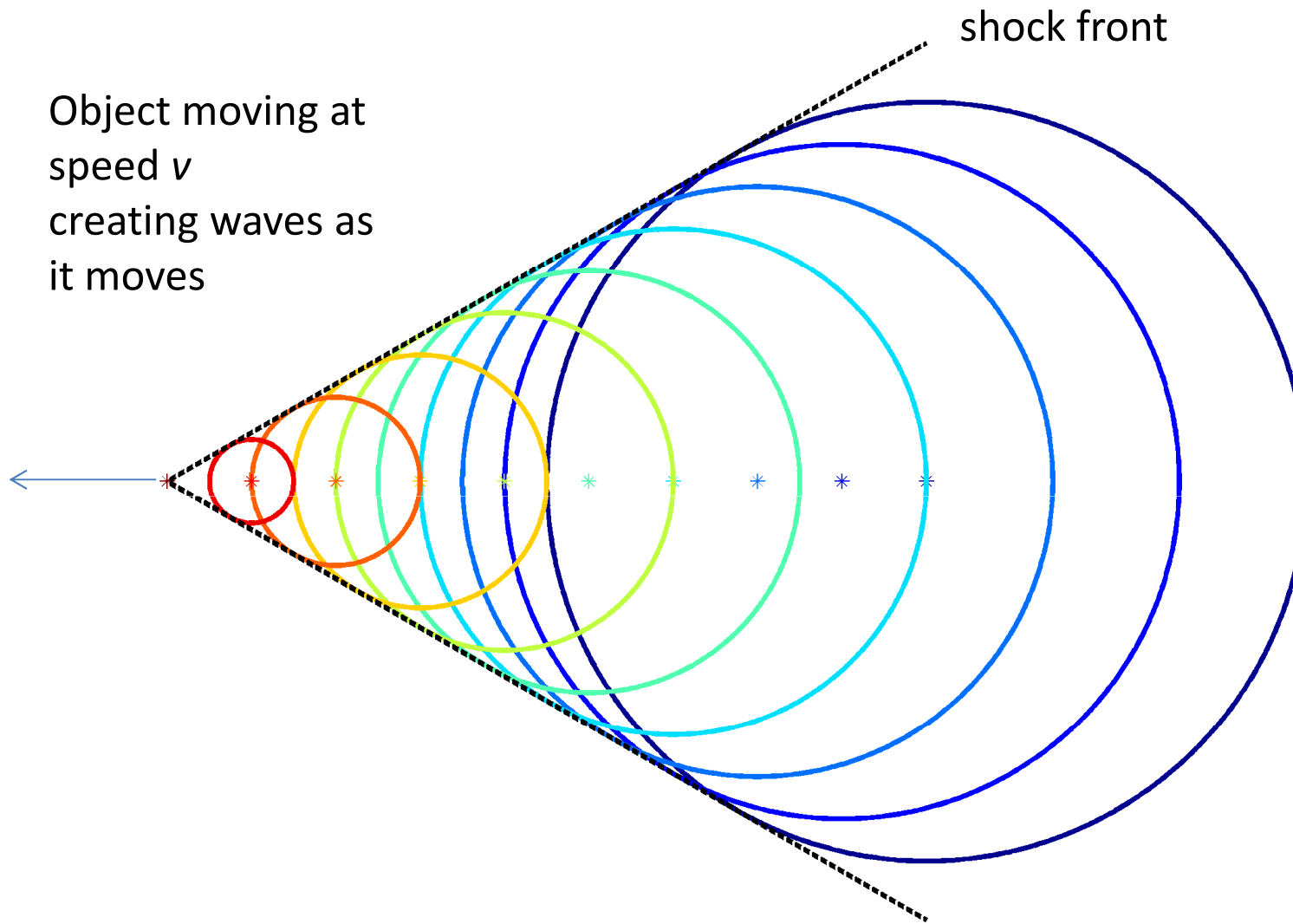


What has a supersonic shockwave got to do with some really simple trigonometry?





