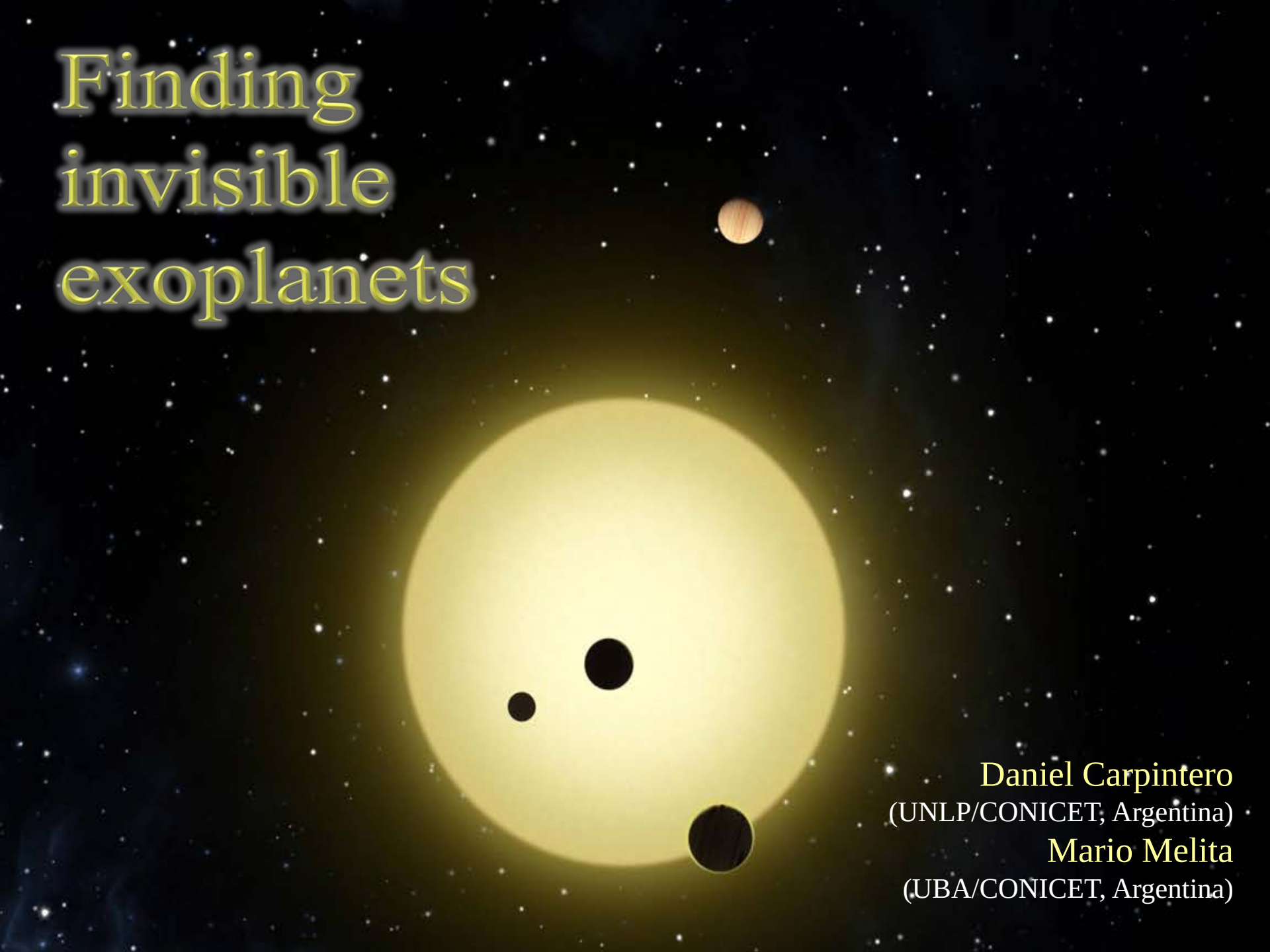
Finding invisible exoplanets



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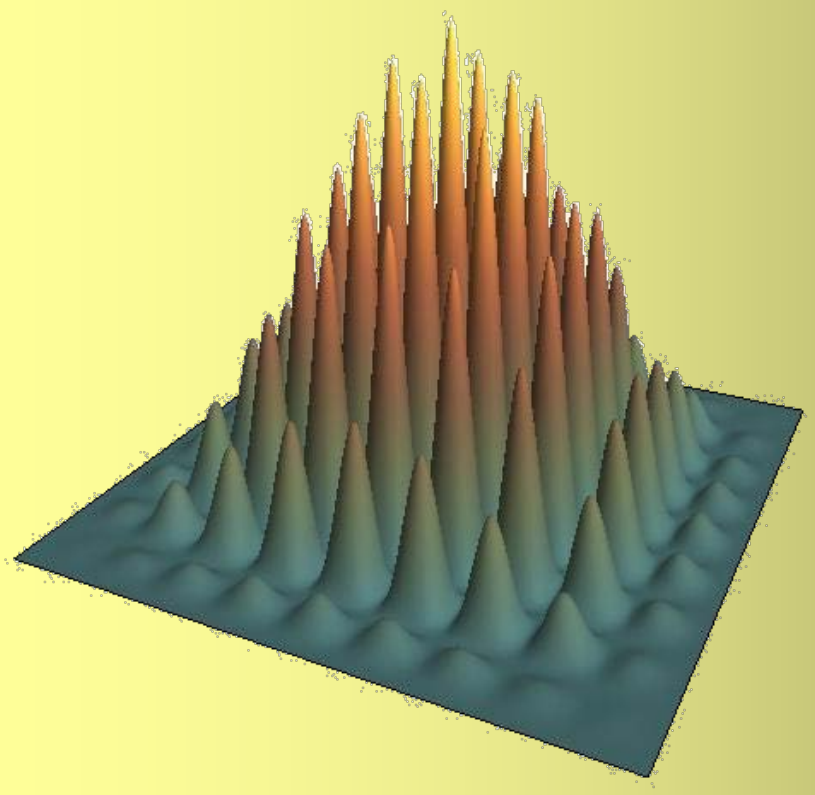
