Doctoral Thesis

From Meteors to Space Safety:

Dynamical Models and Radar Measurements of Space Objects

Daniel Kastinen

Main supervisor:
Dr. Johan Kero

Opponent:
Dr. Detlef Koschny

Doctoral Thesis

From Meteors to Space Safety:

Dynamical Models and Radar Measurements of Space Objects

Daniel Kastinen

from Kumlinge islands in Åland

Main supervisor:
Dr. Johan Kero

Opponent:
Dr. Detlef Koschny

A lot of space

A lot of space

Doctoral Thesis

From Meteors to Space Safety:

Dynamical Models and Radar Measurements of Space Objects

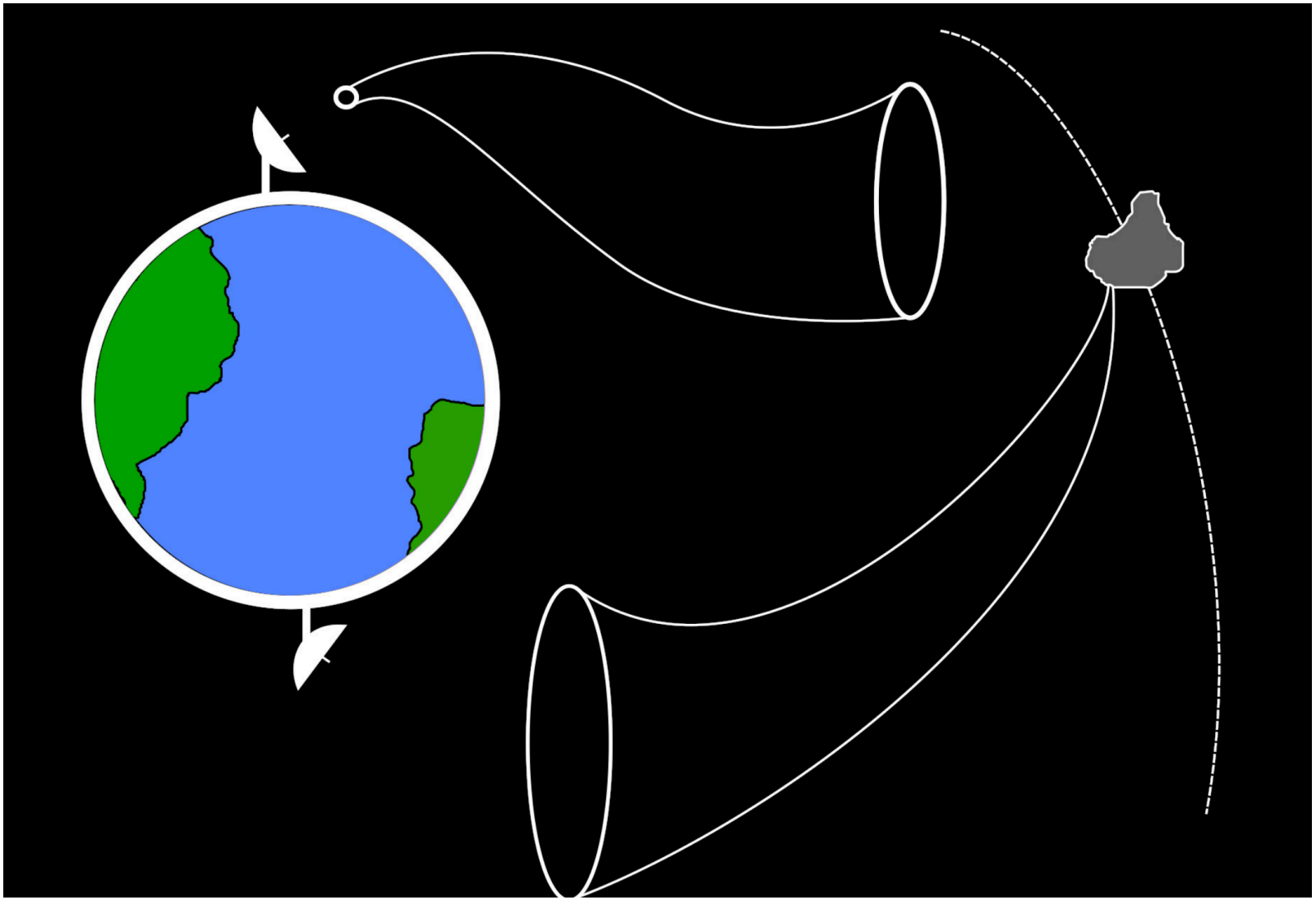
Daniel Kastinen

from Kumlinge islands in Åland

Main supervisor:
Dr. Johan Kero

Opponent:
Dr. Detlef Koschny

Big picture: "Tube"



Big picture: "Tube"

No space even between trains (inspired in Japan)

16	[の]大 00	[ひ]岡 03	[の]博 10	[の]博 13◆	[の]大 20	[の]大 23◆	[こ]名 26	[の]博 30	[ひ]大 33◆	[ひ]大 33◆	[の]博 40◆	[の]大 40◆	[の]大 47◆	[の]博 50	[の]大 53◆	[の]大 53◆	[こ]名 56◆	[こ]名 56◆	
17	[の]大 00	[ひ]岡 03	[の]博 10	[の]博 13◆	[の]大 13◆	[の]広 13◆	[の]大 20	[の]大 23◆	[こ]名 26◆	[こ]名 26◆	[の]博 30	[ひ]大 33◆	[ひ]大 33◆	[の]大 40◆	[の]博 40◆	[の]大 47◆	[の]大 47◆	[の]博 50◆	[の]広 50◆	[の]大 53◆	[の]大 53◆	[こ]名 56
18	[の]岡 00	[ひ]大 03	[の]博 10	[の]広 13◆	[の]大 13◆	[の]広 13◆	[の]大 13◆	[の]大 20	[の]大 23◆	[こ]名 26	[の]広 30	[ひ]大 33◆	[ひ]大 33◆	[こ]三 37	[の]大 40	[の]大 47◆	[の]博 50	[の]大 53◆	[こ]名 56		
19	[の]大 00	[ひ]大 03	[の]広 10	[の]大 13◆	[の]岡 13◆	[の]大 20	[の]大 23◆	[こ]大 26◆	[こ]大 26◆	[の]広 30◆	[の]岡 30◆	[の]岡 30◆	[ひ]大 33◆	[ひ]大 33◆	[こ]三 37	[の]大 40◆	[の]大 47◆	[の]広 50◆	[の]広 50◆	[の]大 53◆	[の]大 53◆	[こ]名 56
20	[の]大 00	[ひ]大 03	[の]岡 10◆	[の]岡 10◆	[の]大 13◆	[の]大 20	[の]大 23◆	[の]大 23◆	[こ]名 26	[の]岡 30◆	[の]岡 30◆	[の]岡 30◆	[の]大 40◆	[の]大 40◆	[の]大 47◆	[の]姫 50	[の]大 53◆	[こ]三 56				