Mach's construction



'Infinitesimally thin' spherical shells of disturbance are created continuously as the object moves. They radiate out at the wave speed c

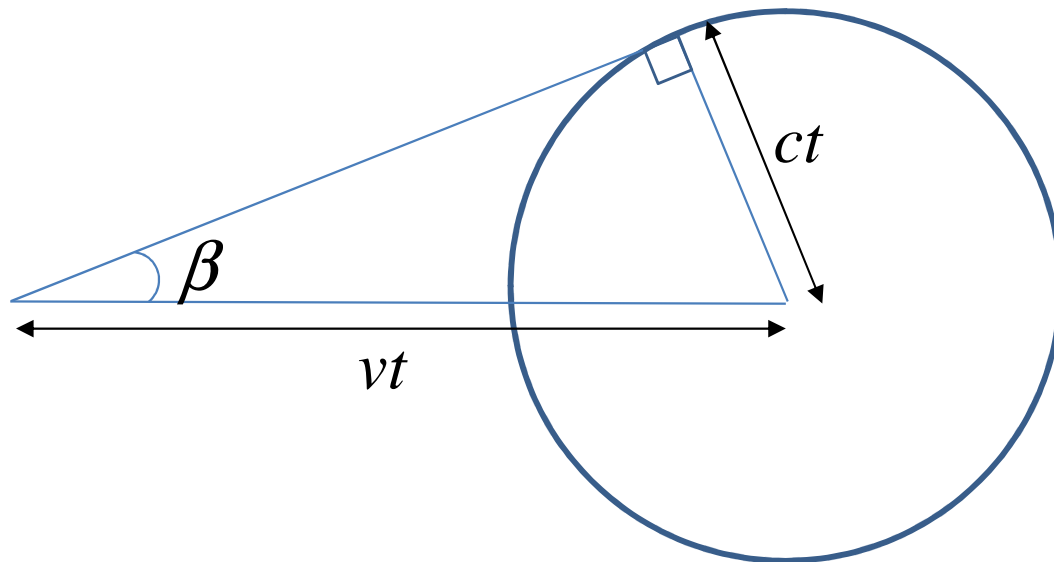
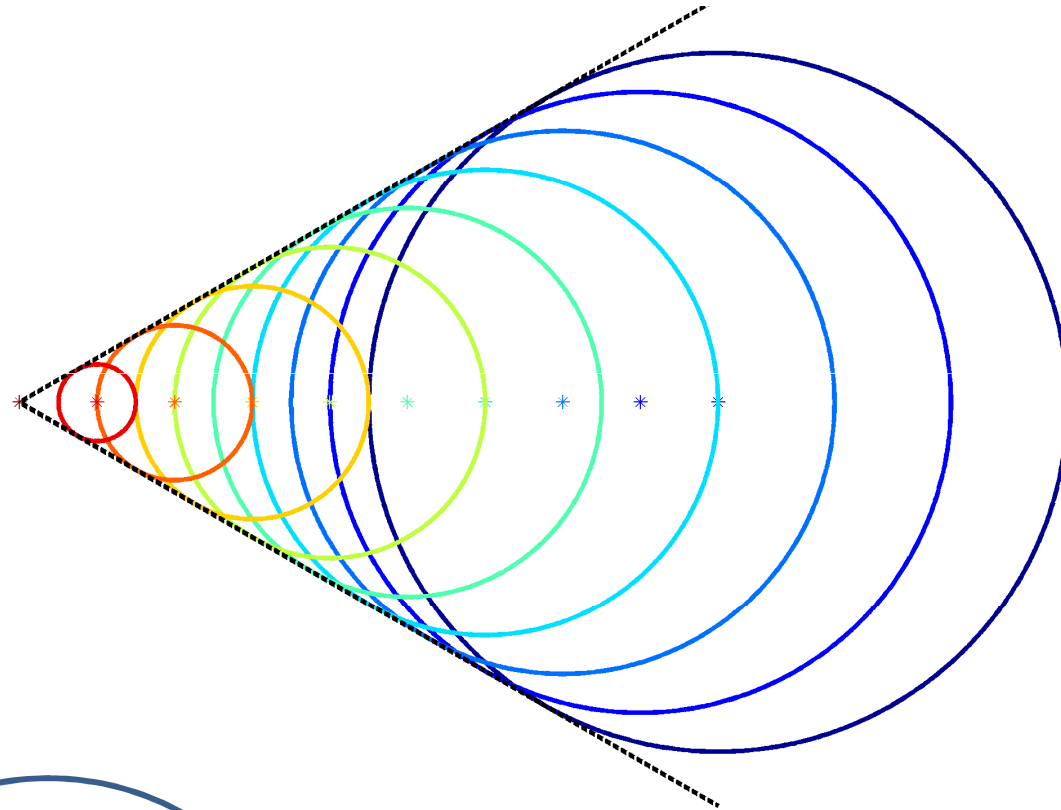
Mach's construction