(UBA/CONICET, Argentina)

GENETIC ALGORITHMS

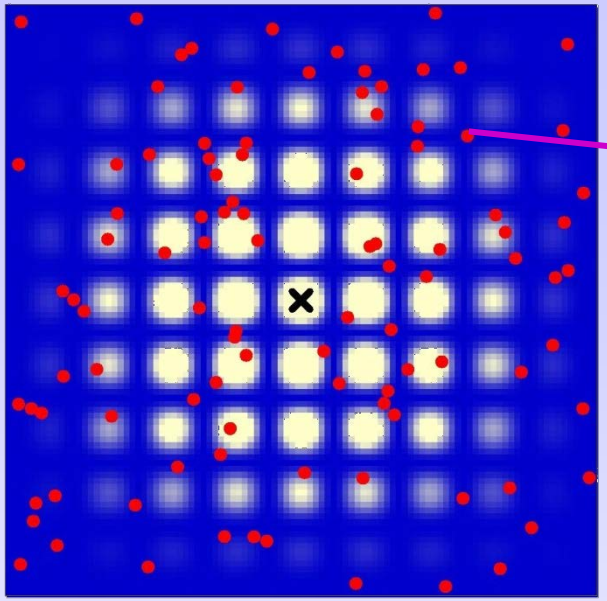
- *They avoid local maxima*
- *Ideal for multidimensional spaces*



