Localisation and acoustic radiation in complex structures

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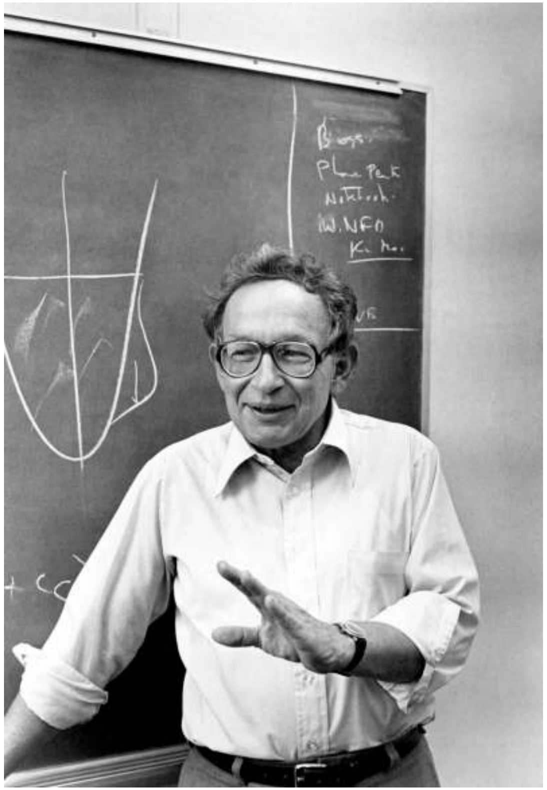
PHYSICAL REVIEW VOLUME 109, NUMBER 5 MARCH 1, 1958

Absence of Diffusion in Certain Random Lattices

P. W. ANDERSON
Bell Telephone Laboratories, Murray Hill, New Jersey

(Received October 10, 1957)

This paper presents a simple model for such processes as spin diffusion or conduction in the "impurity band." These processes involve transport in a lattice which is in some sense random, and in them diffusion is expected to take place via quantum jumps between localized sites. In this simple model the essential randomness is introduced by requiring the energy to vary randomly from site to site. It is shown that at low enough densities no diffusion at all can take place, and the criteria for transport to occur are given.



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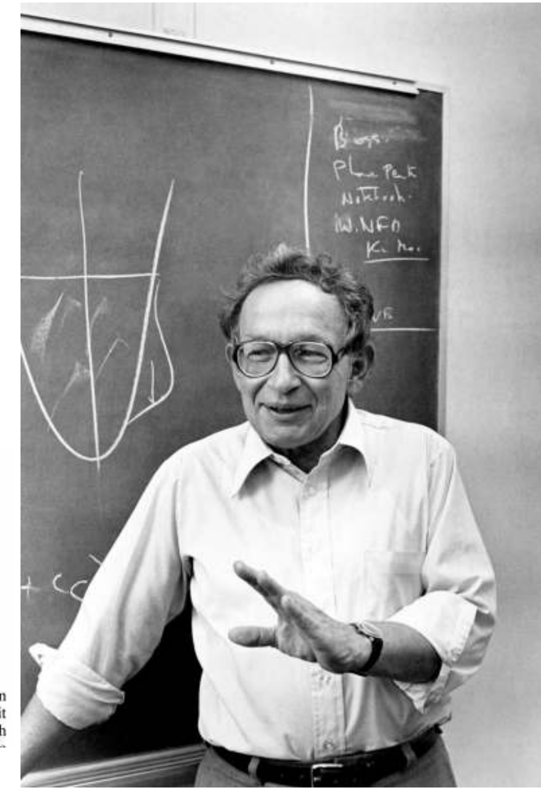

Figure 1. P. W. Anderson

Figure 2. Filoche and Mayboroda

Universal mechanism for Anderson and weak localization

Marcel Filoche[a,b,1] and Svitlana Mayboroda[c]

[a]Physique de la Matière Condensée, Ecole Polytechnique, Centre National de la Recherche Scientifique, 91128 Palaiseau, France; [b]Centre de Mathématiques et de Leurs Applications, Ecole Normale Supérieure de Cachan, Centre National de la Recherche Scientifique, UniverSud, 94230 Cachan, France; and [c]School of Mathematics, University of Minnesota, Minneapolis, 55455 MN

Edited by Michael Berry, University of Bristol, Bristol, United Kingdom, and approved July 20, 2012 (received for review December 13, 2011)

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Consider for instance a simple case of Anderson localization illustrated in Fig. 1. The original domain (called Ω) is a unit square. It is divided into 400 = 20 × 20 smaller squares. On each

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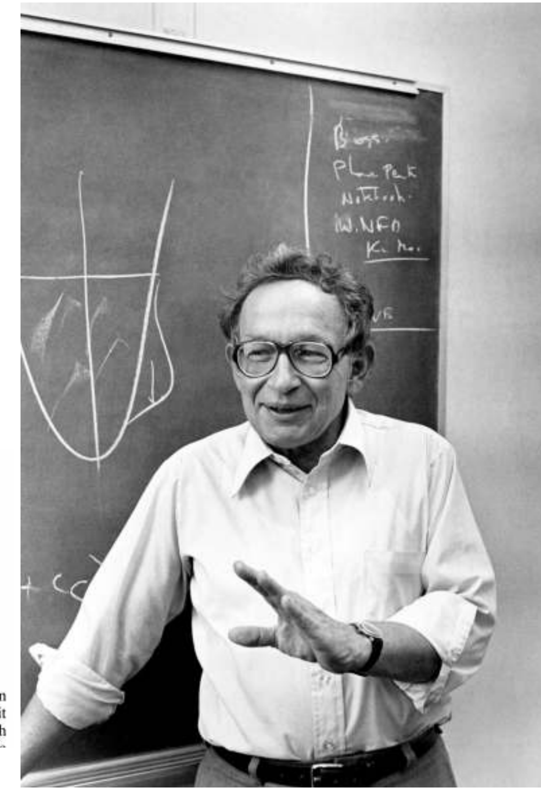