Doctoral Thesis

From ~~Meteors~~ Metro to Space Safety

Dynamical Models and Radar Measurements of Space Objects

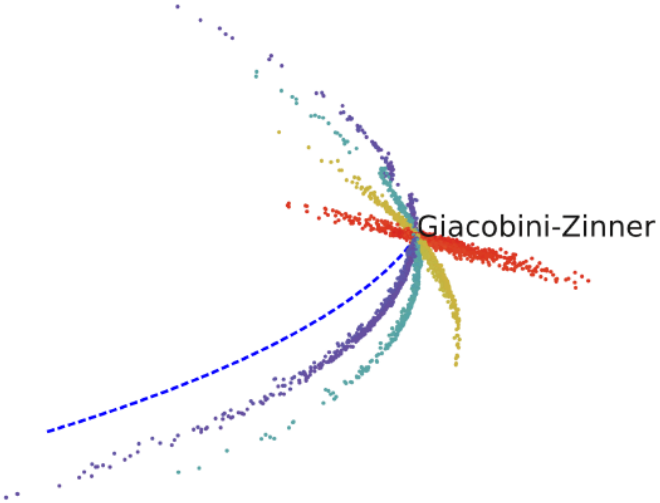
and

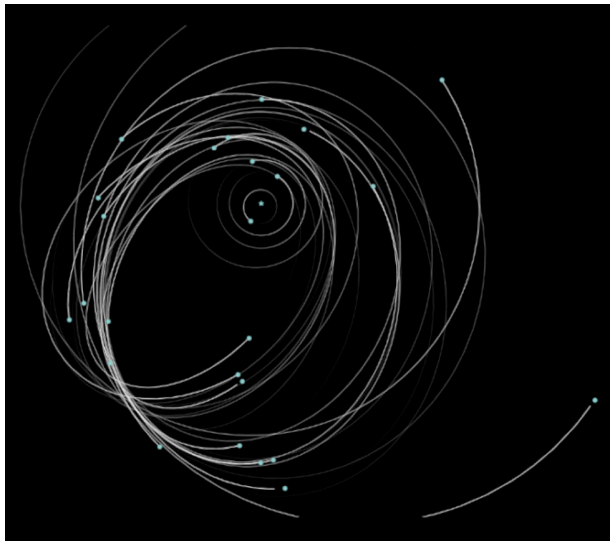
Daniel Kastinen

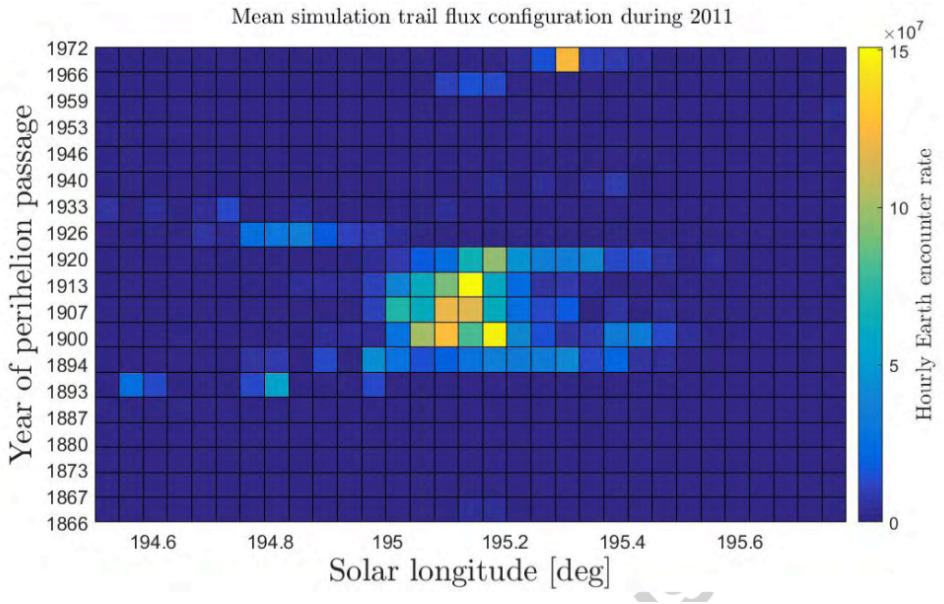
Main supervisor:
Dr. Johan Kero

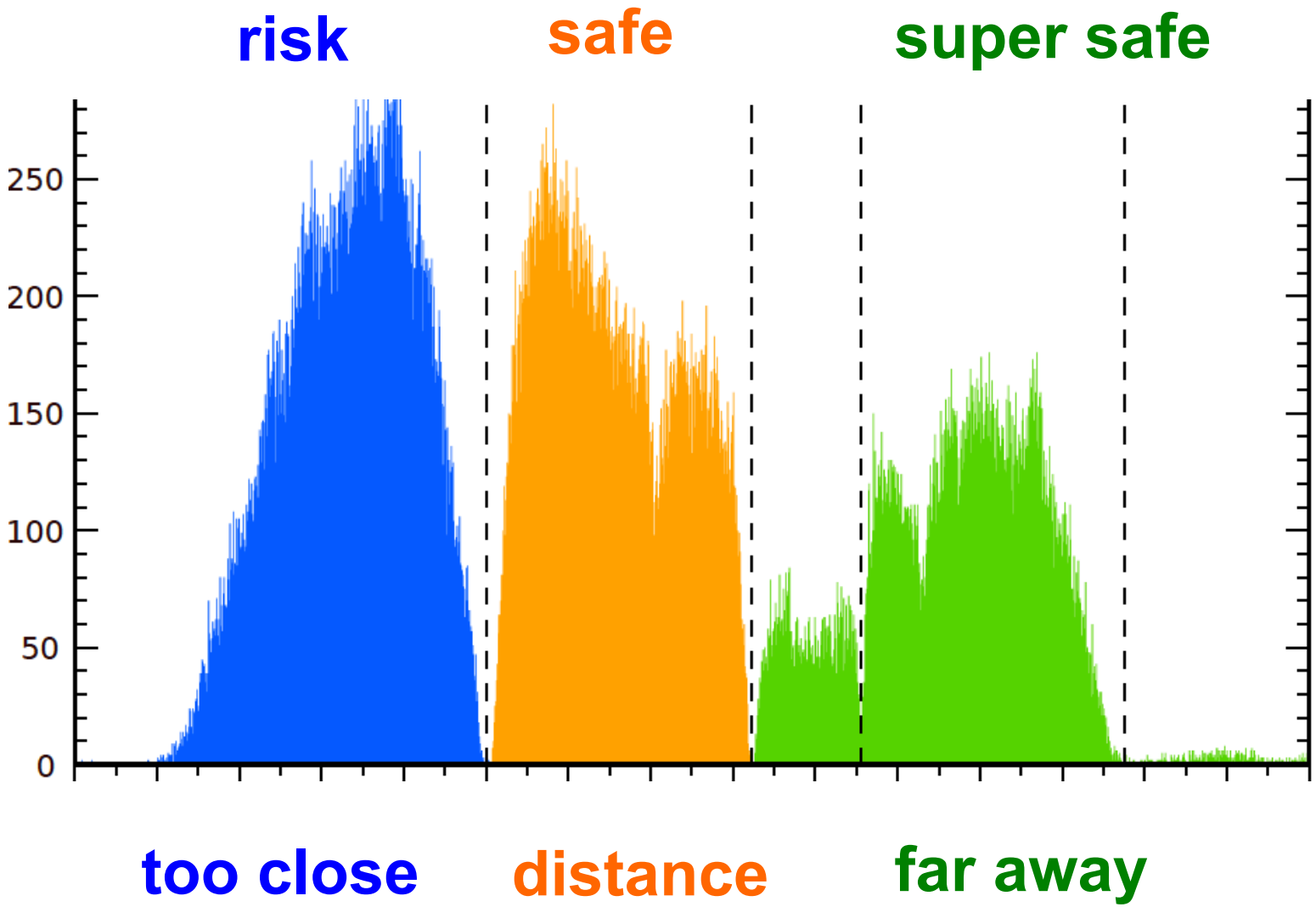
Opponent:
Dr. Detlef Koschny

Need good simulation to avoid collisions








risk
safe
super safe
250
200
150
100
50
0
too close
distance
far away

Also Stockholm Metro is

A lot of space