Example:
81 local maxima,
1 absolute maximum

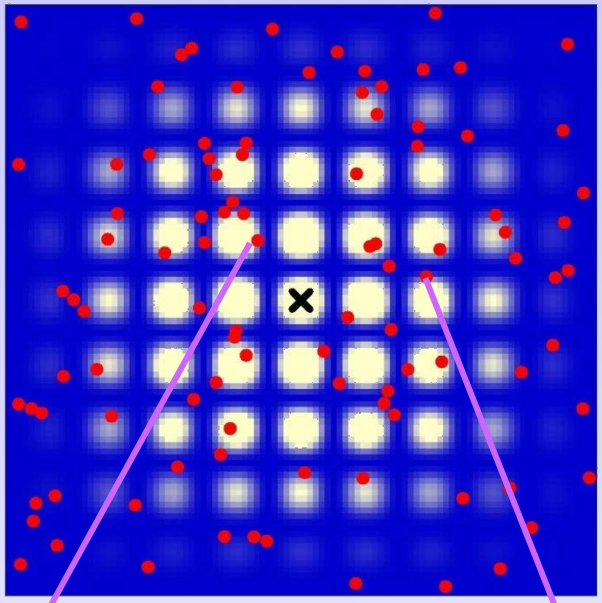
Fitness:
value of the function

Initial population



Individual

Initial population



(0,427 ; 0,601)

(0,712 ; 0,540)

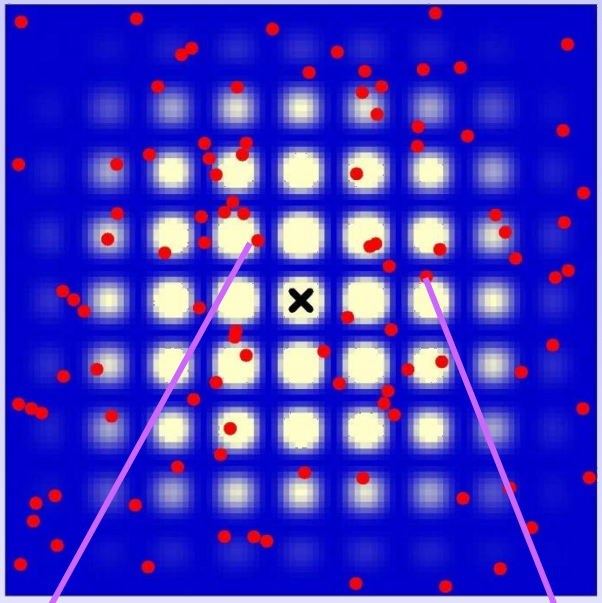
4	2	7	6	0	1

Genotypes

7	1	2	5	4	0

Crossover

Initial population



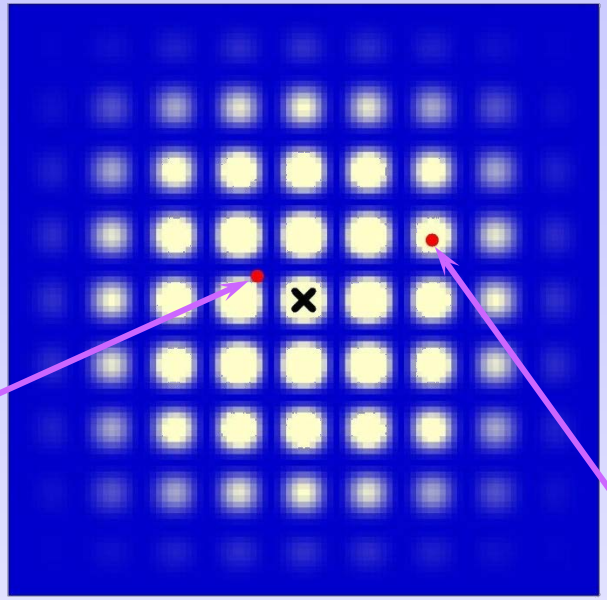
(0,427 ; 0,601)

(0,712 ; 0,540)

4	2	7	6	0	1

Genotypes

7	1	2	5	4	0



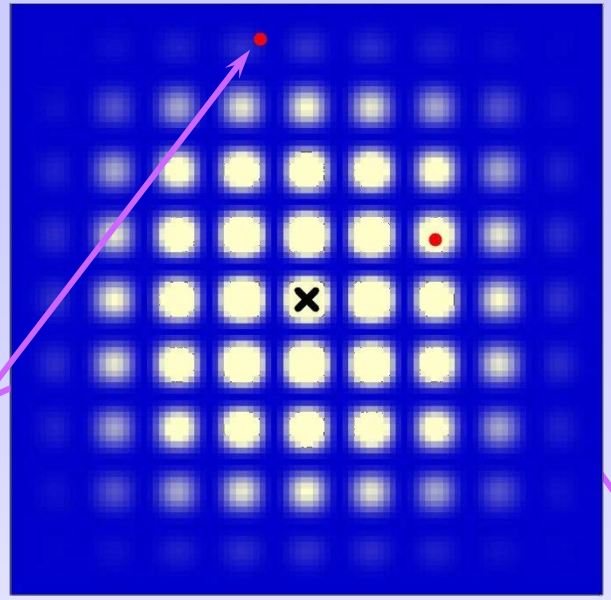
(0,422 ; 0,540)

