$$\Rightarrow \vec{e}_\varphi : R(2\cos\theta\,\dot\varphi\dot\theta + \sin\theta\,\ddot\varphi) = 0$$

$$\vec{e}_r : R(-\sin^2\theta\,\dot\varphi^2 - \dot\theta^2) = -\tilde\lambda - g\cos\theta$$ ✓

$$\vec{e}_\theta : R(\ddot\theta - \dot\varphi^2\cos\theta\sin\theta) = g\sin\theta$$

d) $\sum_{i=0}^{N}(F_i^{(a)} - m\ddot{\vec{r}}_i)\,\delta\vec{r}_i = 0$ ✓ 1 Teilchen $\Rightarrow (m g \vec{e}_z - m\ddot{\vec{r}})\,\delta\vec{r} = 0$ ✓ ~~...~~ $\ddot{\vec{r}} = \begin{pmatrix}\ddot x\\ \ddot y\\ \ddot z\end{pmatrix}$

e) $\delta\vec{r} = \frac{\partial\vec{r}}{\partial\theta}\delta\theta + \frac{\partial\vec{r}}{\partial\varphi}\delta\varphi$ $\quad \delta\vec{r} = \begin{pmatrix}\delta x\\ \delta y\\ \delta z\end{pmatrix}$

$\vec{x} = a\vec{e}_x + b\vec{e}_y + c\vec{e}_z = \begin{pmatrix}a\\ b\\ c\end{pmatrix}$

$$\Rightarrow \delta\vec{r} = R\vec{e}_\theta\,\delta\theta + R\sin\theta\,\vec{e}_\varphi\,\delta\varphi$$ ✓ $\quad \delta\vec{r} = \begin{pmatrix}0\,\delta r\\ R\sin\theta\,\delta\varphi\\ R\delta\theta\end{pmatrix}$

$$\Rightarrow (-mg(\cos\theta\,\vec{e}_r - \sin\theta\,\vec{e}_\theta) - m\ddot{\vec{r}})\,(R(\vec{e}_\theta\,\delta\theta + \sin\theta\,\vec{e}_\varphi\,\delta\varphi)) = 0$$

$$\Rightarrow (mg\sin\theta R - mR^2(\ddot\theta - \dot\varphi^2\cos\theta\sin\theta))\,\delta\theta - m\sin\theta R^2(2\cos\theta\,\dot\varphi\dot\theta + \sin\theta\,\ddot\varphi)\,\delta\varphi = 0$$

$$\Rightarrow [g\sin\theta - R(\ddot\theta - \dot\varphi^2\cos\theta\sin\theta)]\,\delta\theta - \sin\theta R(2\cos\theta\,\dot\varphi\dot\theta + \sin\theta\,\ddot\varphi)\,\delta\varphi = 0$$ ✓ ✓

$$\Rightarrow g\sin\theta - R(\ddot\theta - \dot\varphi^2\cos\theta\sin\theta) = 0$$

Top!

$$\wedge\ 2\cos\theta\,\dot\varphi\dot\theta + \sin\theta\,\ddot\varphi = 0$$ ✓

Vorrechnen?

S/S