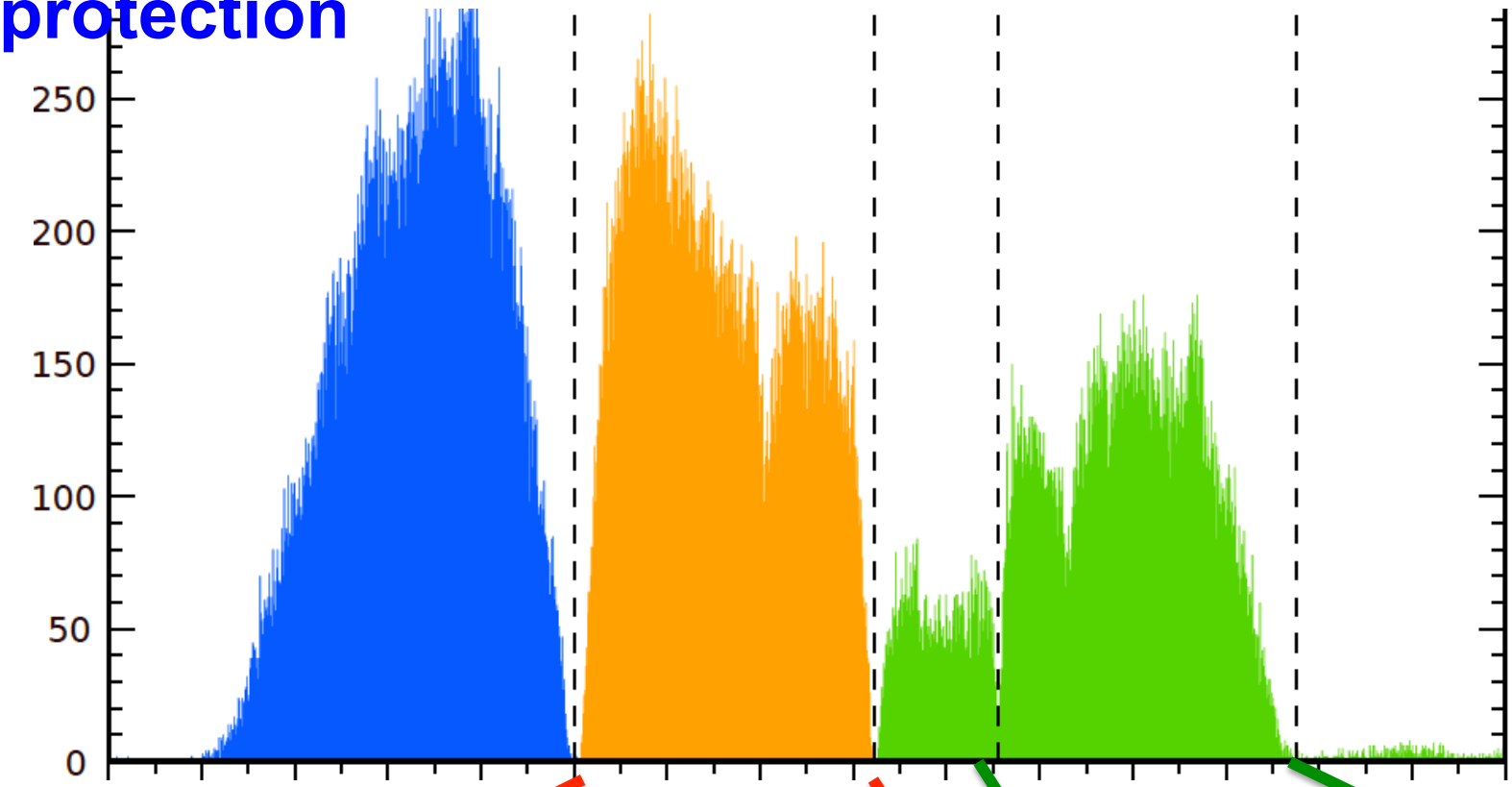
A lot of space

no space

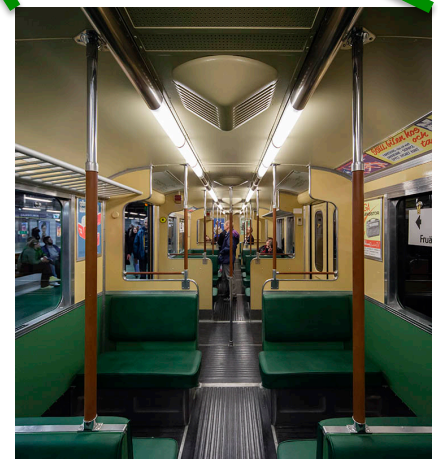
risk without protection

safe

super safe



Application even to Covid-19



Doctoral Thesis

From ~~Meteors~~ Metro to Space Safety: Dynamical Models and Radar Measurements of Space Objects ? and

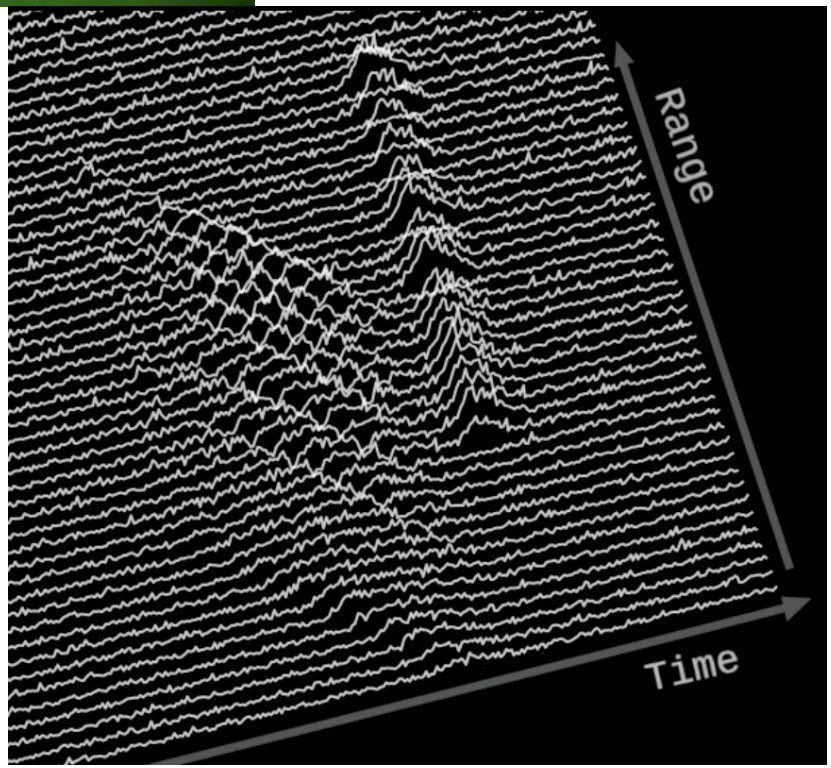
Daniel Kastinen

Main supervisor:
Dr. Johan Kero

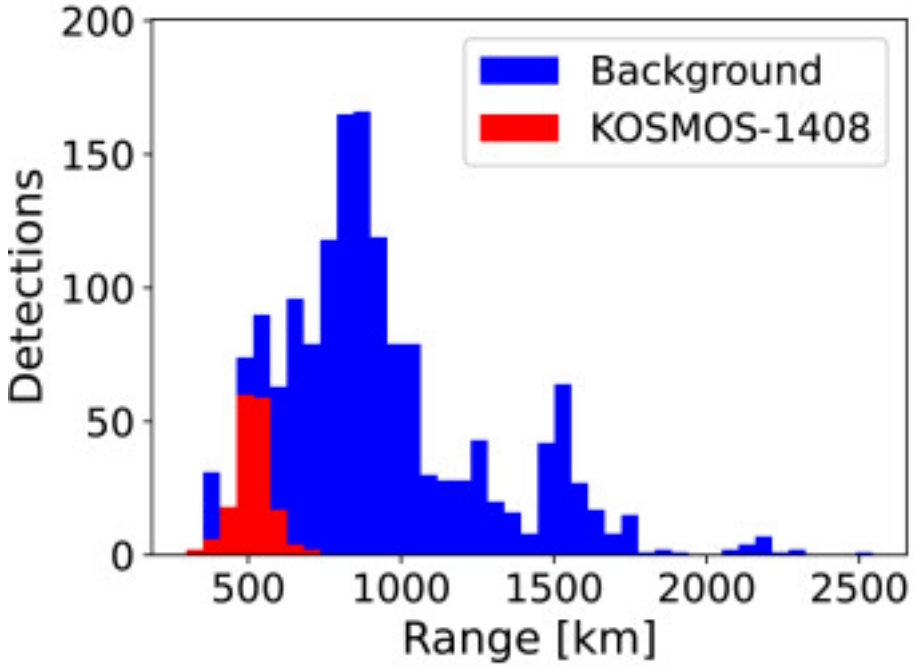
Opponent:
Dr. Detlef Koschny

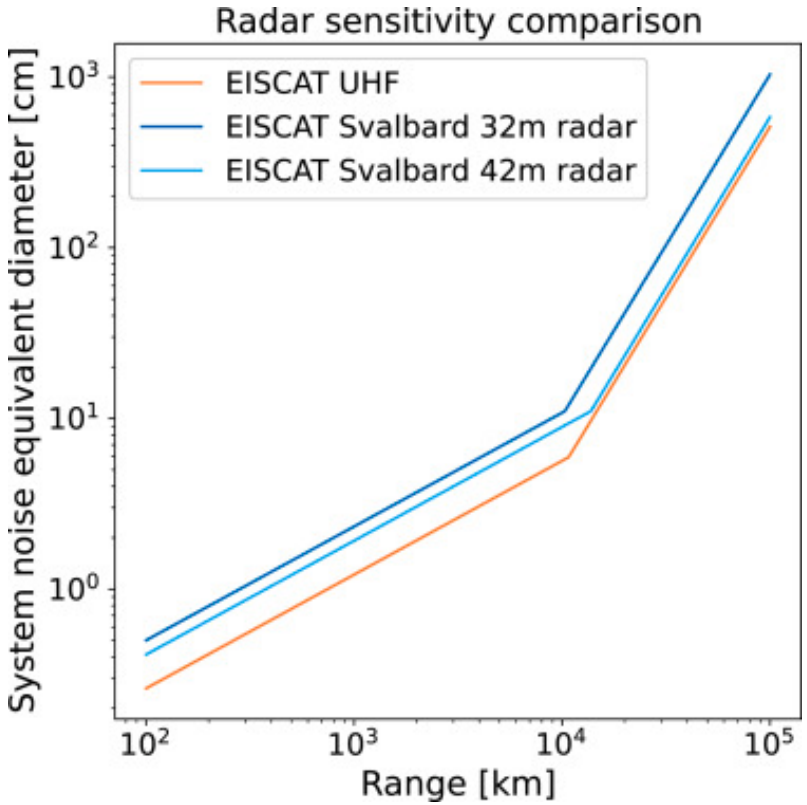
Can we measure from safe distance Kiruna

