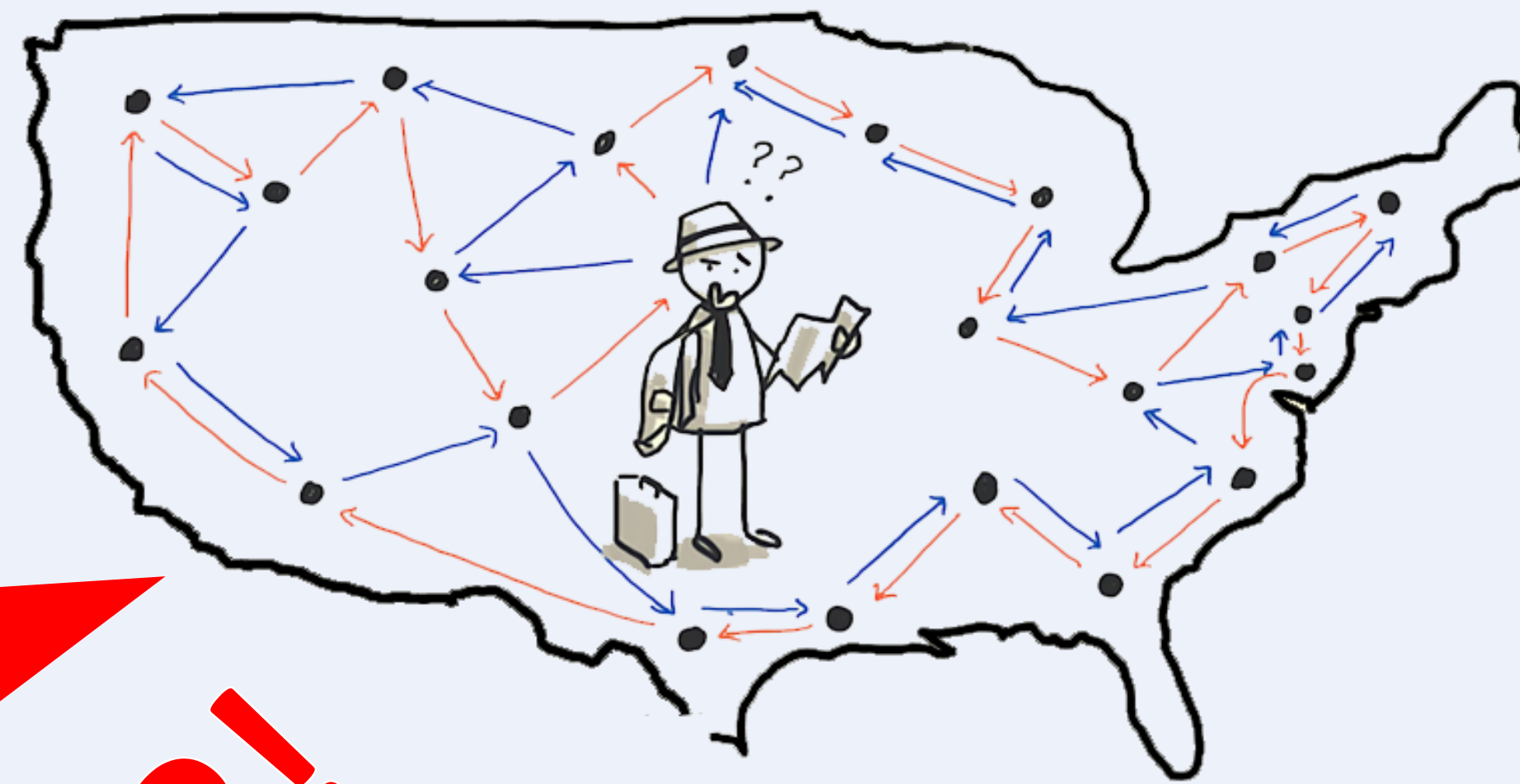


Network of phase frustrated Photon Bose-Einstein Condensates

Introduction

Finding the **ground state** of a physical system such as a network of coupled photon Bose-Einstein Condensates (**pBECs**) is a Nondeterministic Polynomial Complete (**NP-C**) problem.

Traveling salesman wants to visit all towns in shortest possible time and return.