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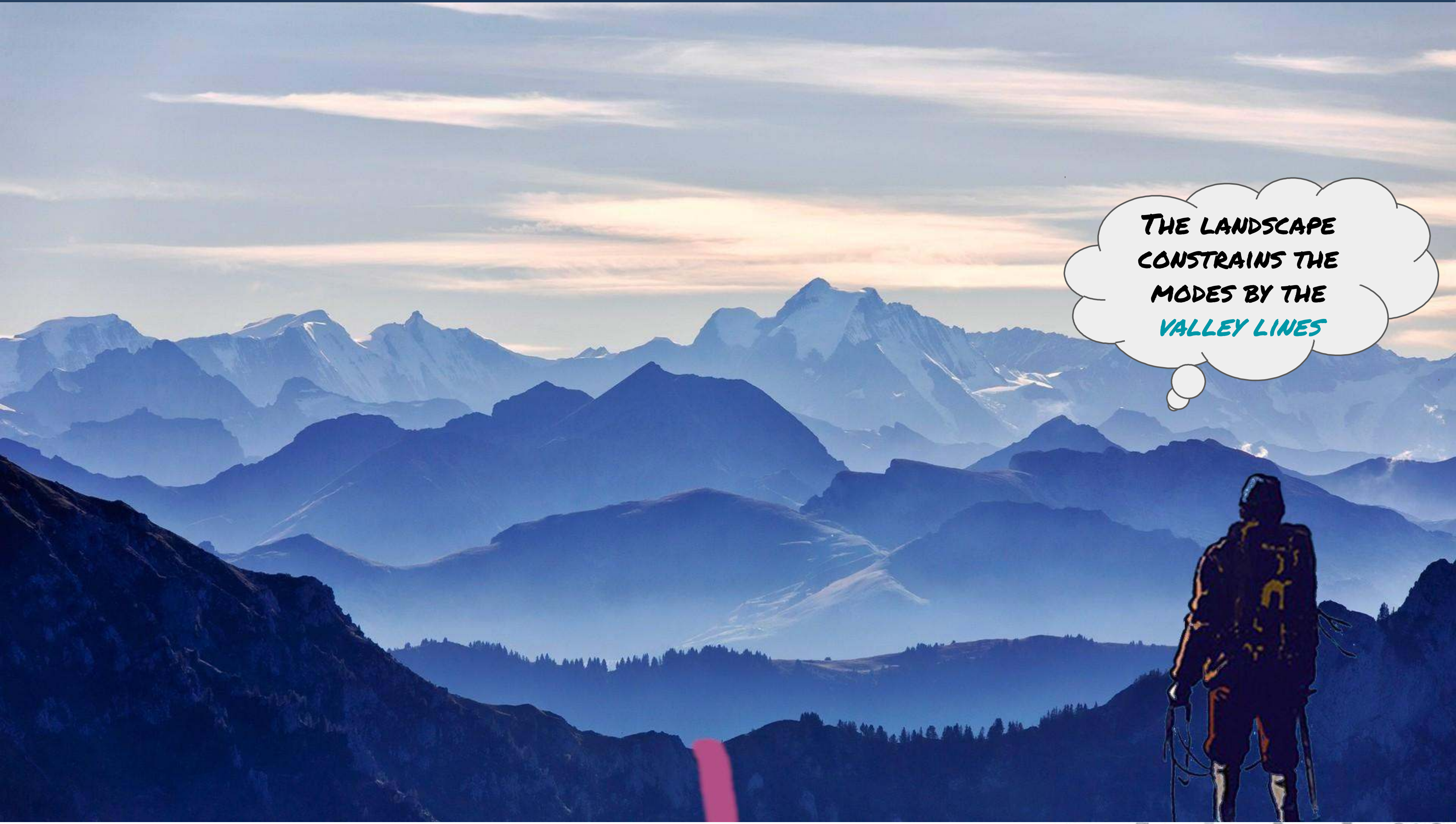
LANDSCAPE OF LOCALISATION