Yes, EISCAT can

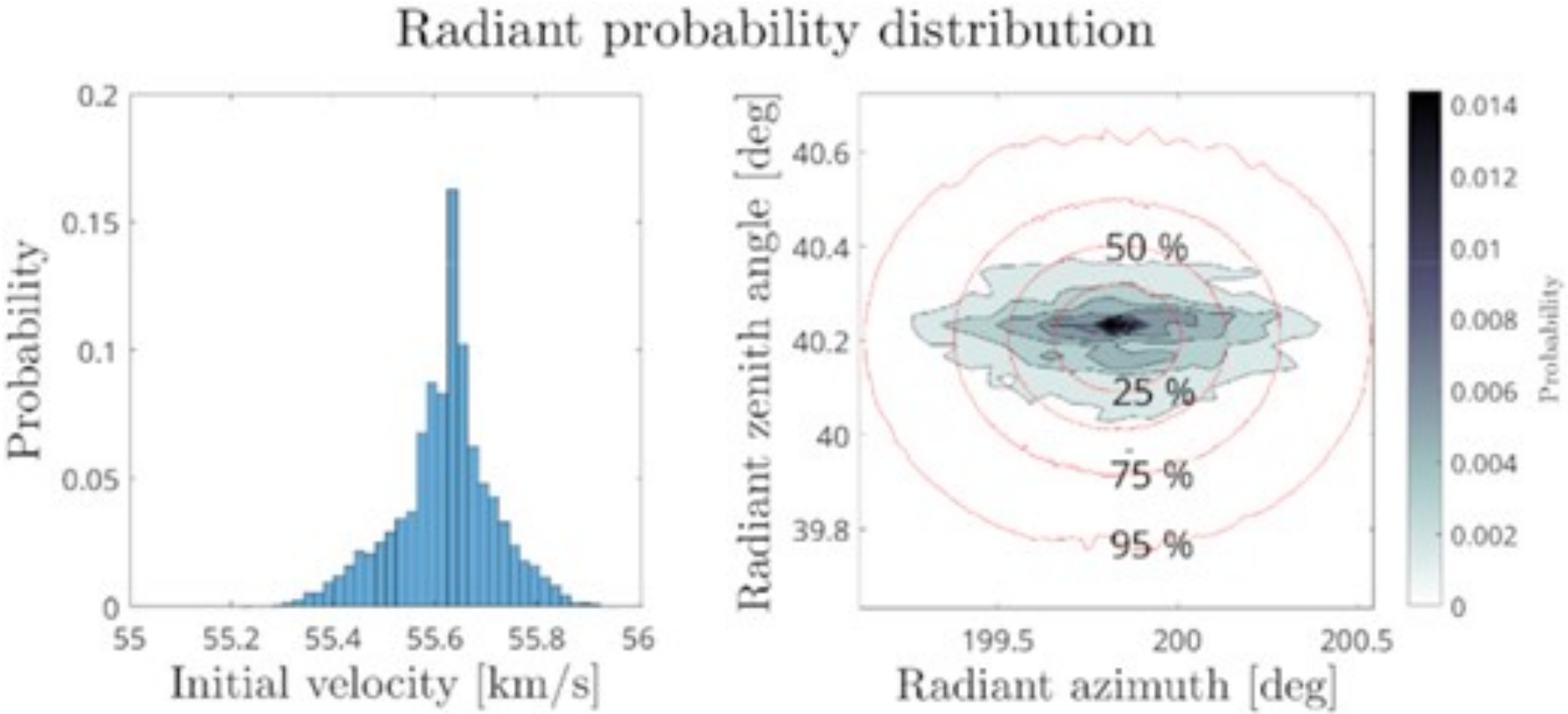


EISCAT can measure ~cm @1000 km

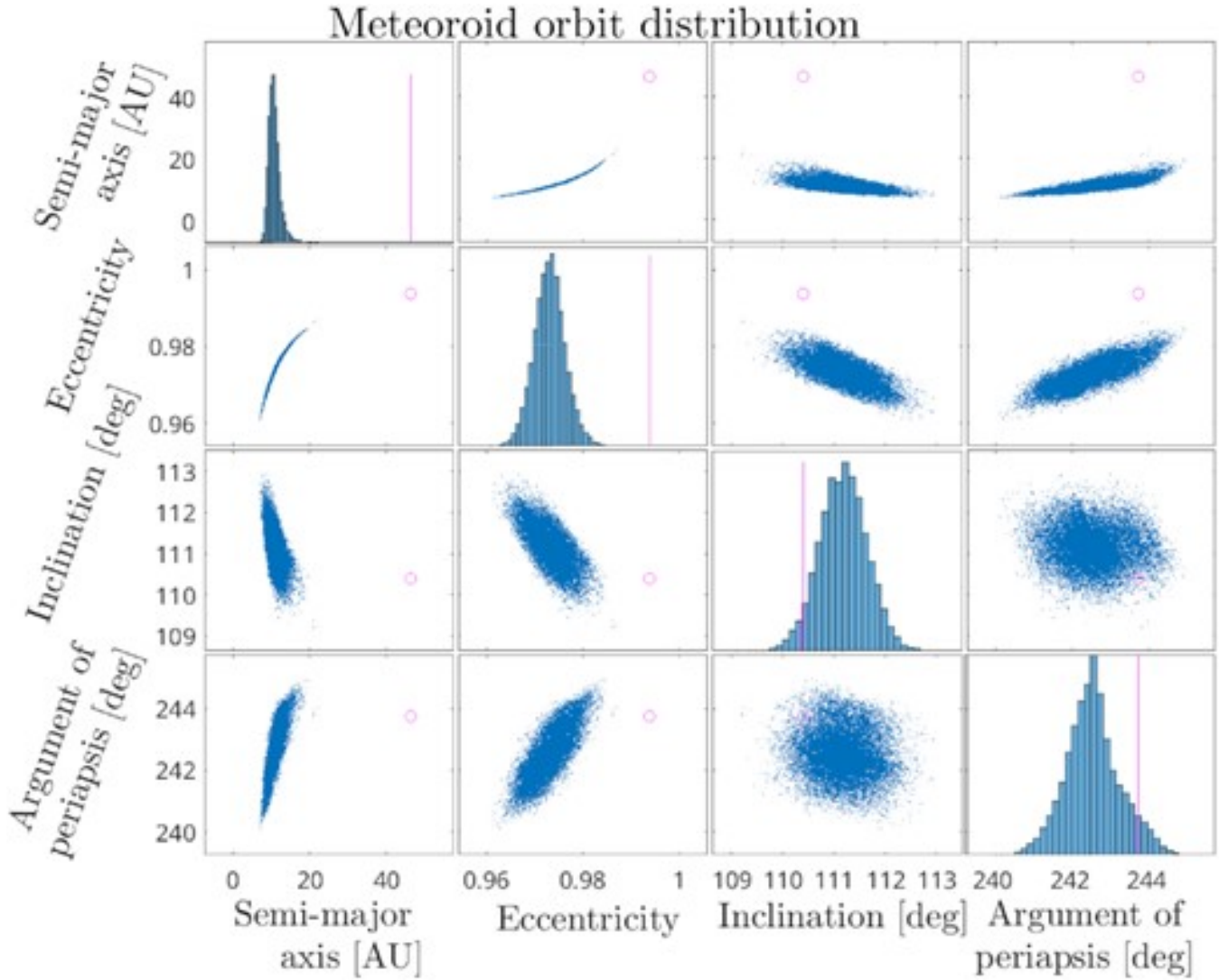




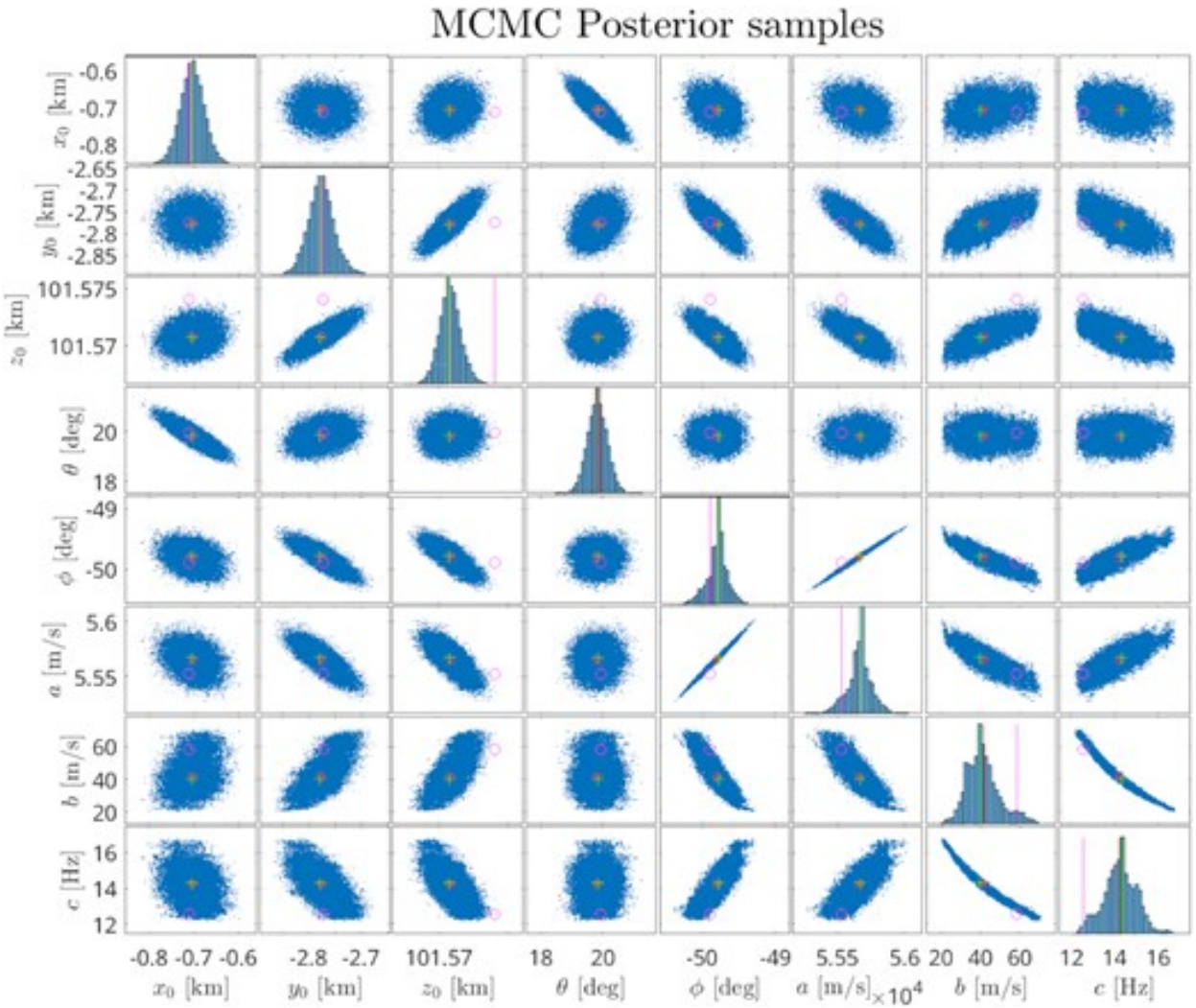
But need to examine error/probability



More to examine error/probability