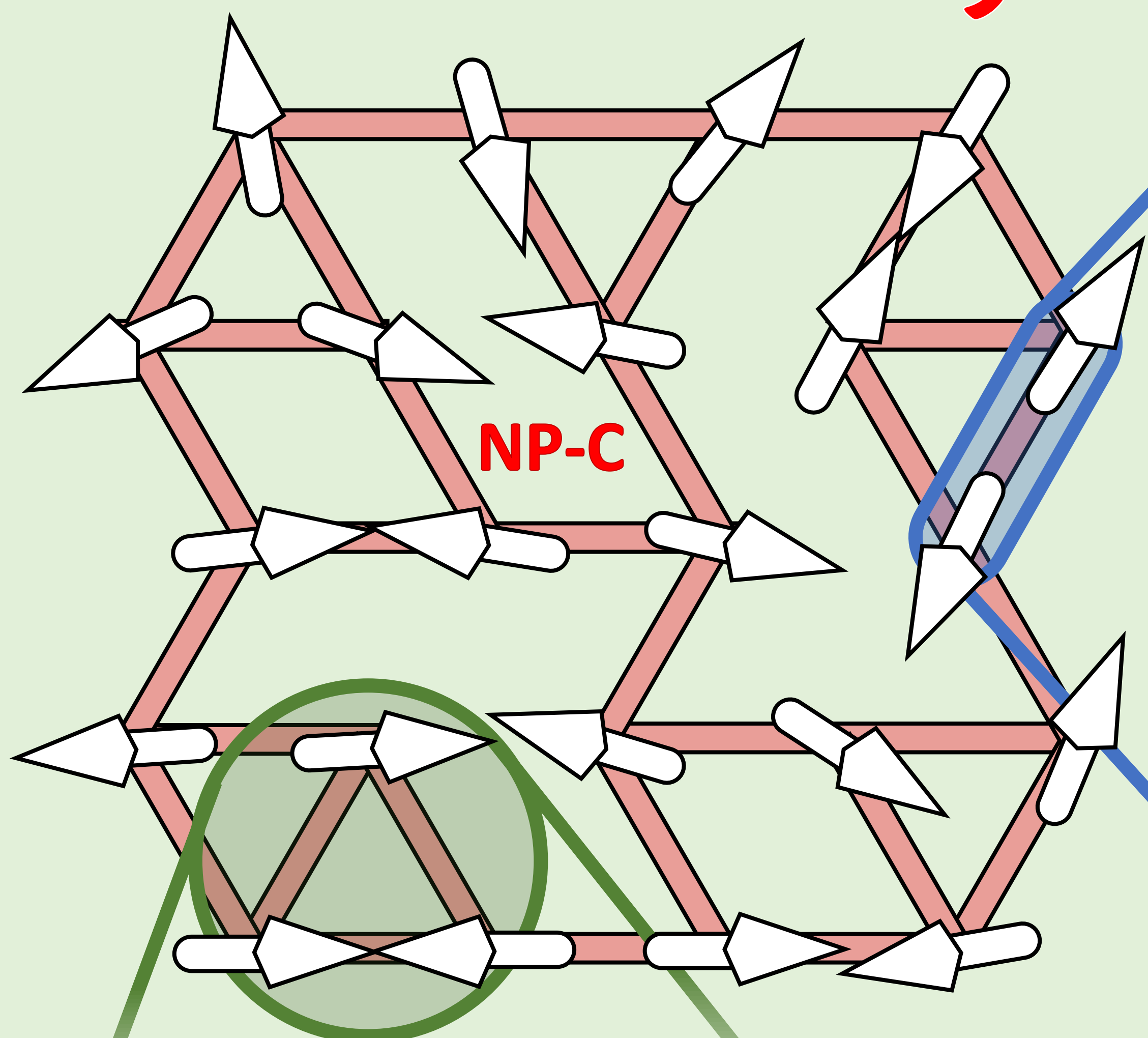


If a solution to one of the problems from NP-C class is found, then a solution to **any** other problem from this class can be acquired by **remapping** it (in polynomial time) to already solved one.