The landscape constrains the modes by the valley lines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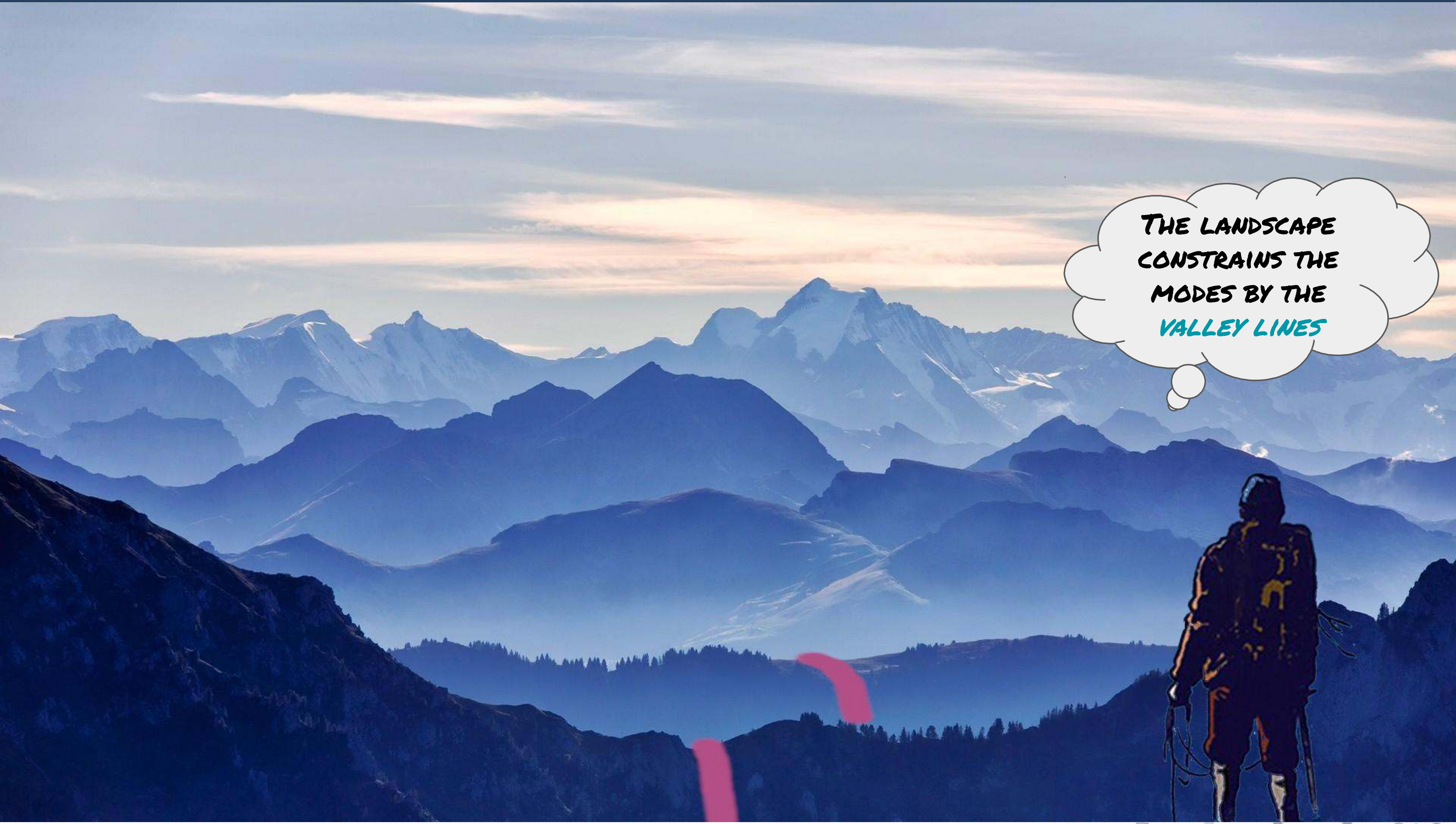