c is the wave speed
 v is the velocity of the object making the waves

Mach number

$$M = \frac{v}{c}$$

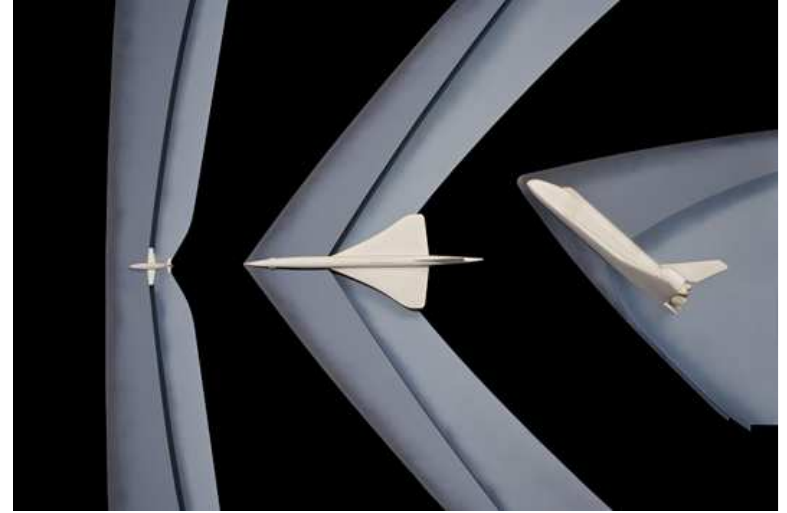
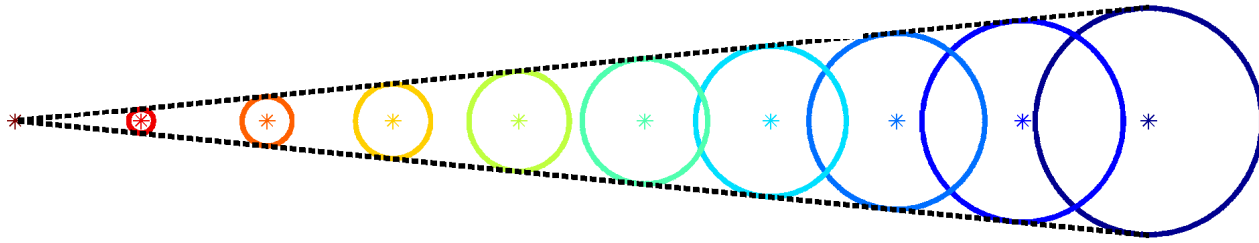
$$v/c = 2. \quad \sin^{-1}(c/v) = 30^\circ$$