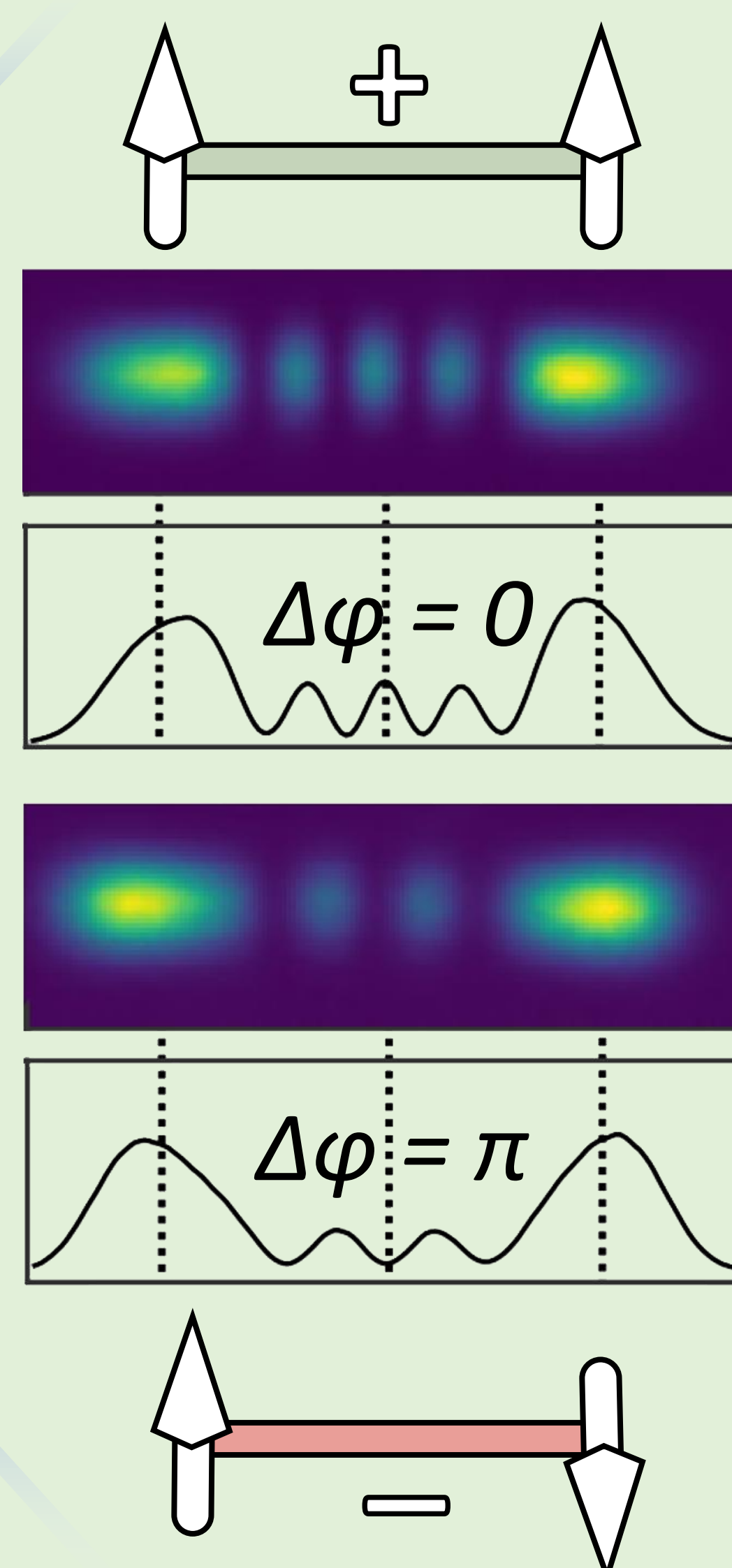
A problem mapped to a physical system can be solved by extracting the ground state of the system and remapping it to the original problem.