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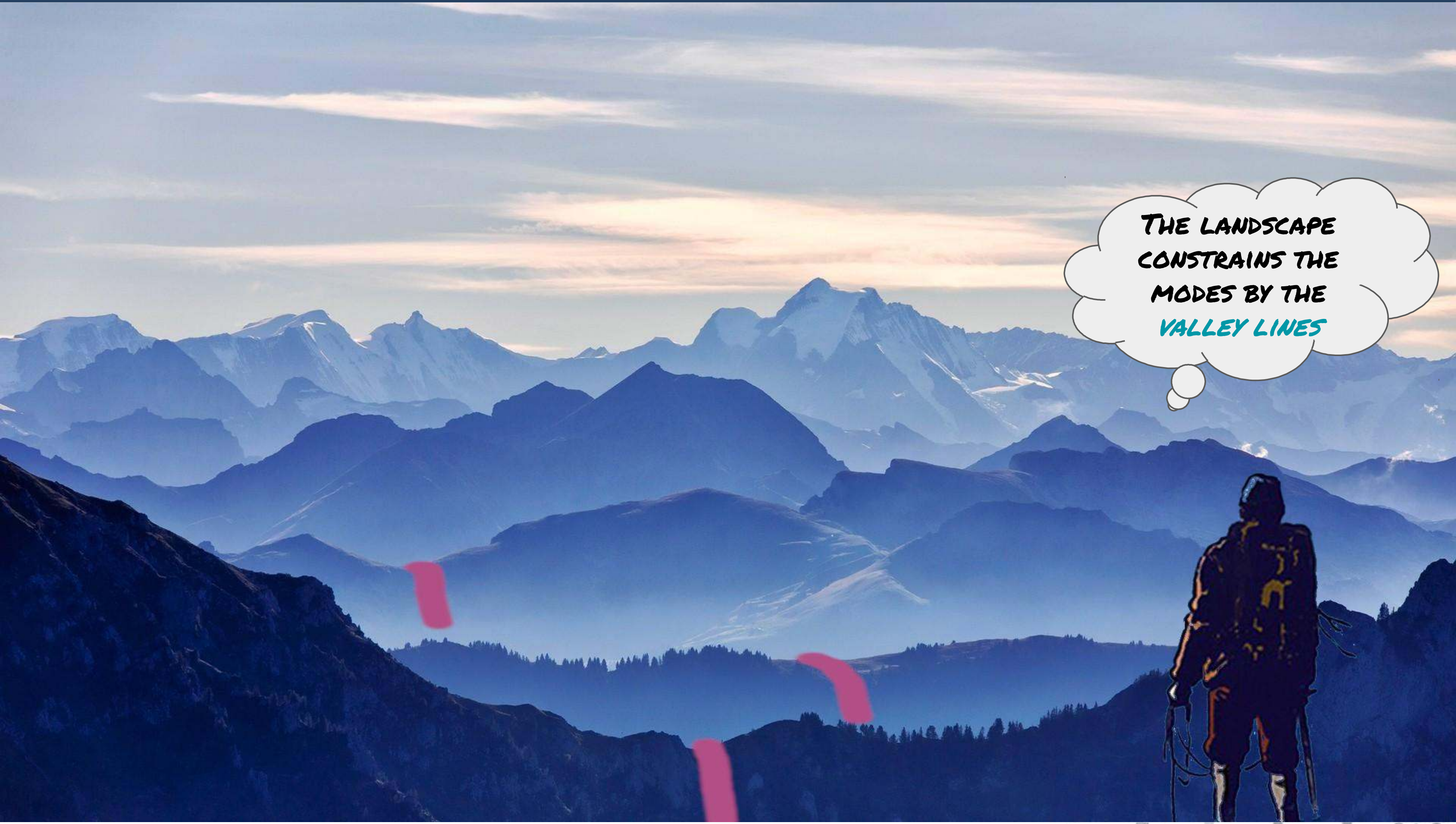
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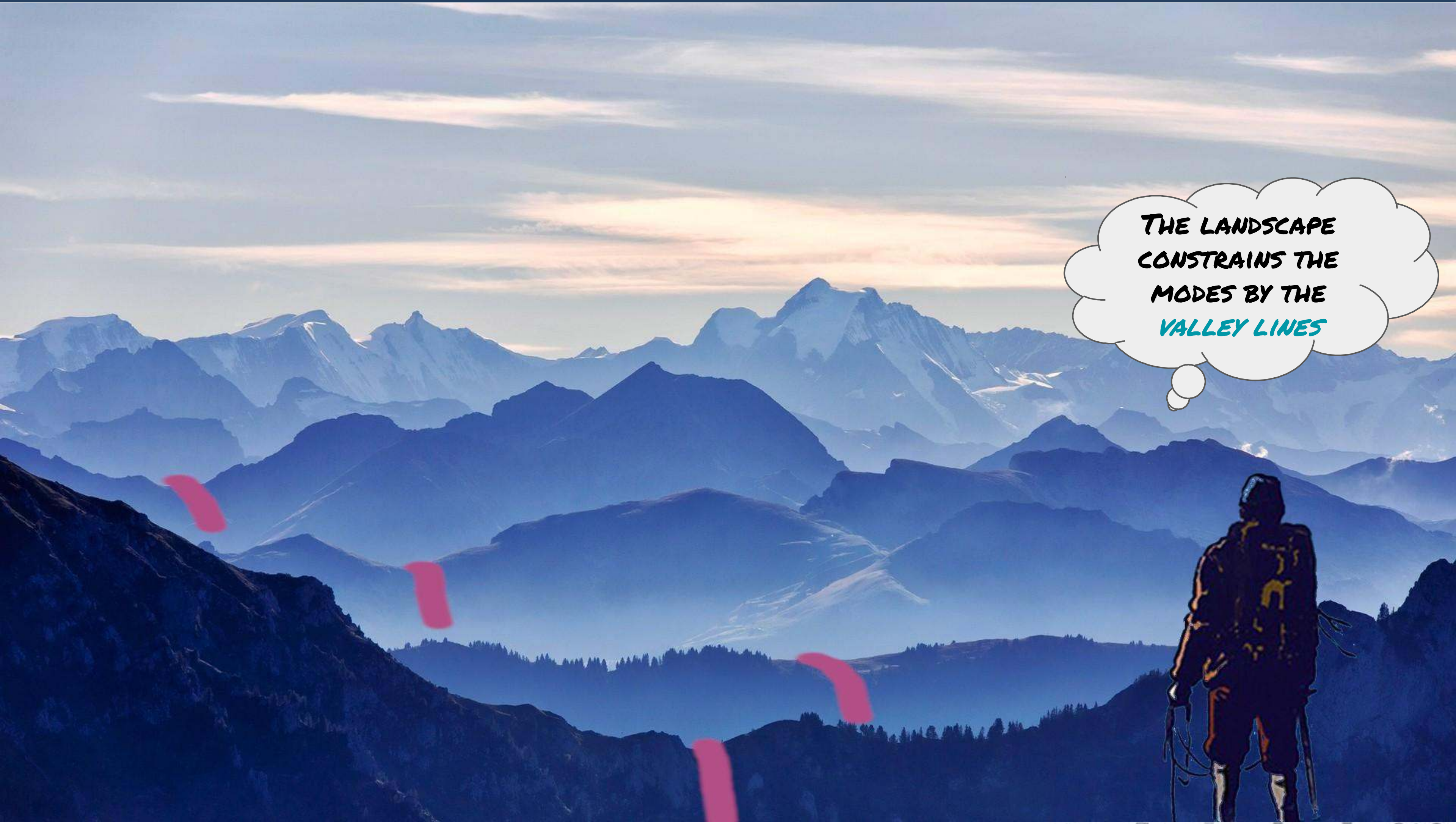
