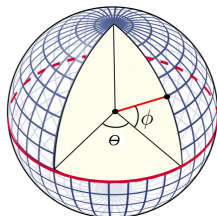
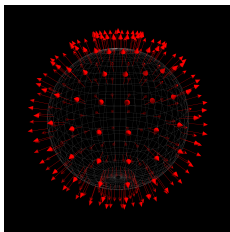
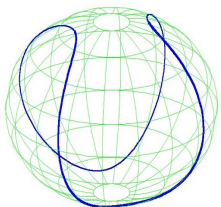
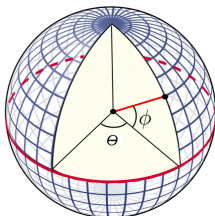
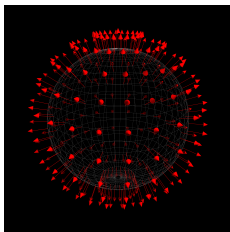
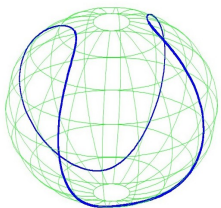


S^2 : geodesic param by arc length must be a great circle



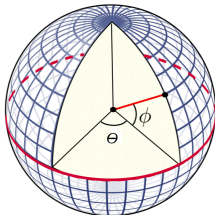
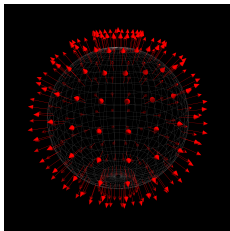
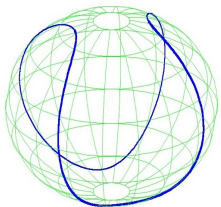
- On sphere $U = \frac{\gamma(s)}{R}$

S^2 : geodesic param by arc length must be a great circle



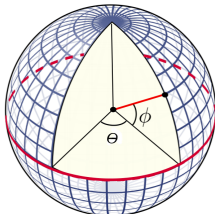
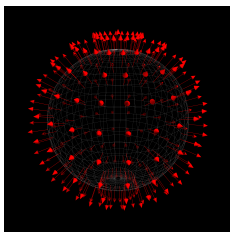
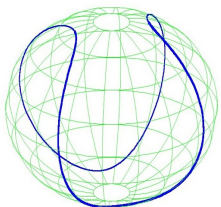
- On sphere $U = \frac{\gamma(s)}{R}$ so $\gamma(s) = RU$. Also $|\gamma| = R$.
- γ is param by arc length so is unit speed so no chain rule is needed for derivatives (note we already proved that any geodesic has constant speed, so we can certainly make it unit speed).

S^2 : geodesic param by arc length must be a great circle



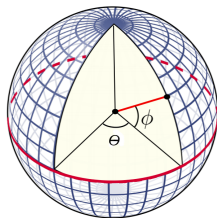
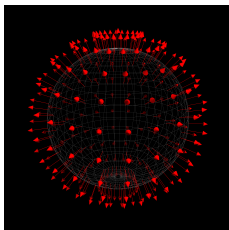
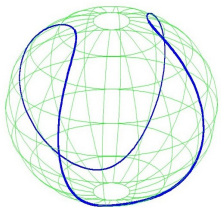
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 $\gamma'' = (\gamma'' \cdot U)U =$

S^2 : geodesic param by arc length must be a great circle



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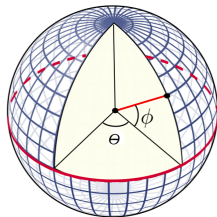
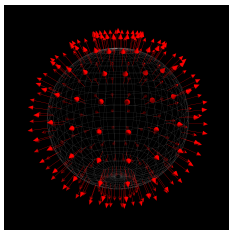
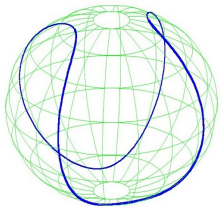
S^2 : geodesic param by arc length must be a great circle



- $$\gamma'' = (\gamma'' \cdot U)U = (\gamma'' \cdot \frac{\gamma}{R})\frac{\gamma}{R} = \frac{1}{R^2}(\gamma'' \cdot \gamma)\gamma$$

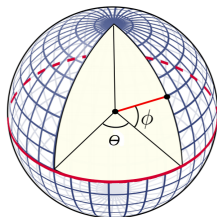
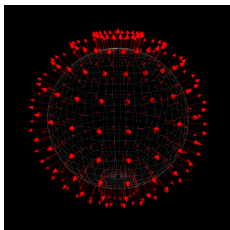
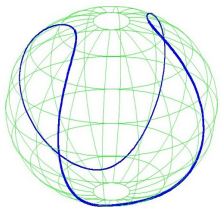
$$|\gamma''| = |\frac{1}{R^2}(\gamma'' \cdot \gamma)\gamma| = \frac{1}{R^2}|\gamma''||\gamma|\cos(\theta)|\gamma|$$

S^2 : geodesic param by arc length must be a great circle



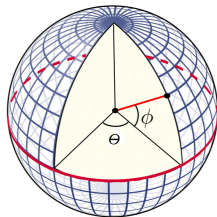
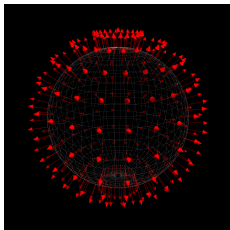
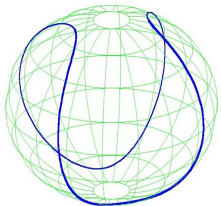
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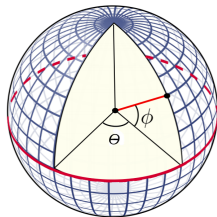
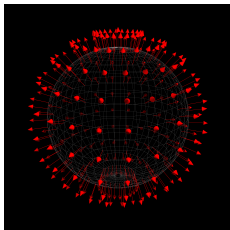
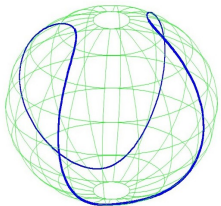
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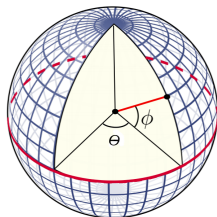
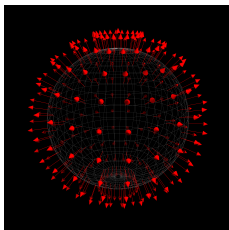
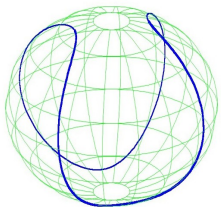
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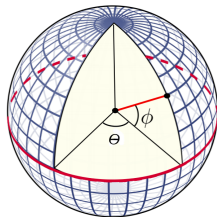
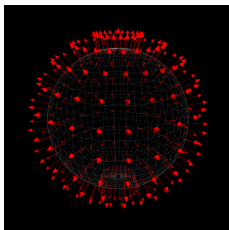
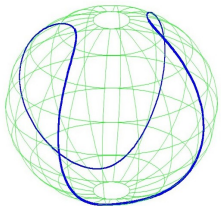
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 However $T \perp B$, so $|\kappa| = \frac{1}{R}$ & $\tau = 0$, ie circle radius R .