Methods

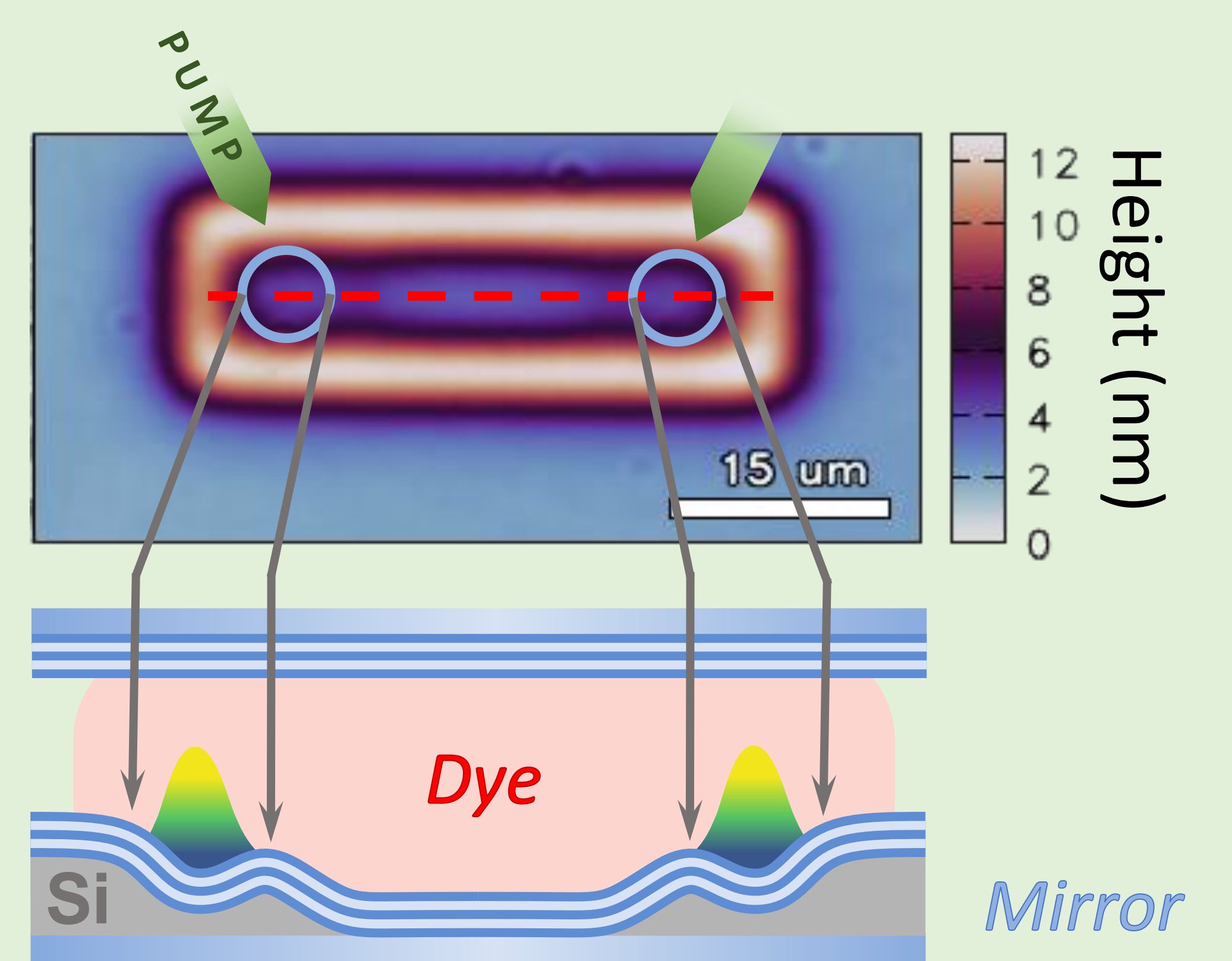
Nearest neighbor interaction between pBEC's is defined by the shape of connecting waveguides.