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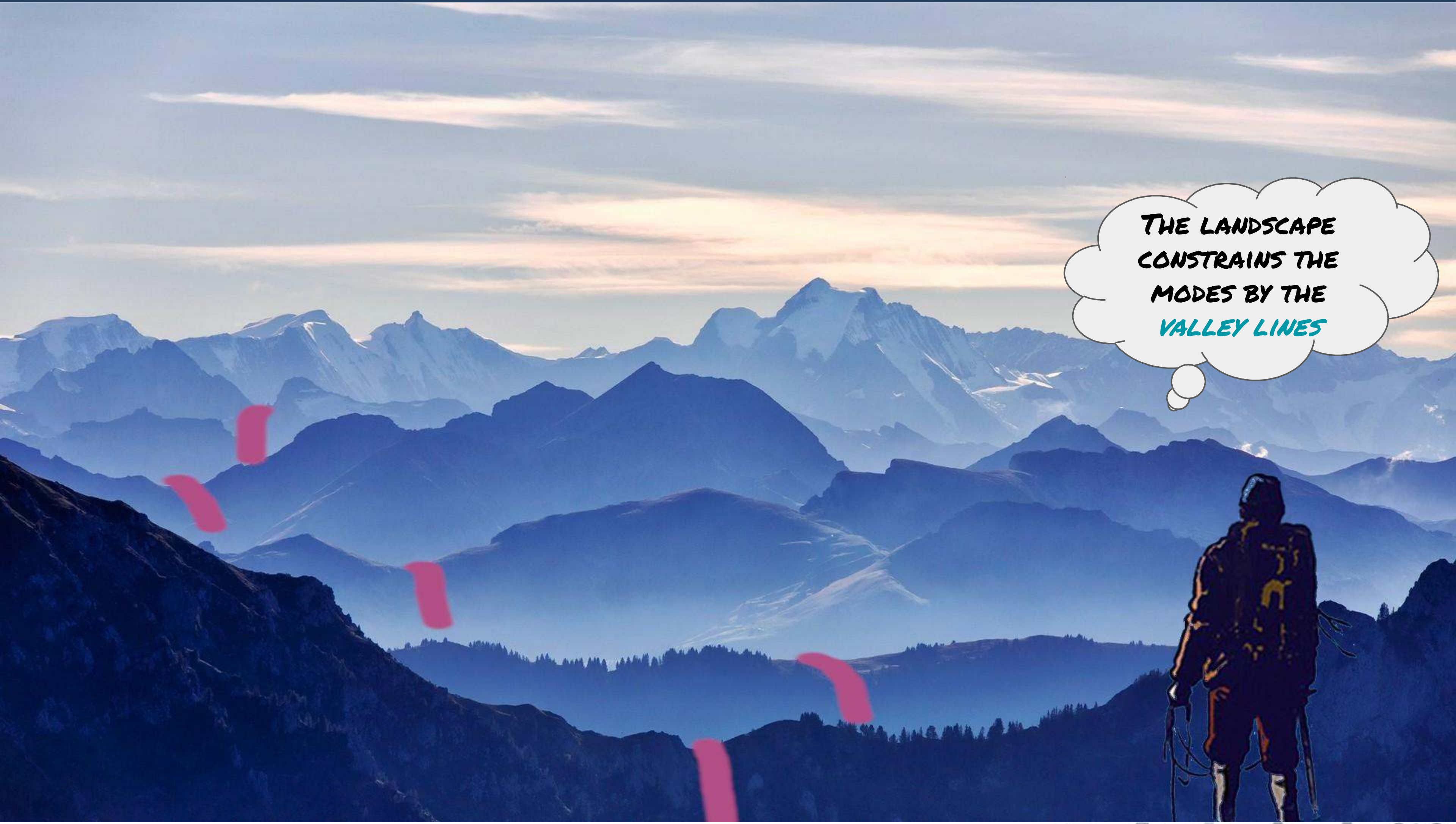
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