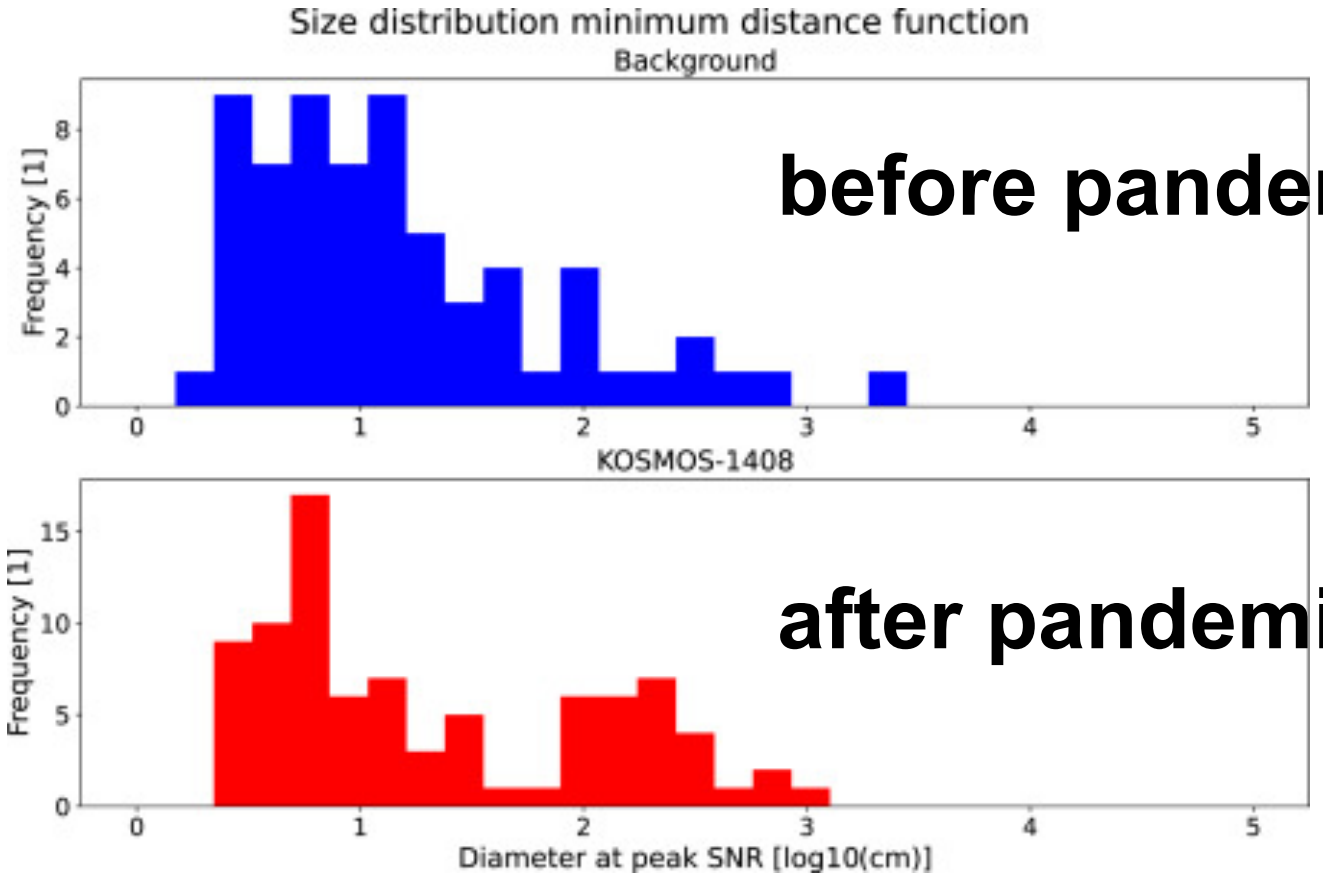


Even more to examine error/probability



only Daniel can imagine the trajectory…

Anyway, result



before pandemic

after pandemic

distancing

Doctoral Thesis

From Meteors to Space Safety:

Dynamical Models and Radar Measurements of Space Objects

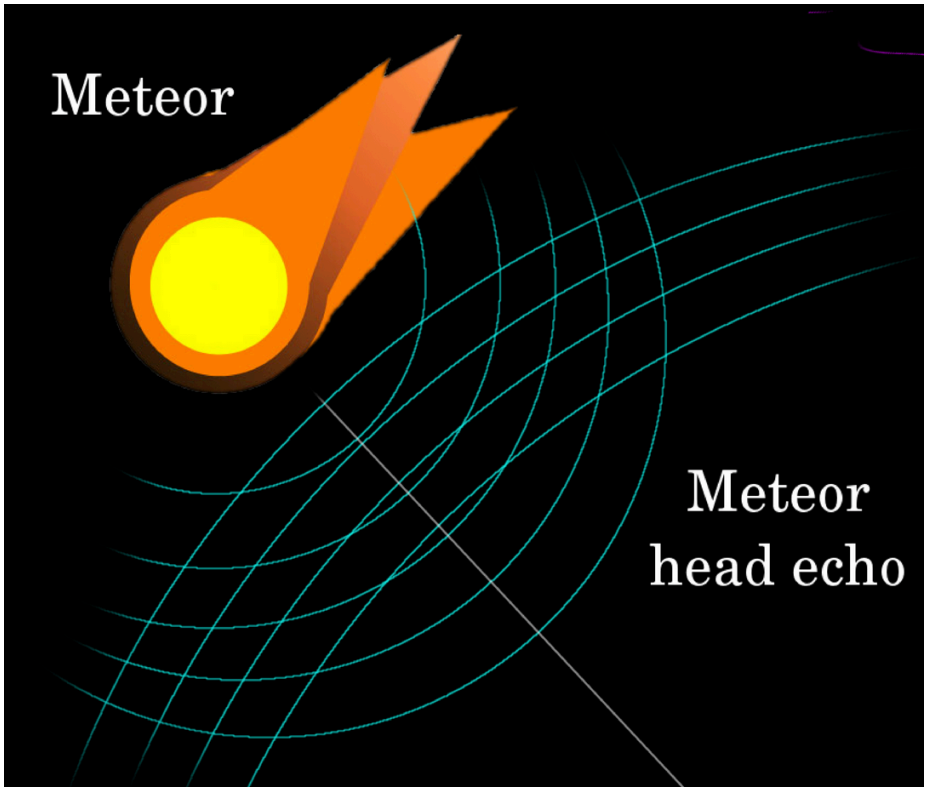
Daniel Kastinen

started PhD course, April 2017

Main supervisor:
Dr. Johan Kero

Opponent:
Dr. Detlef Koschny

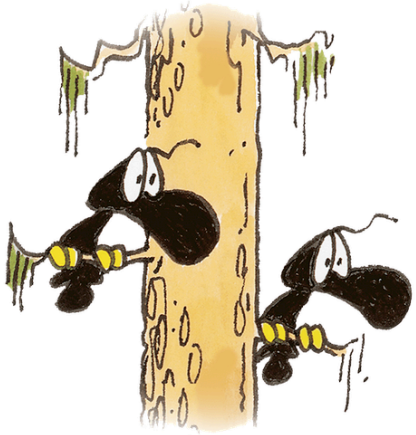
Meteor = fire



And, June 2017

"Fire" at "Debris" station

Air pollution: space safety



Crow (=space object) nests there

= air traffic safety is related

Doctoral Thesis

From ~~Meteors~~ Fire to ~~Space~~ Air Safety:

Dynamical Models and Radar Measurements of Space Objects

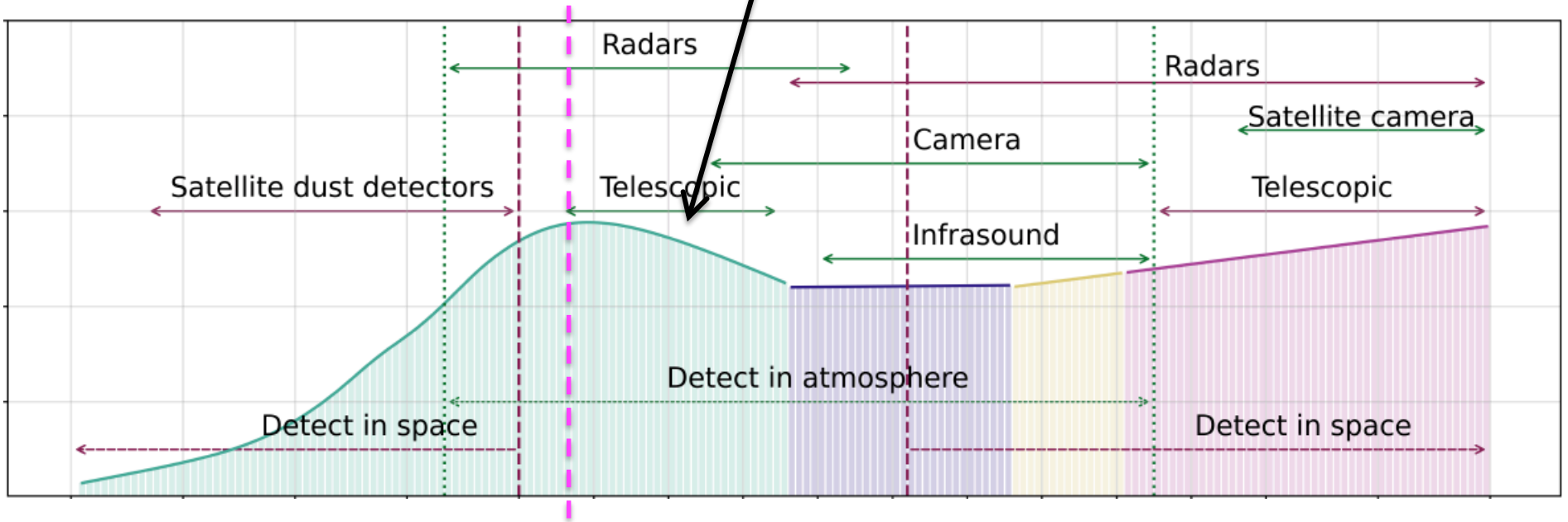
Daniel Kastinen

started PhD course, April 2017

Main supervisor:
Dr. Johan Kero

Opponent:
Dr. Detlef Koschny

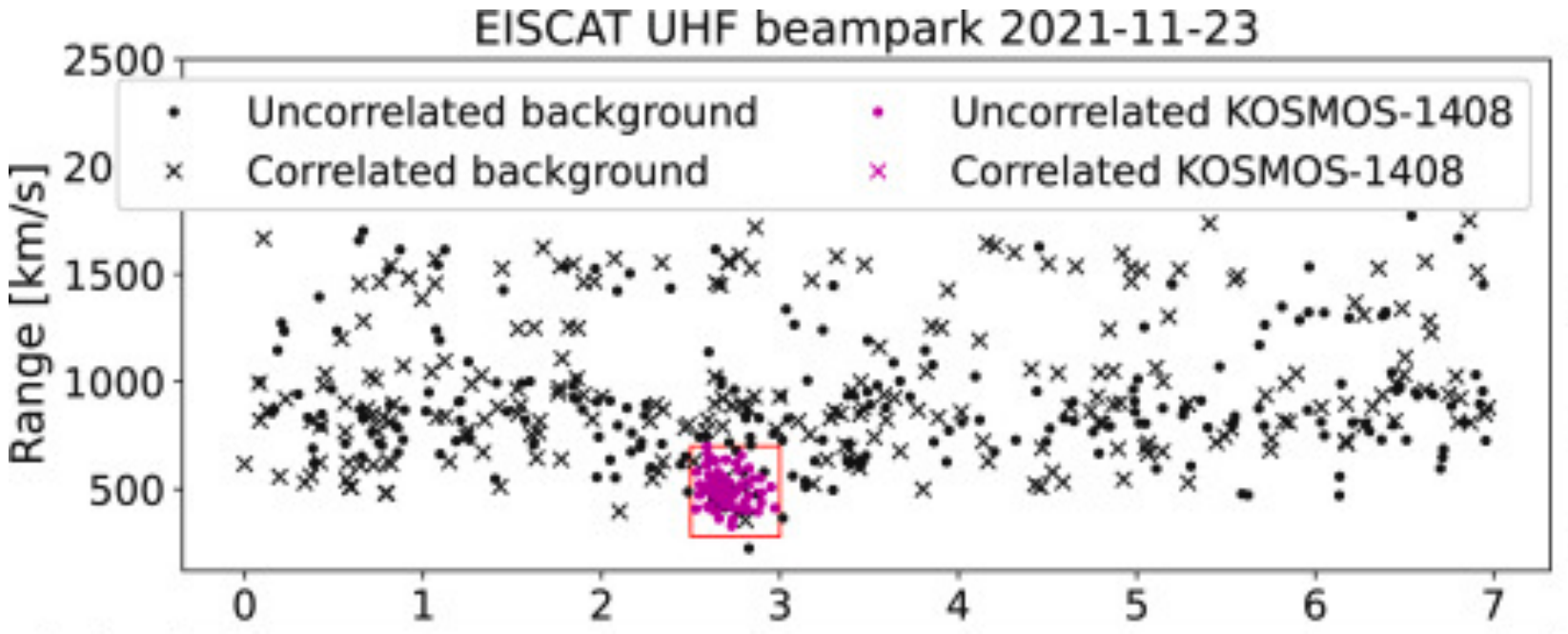
no place to live

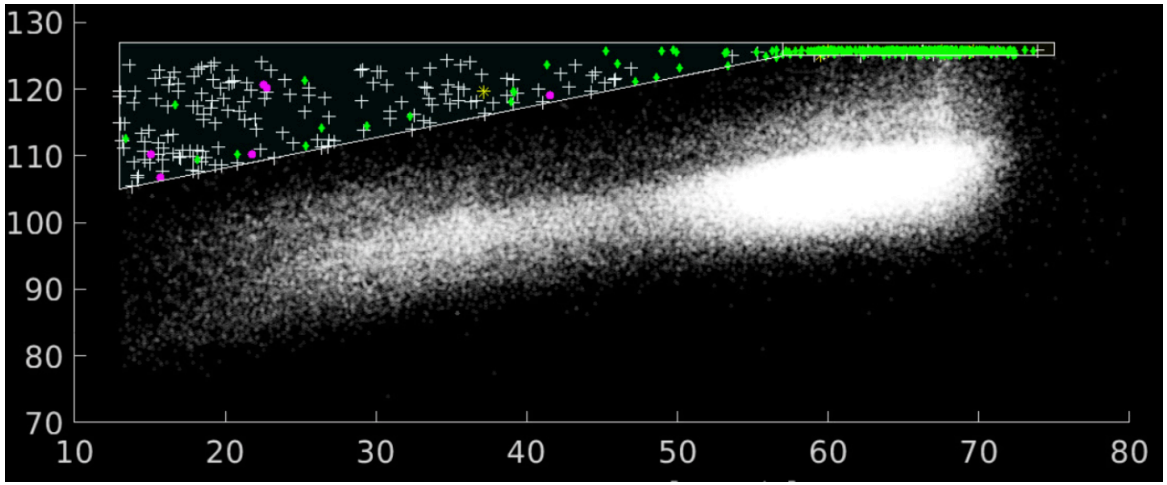


fire

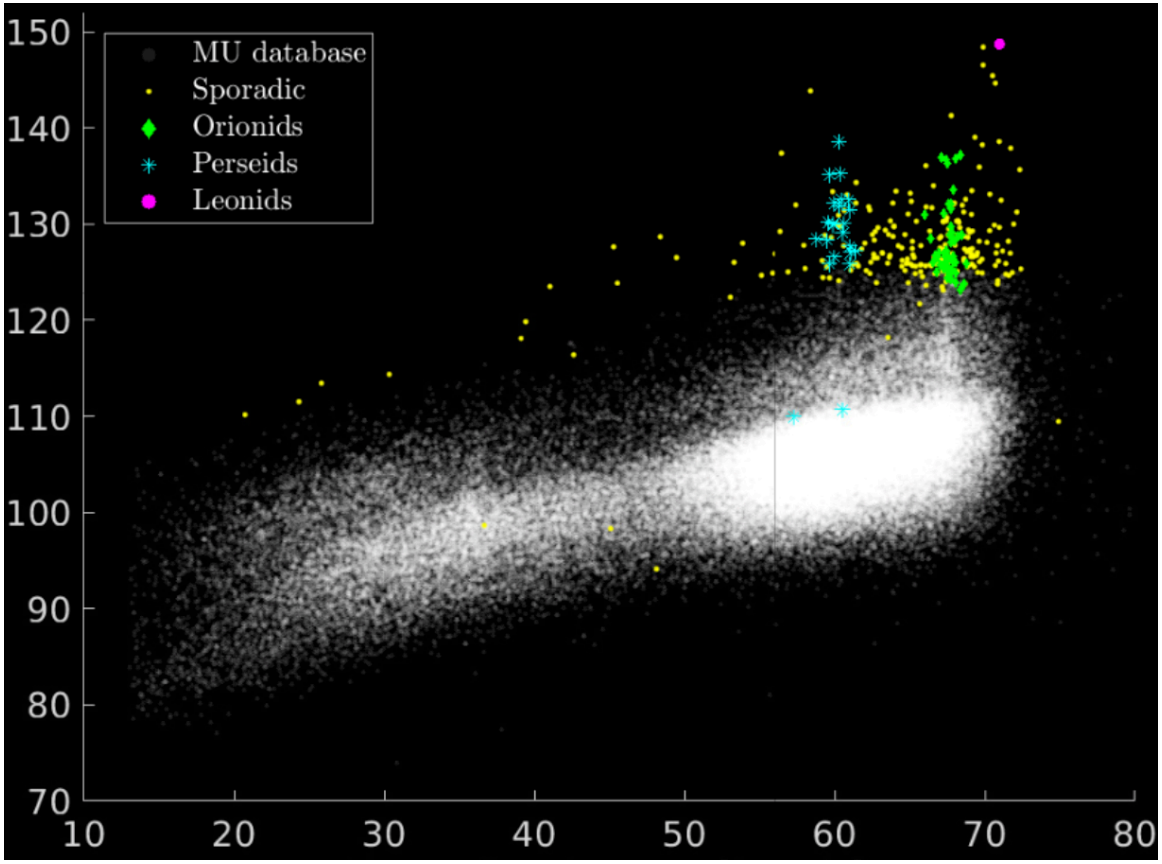
increase again

