DEGREES OF FREEDOM BOOKKEEPING

Why 4 images give an exact solution for m=2 model

EQUATIONS (Constraints):

- Each image gives 2 equations (x and y components)
- 4 images → 8 equations total

UNKNOWNS (Parameters):

- θ_E (Einstein radius): 1 parameter
- (a, b) quadrupole amplitudes: 2 parameters
- φ_γ quadrupole phase: 1 parameter (NONLINEAR)
- (β_x, β_y) source position: 2 parameters
- Total: 6 parameters (5 linear + 1 nonlinear)

SOLUTION STRATEGY:

1. Fix φ_γ → 5 linear unknowns, 8 equations
2. Use 5 equations to solve for 5 unknowns exactly
3. Remaining 3 equations give consistency condition
4. Find φ_γ where consistency = 0 (rootfinding)

8 equations - 6 unknowns = 2 redundant equations
→ System is OVERDETERMINED → Consistency check possible!