Two-body problem

$$\min_{\phi} \sum_{t=1}^{T} \dot{\boldsymbol{r}}_t \cdot \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \tag{1}$$

$$\min_{\phi} \sum_{t=1}^{T} \| \dot{\boldsymbol{r}}_t \cdot \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \|_2^2 \tag{2}$$

$$\min_{\phi} \sum_{t=1}^{T} \left(\| \dot{\boldsymbol{r}}_t \cdot \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \|_2^2 + \frac{1}{\| \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \|_2^2} \right) \tag{3}$$

$$\min_{\phi} \sum_{t=1}^{T} \left(\| \dot{\boldsymbol{r}}_t \cdot \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \|_2^2 - \log \left(\| \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \|_2^2 \right) \right) \tag{4}$$

$$\min_{\phi} \sum_{t=1}^{T} \left(\frac{\dot{\boldsymbol{r}}_t \cdot \bigtriangledown \phi \left(\boldsymbol{r}_t \right)}{\| f_t \|_2^2 * \| \bigtriangledown \phi (\boldsymbol{r}_t) \|_2^2} - \left(1 - \| \bigtriangledown \phi \left(\boldsymbol{r}_t \right) \|_2^2 \right)^2 \right) \tag{5}$$

$$\min_{\phi} \sum_{t=1}^{T} \frac{\dot{\boldsymbol{r}}_t \cdot \bigtriangledown \phi \left(\boldsymbol{r}_t \right)}{\| f_t \|_2^2 * \| \bigtriangledown \phi (\boldsymbol{r}_t) \|_2^2} - \sum_{x \in R^4} \left(1 - \| \bigtriangledown \phi (x) \|_2^2 \right)^2 \tag{6}$$

$$\sum () \tag{7}$$

$$\tag{8}$$