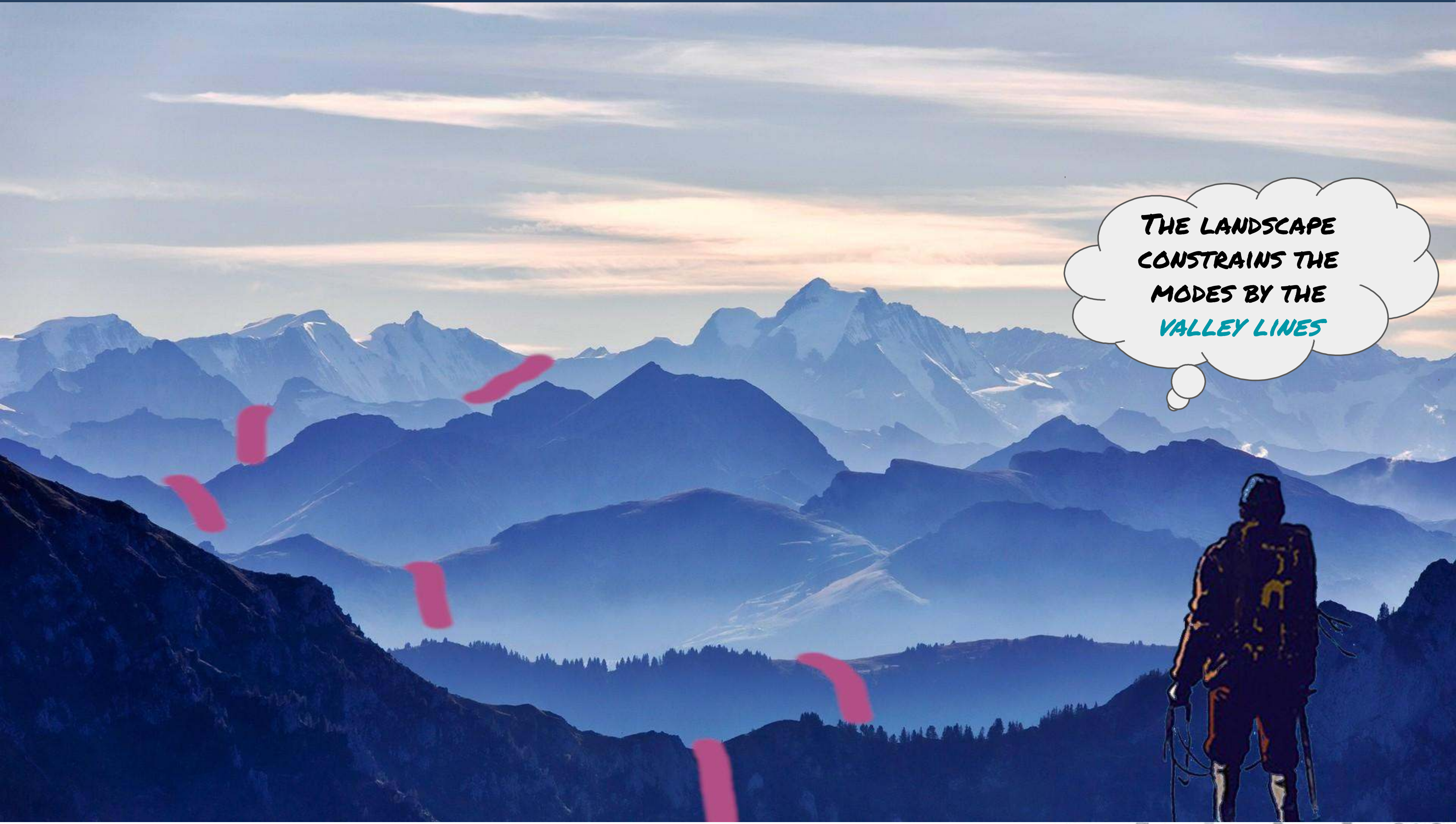
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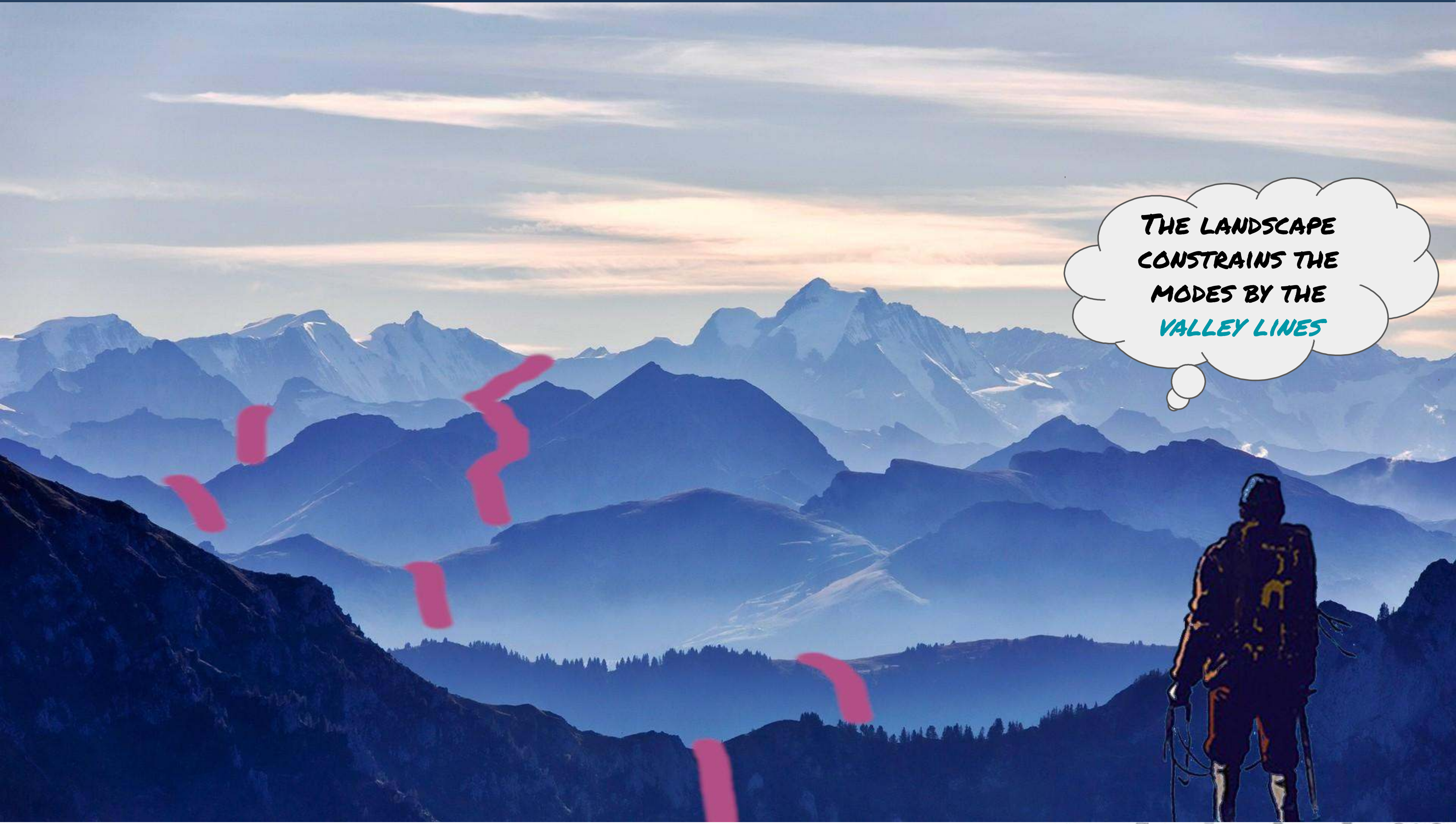