(0,717 ; 0,601)

4	2	2	5	4	0

Genotypes

7	1	7	6	0	1



(0,422 ; 0,940)

(0,717 ; 0,601)

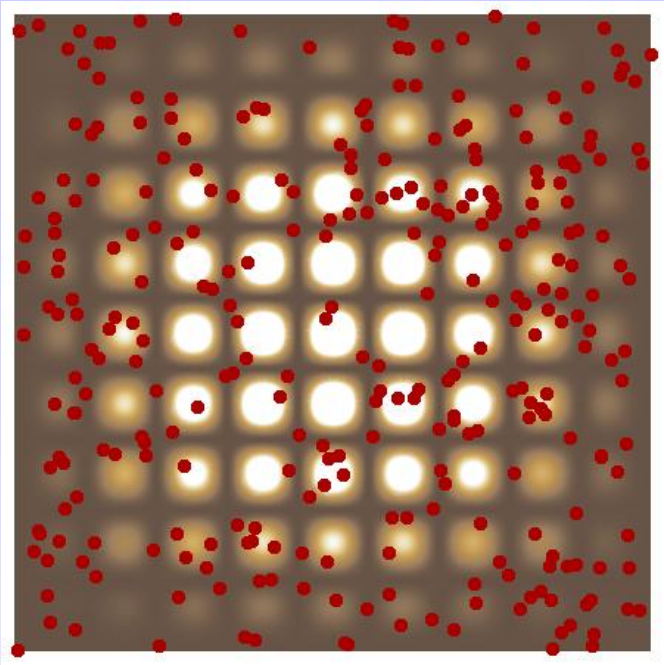
4	2	2	9	4	0

Genotypes

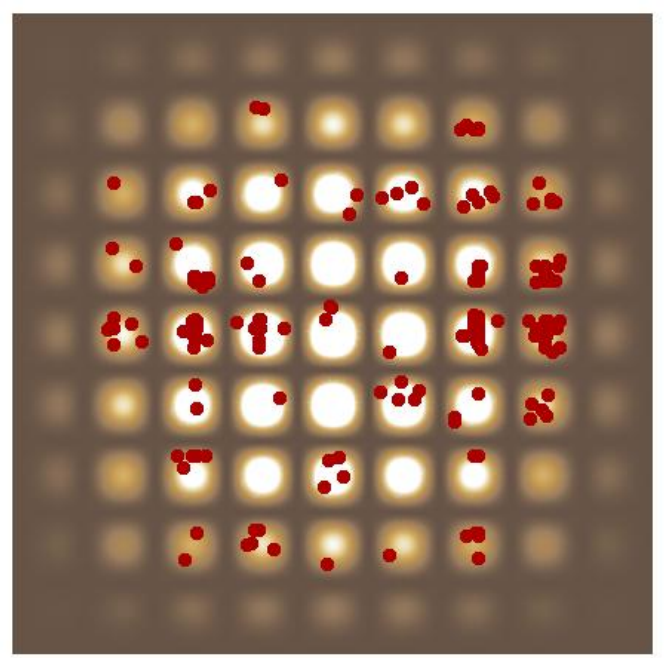