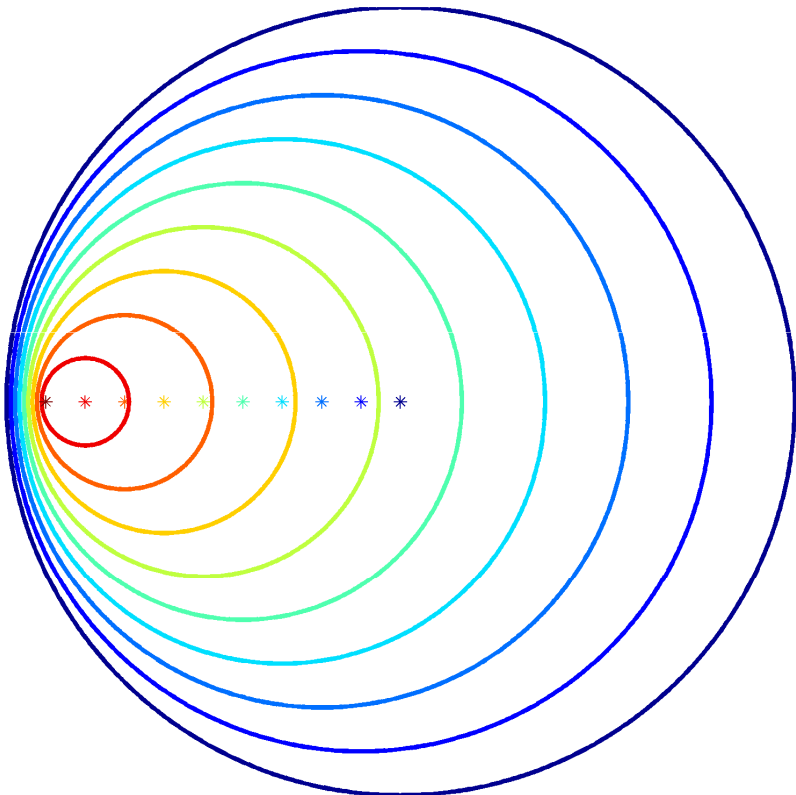
$$vt \sin \beta = ct$$

$$\therefore \beta = \sin^{-1} \left(\frac{c}{v} \right) = \sin^{-1} \frac{1}{M}$$

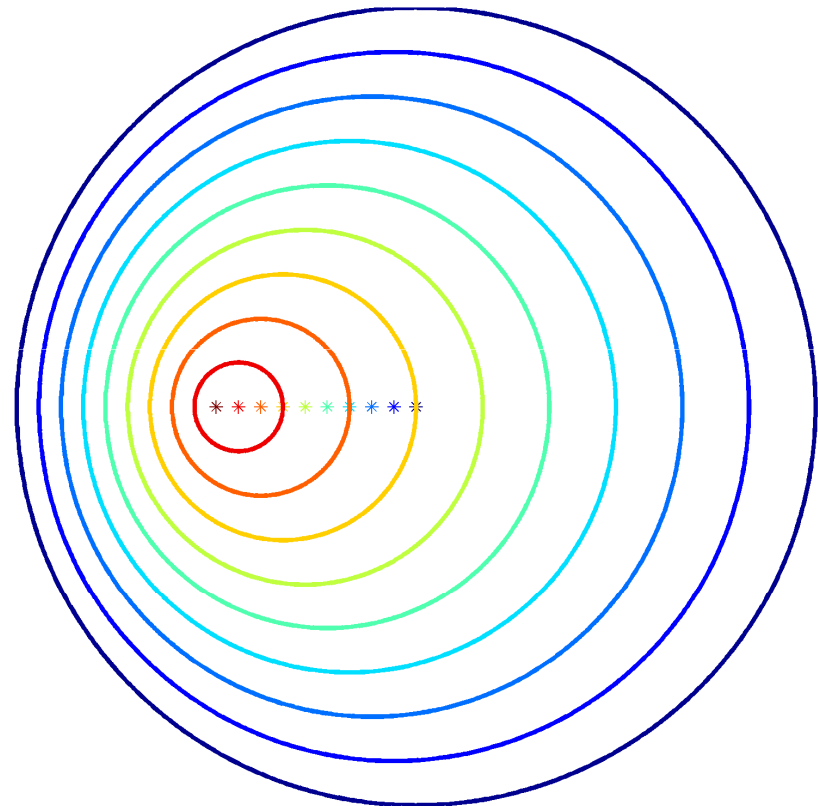
$$v/c = 10. \quad \sin^{-1}(c/v) = 5.7392^\circ$$



$$v/c = 0.9. \quad \sin^{-1}(c/v) = \text{NaN}^\circ$$



$$v/c = 0.5. \quad \sin^{-1}(c/v) = \text{NaN}^\circ$$



Kelvin wedge via Mach's construction?

$$v/c = 3. \quad \sin^{-1}(c/v) = 19.4712^\circ$$