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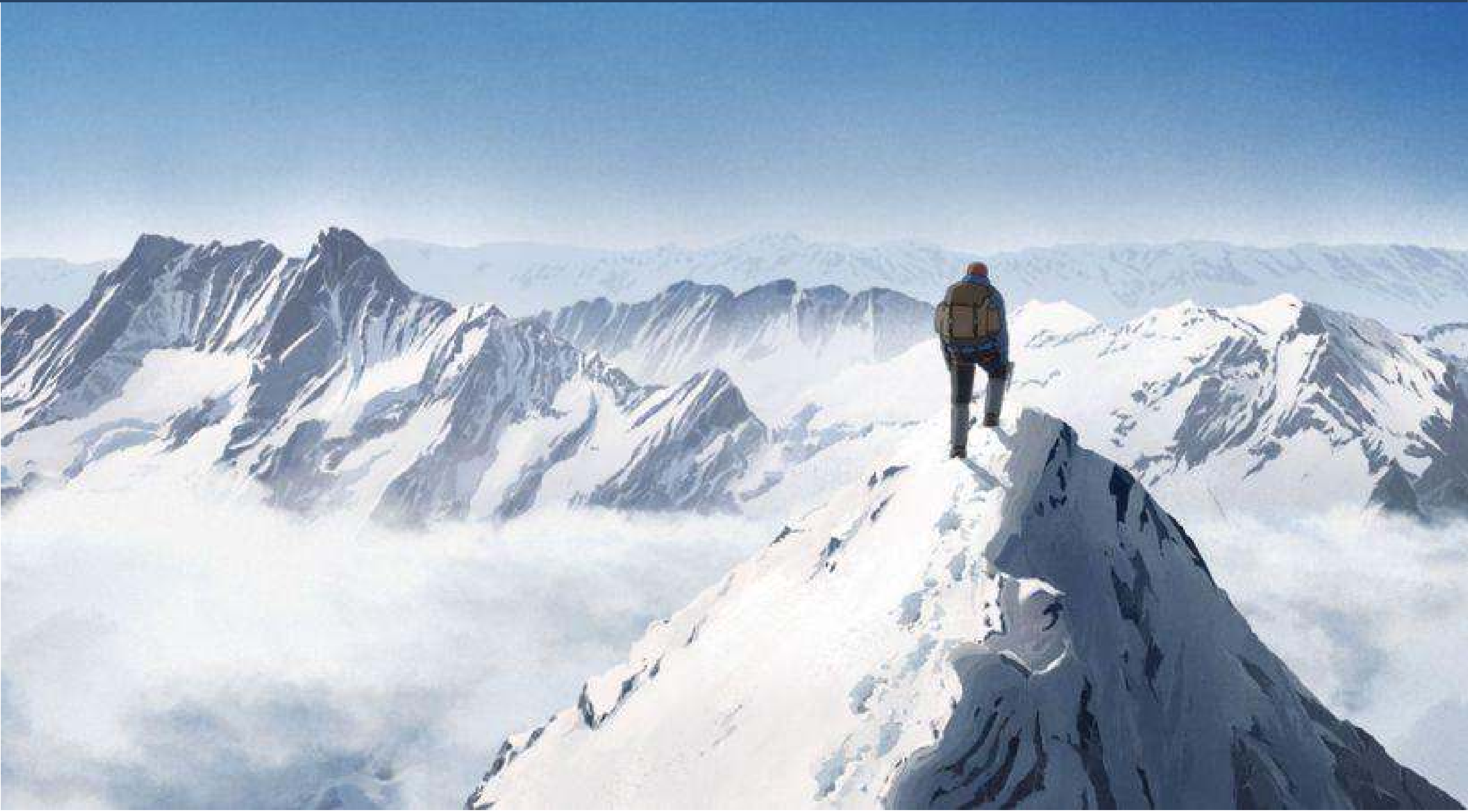
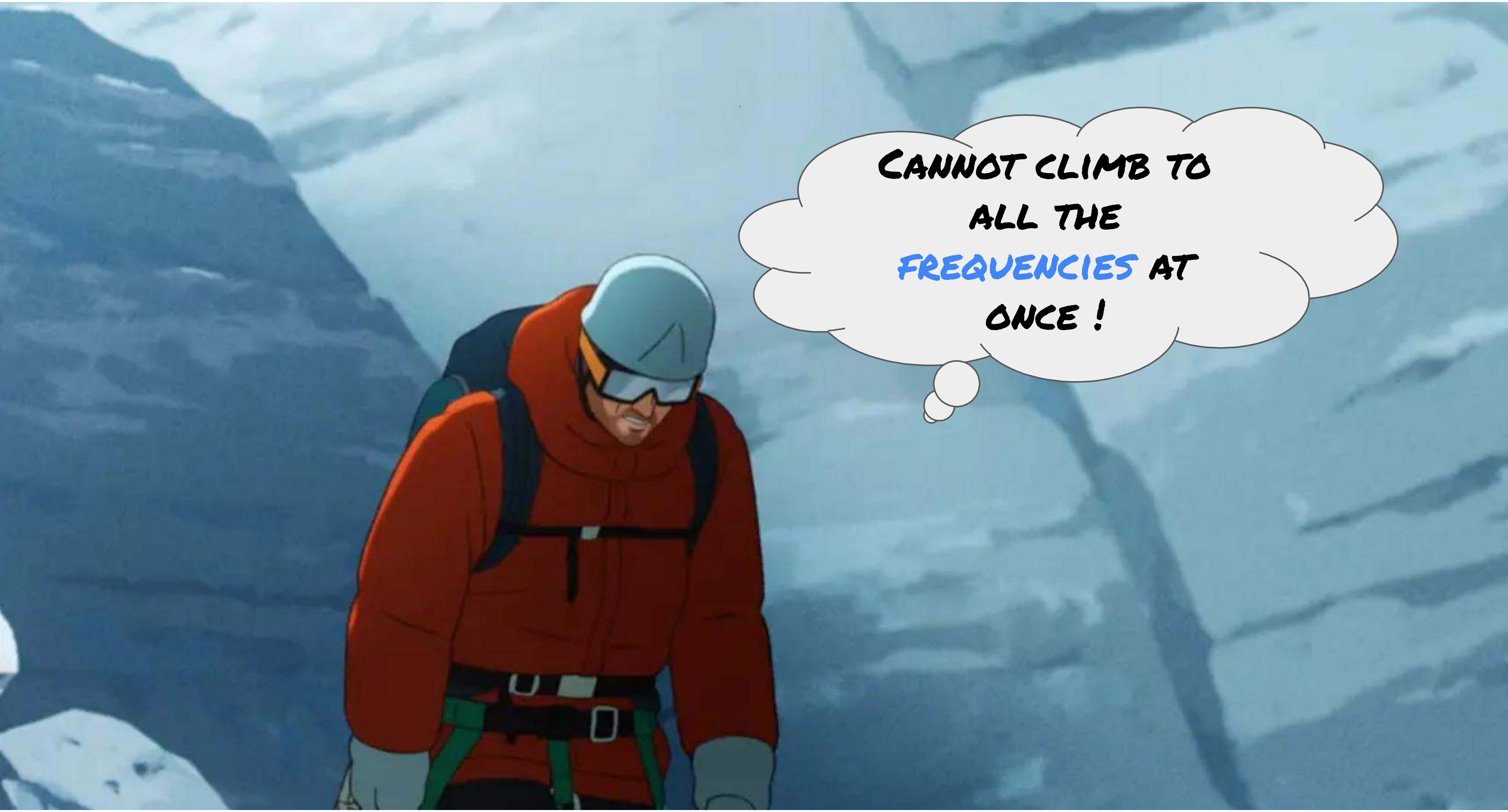
Finding the
peak will give
me the
frequency