With EISCAT new nesting place of crow

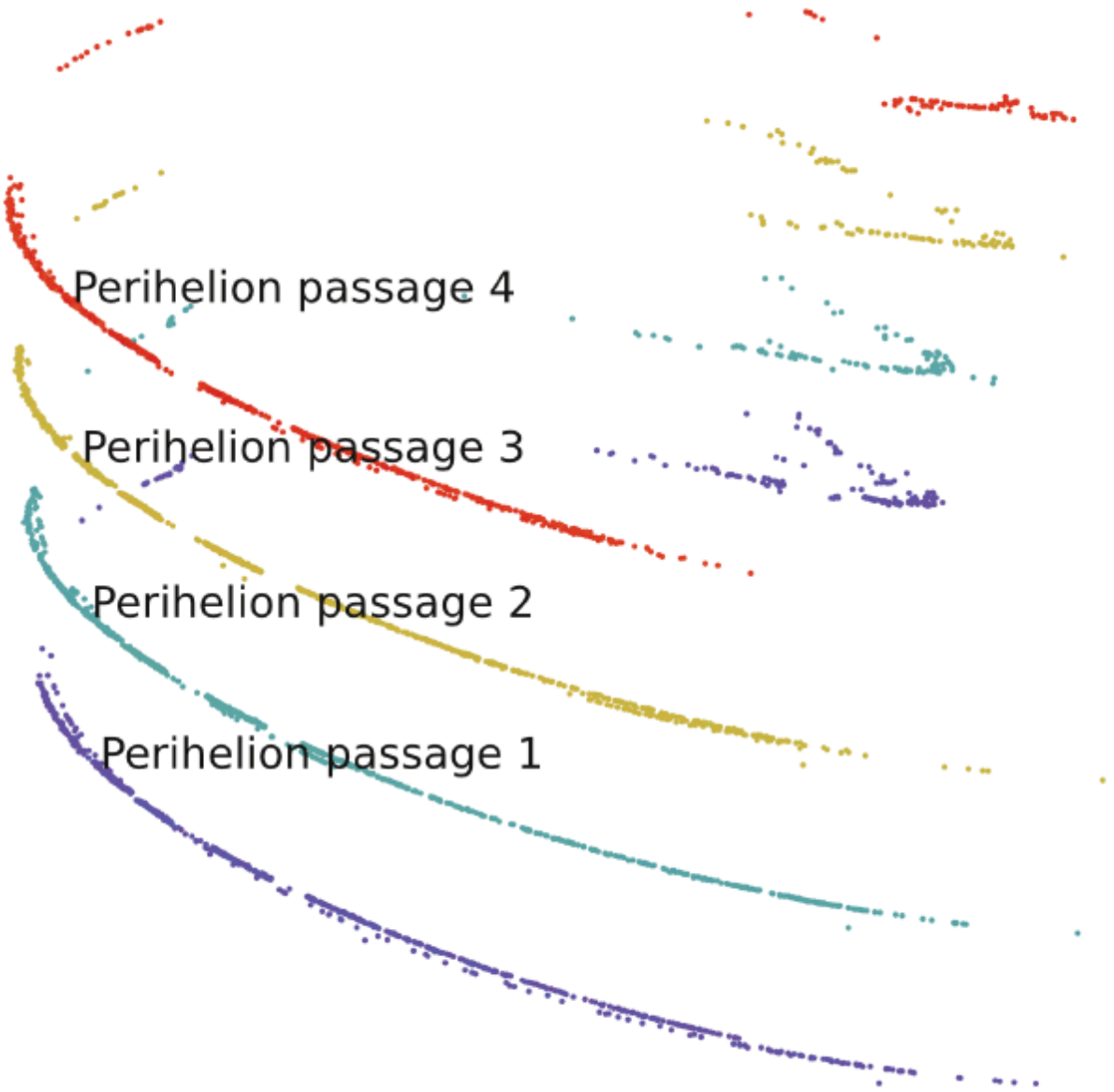




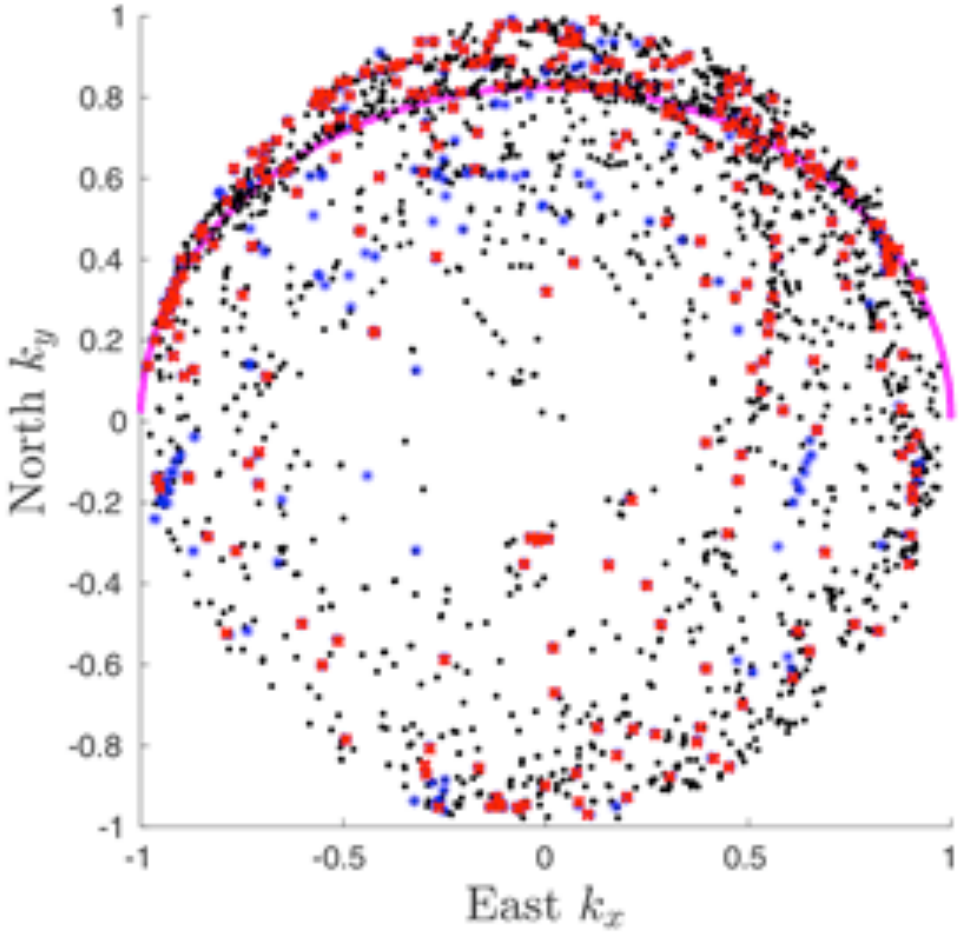
nest is expanding



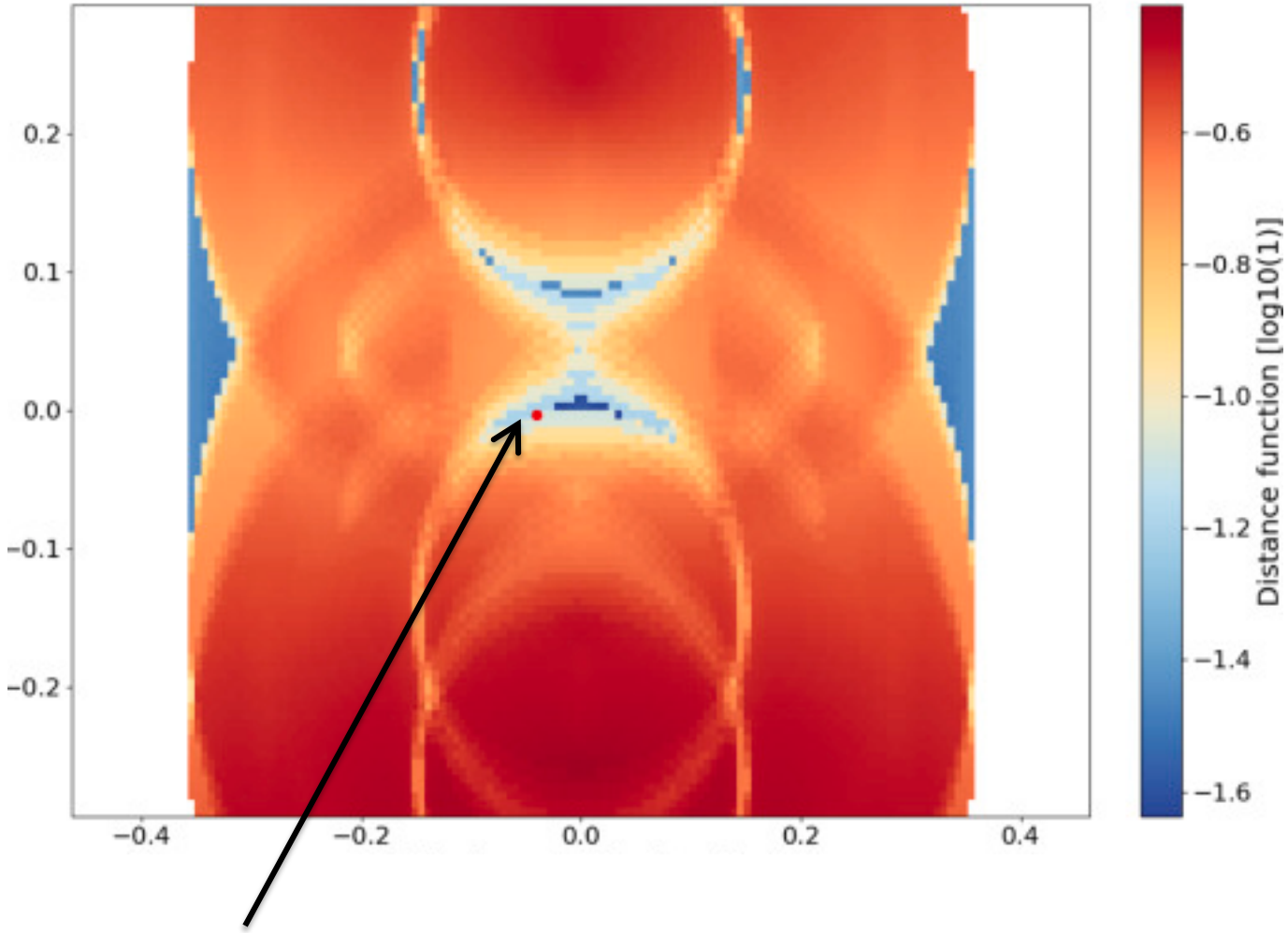
Let's simulate: large-size birds fly spiral



expected bird probability



resultant "bird-error" probability



most "safe" spot

Conclusion:

crow does not follow Hamiltonian