

DNLS - DIMER

$$i \dot{\psi}_1 = v \psi_2 - \pi |\psi_2|^2 \psi_1 -$$

$$i \dot{\psi}_2 = v \psi_1 - \pi |\psi_1|^2 \psi_2$$

$$\mathcal{P} = \begin{pmatrix} \mathcal{P}_{11} & \mathcal{P}_{12} \\ \mathcal{P}_{21} & \mathcal{P}_{22} \end{pmatrix} = \begin{pmatrix} |\psi_1|^2 & \psi_1 \psi_2^* \\ \psi_2 \psi_1^* & |\psi_2|^2 \end{pmatrix}$$

$$i \dot{\psi}_1 \psi_1^* = v \psi_2 \psi_1^* - \pi |\psi_1|^2 \psi_1 \psi_1^* -$$

$$i \dot{\psi}_1^* \psi_1 = -v \psi_2^* \psi_1 + \pi |\psi_1|^2 \psi_1^* \psi_1 -$$

$$i (\dot{\psi}_1 \psi_1^* + \dot{\psi}_1^* \psi_1) = -v (\psi_1 \psi_2^* - \psi_2 \psi_1^*)$$

$$\boxed{i \dot{\mathcal{P}}_{11} = -v (\mathcal{P}_{12} - \mathcal{P}_{21})} \leftarrow$$

$$i \dot{\psi}_2 \psi_2^* = v \psi_1 \psi_2^* - \pi |\psi_2|^2 \psi_2 \psi_2^*$$

$$i \dot{\psi}_2^* \psi_2 = -v \psi_1^* \psi_2 + \cancel{\pi |\psi_1|^2 \psi_2^* \psi_2}$$

$$i \dot{p}_{22} = v(p_{12} - p_{21})$$

$$i \dot{\psi}_1 \psi_2^* = v \psi_2 \psi_2^* - \pi |\psi_1|^2 \psi_1 \psi_2^*$$

$$i \dot{\psi}_2^* \psi_1 = -v \psi_1^* \psi_1 + \pi |\psi_2|^2 \psi_2^* \psi_1$$

$$i \dot{p}_{12} = -v(p_{11} - p_{22}) - \pi(p_{11} - p_{22})p_{12}$$

$$i \dot{p}_{21} = \dots$$

$$\dot{p} = 2Vq$$

$$\dot{q} = -2Vp - \pi p^2$$

$$q = \frac{\dot{p}}{2V}$$

$$\dot{r} = \pi p q$$

$$q = \frac{\dot{p}}{2V}$$

$$\dot{r} = \frac{\pi}{2V} p \dot{p}$$

$$\frac{d}{dt} r = \left(\frac{dx}{dt} \right) \frac{d}{dt} P^2 \rightarrow$$

$$r(t) = r_0 + \frac{x}{4v} [P^2 - P_0^2]$$

$$r(t) = \left(r_0 - \frac{x}{4v} \right) P_0^2 + \frac{x}{4v} P^2$$

$$\frac{\ddot{P}}{2v} = -2vP - xP \left[\left(r_0 - \frac{x}{4v} \right) P_0^2 + \frac{x}{4v} P^2 \right]$$

$$\ddot{P} = - \left[(2v)^2 + 2vxr_0 - \frac{x^2}{2} P_0^2 \right] P - \frac{x^2}{2} P^3$$

$$\ddot{P} + \square' P + \square' P^3 = 0$$

Newton \rightarrow Energy