7	1	7	6	0	1

Mutation

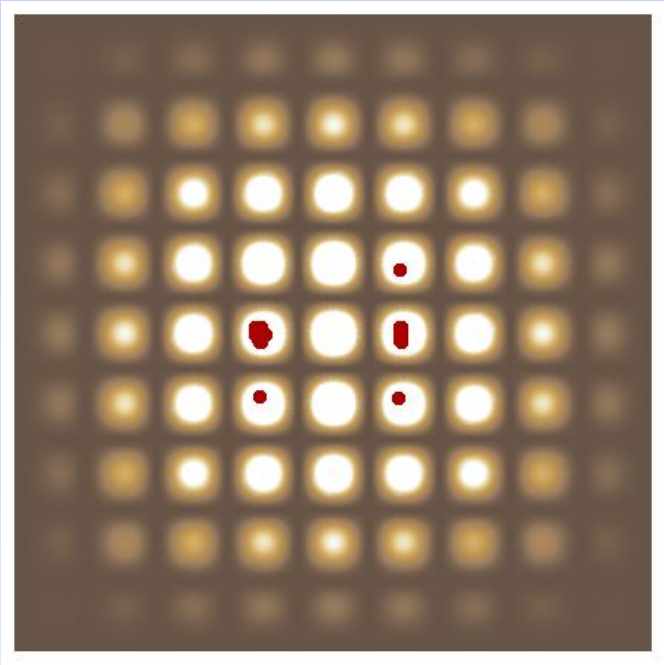
Initial population:



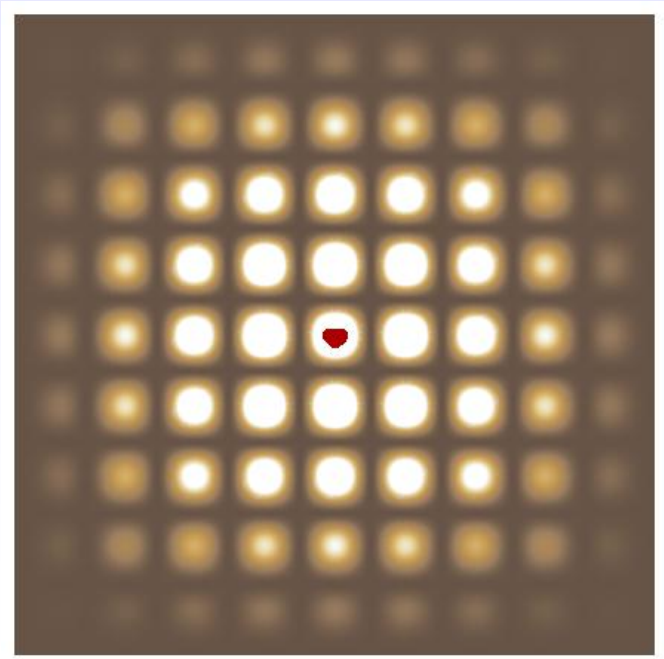
Second generation:



Fifth generation:



Twentieth generation:

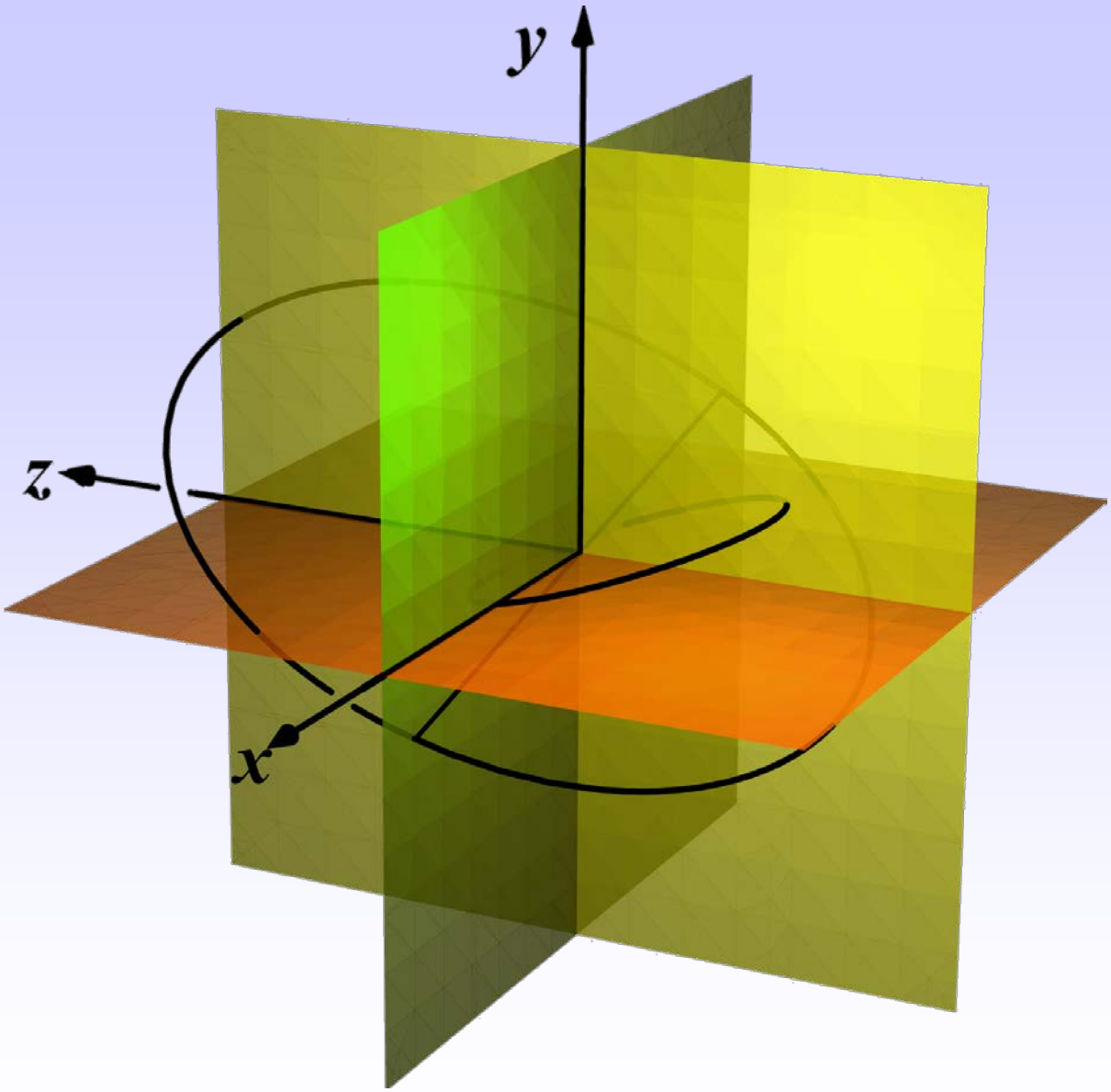


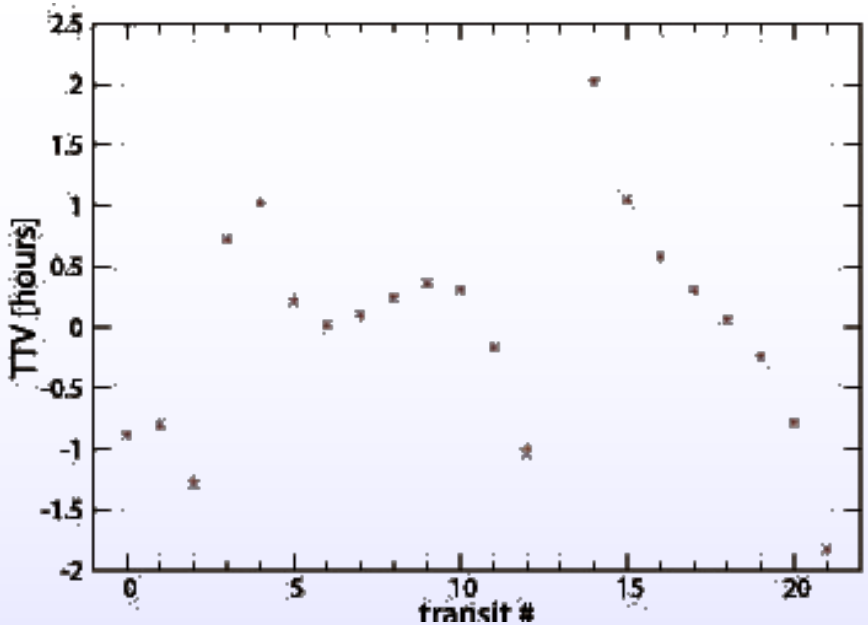
Parameters:

- Number of individuals
- Mutation rate
- Reproduction plan
- Elitism
- Selection pressure
- Crossover rate

Part II:

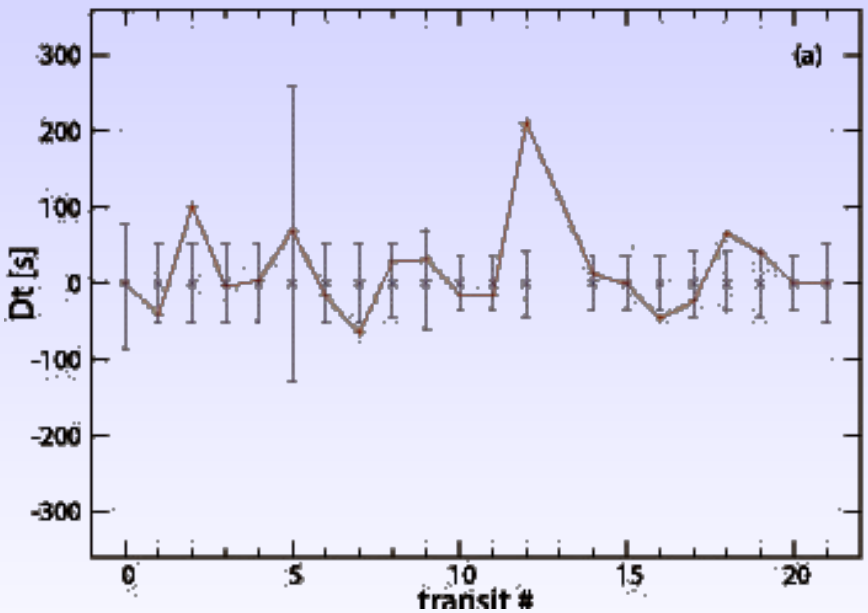
EXOPLANETS

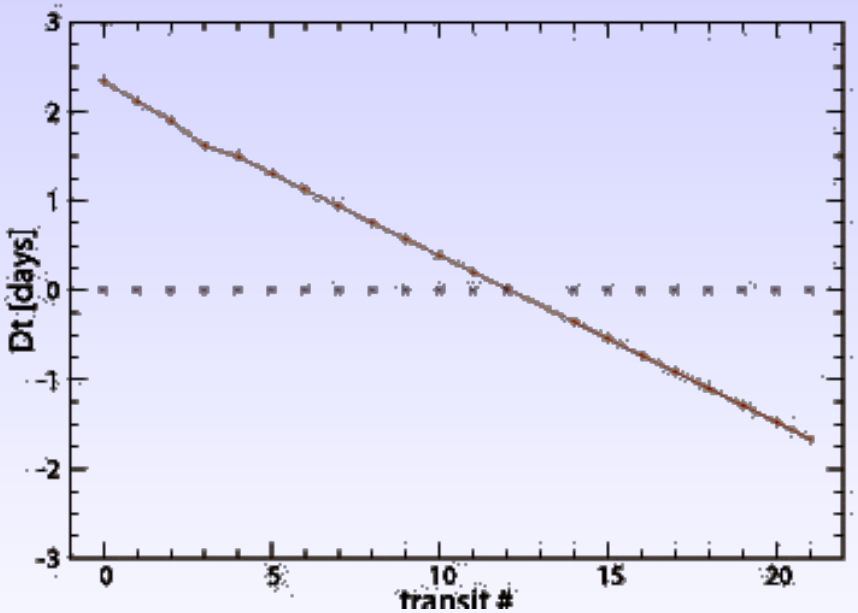

y
z
x



$$\text{Individual} = \{a_1, e_1, i_1, \Omega_1, \omega_1, \lambda_1, m_1, a_2, e_2, i_2, \Omega_2, \omega_2, \lambda_2, m_2, m_\star\}$$

$$f = \left[\sum_{i=1}^{N} |t_{\mathrm{obs},i} - t_{\mathrm{calc},i}| \right]^{-1}$$


(a)
Dt [s]
300
200
100
0
-100
-200
-300
0
5
10
15
20
transit #


Dt [days]
3
2
1
0
-1
-2
-3
0
5
10
15
20
transit #