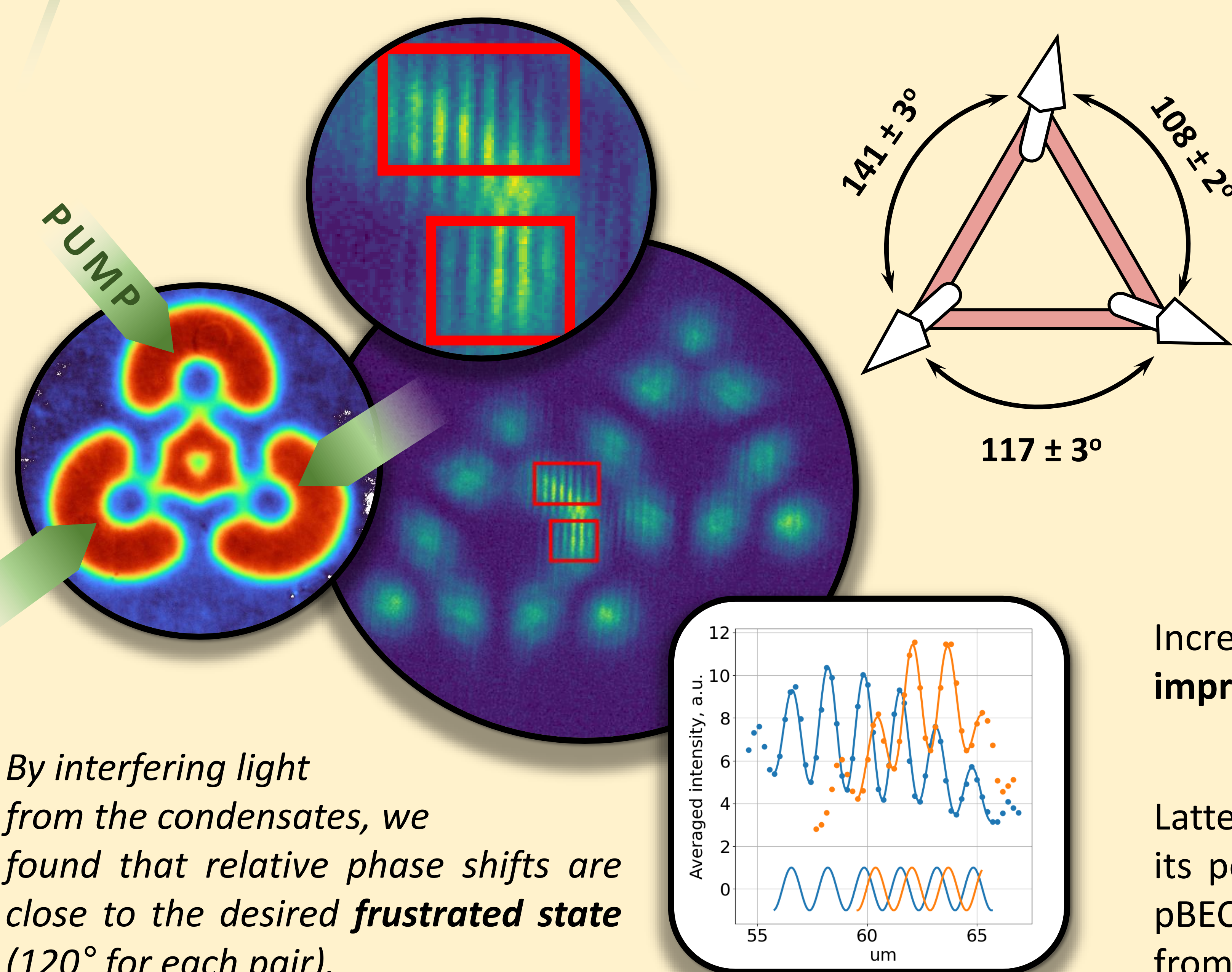
SAME?!!



Permanent structures on one of the mirrors **spatially confine** fluorescence of the dye.



Dye (rhodamine) fluorescence is excited by an external (laser) pump and is **spectrally confined** by the mirror resonator. Photon condensation is achieved via light **thermalization** due to multiple acts of light absorption and reemission of the dye.



By interfering light from the condensates, we found that relative phase shifts are close to the desired **frustrated state** (120° for each pair).

Results and Outlook

We were able to **negatively couple three pBEC's** in a triangular manner. This is an essential building block for further **scaling of the system**.

Increasing the number of negatively coupled pBECs requires **improving the phase readout** mechanism.

Latter can be done by using a **'seeding' laser**. Small fraction of its power is sent into cavity to lock the phase of one of the pBEC. And the rest is used to interfere it with the light coming from the whole lattice of pBECs.

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