Finding the peak will give me the frequency
Nice booty !




I FOUND A
FREQUENCY
!
F


F 2
F 1
F 5
F 3
F 6
But it was
a local
one
F
F 4


CANNOT CLIMB TO
ALL THE
FREQUENCIES AT
ONCE !

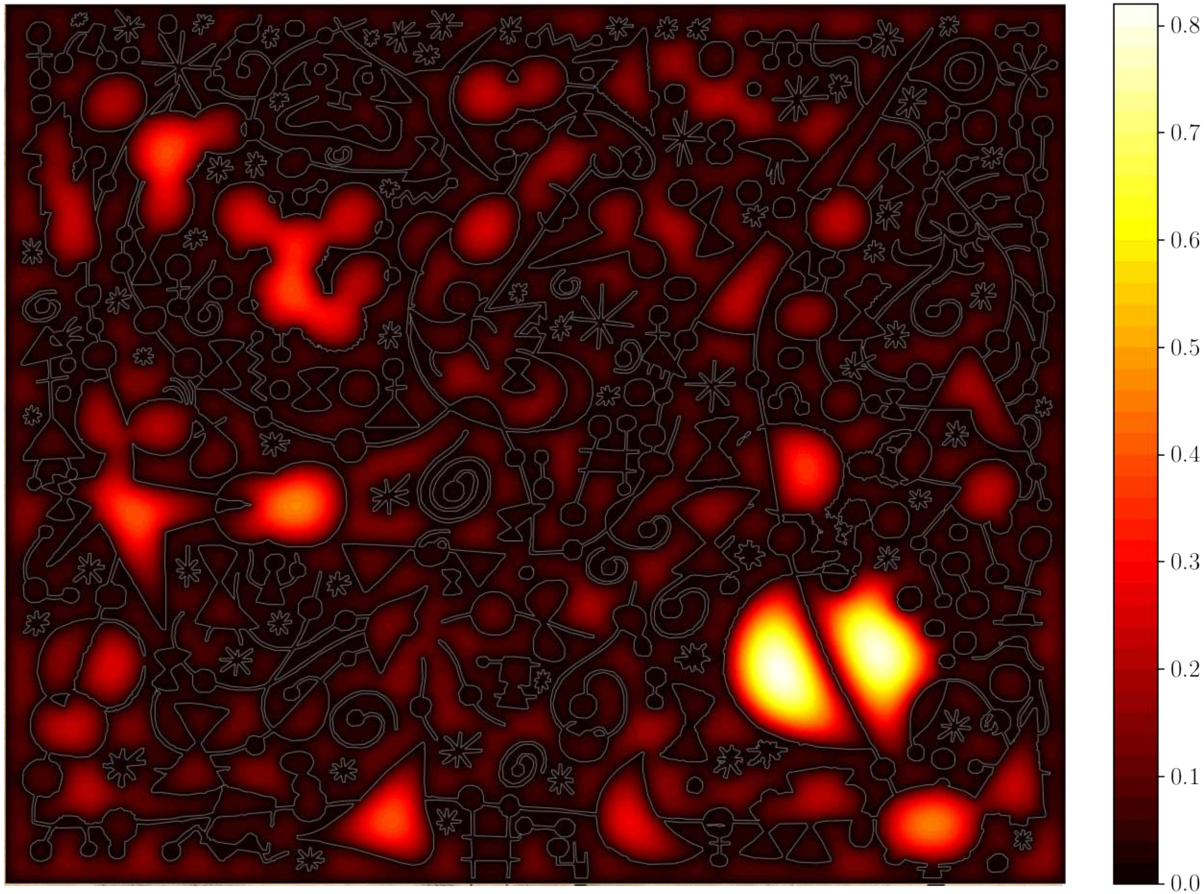

But For Sure with
a structure !


Back to the Lab
!

Figure 3. Some art

Figure 4. Joan Miró

$$\mathcal{L}u = 1$$



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The landscape predicts mode localisation

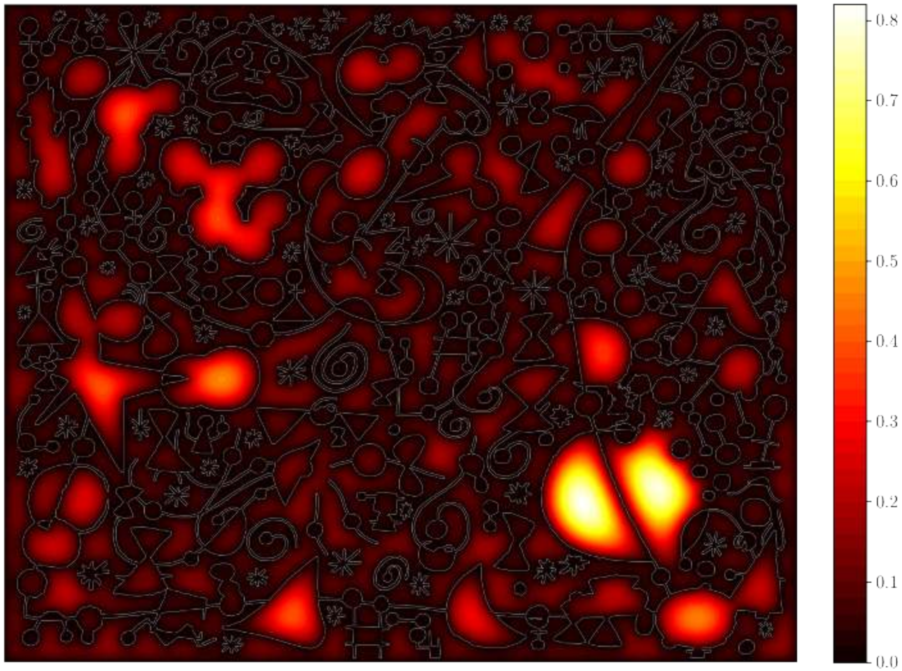

Figure 5. Some landscape

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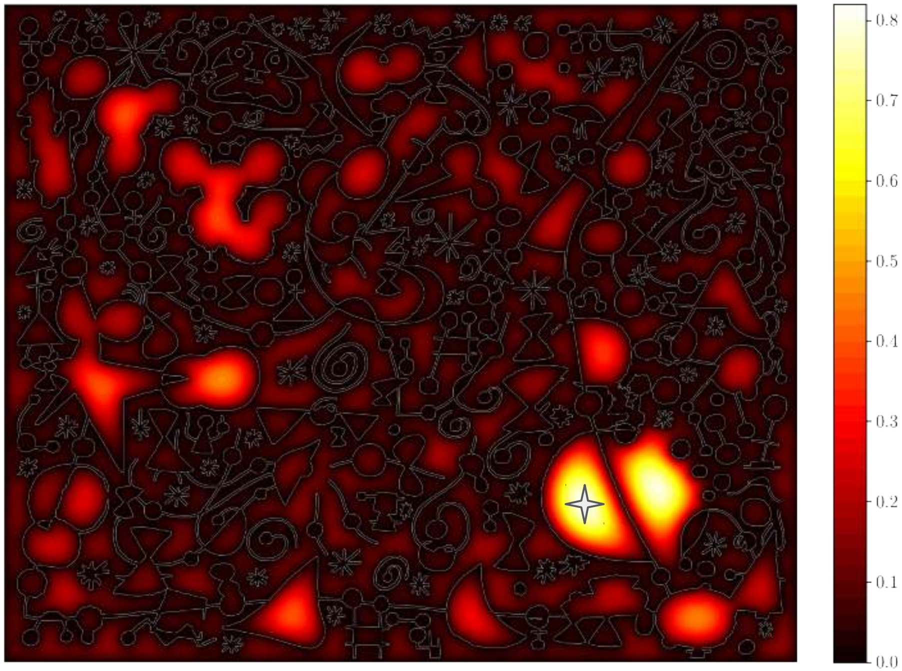

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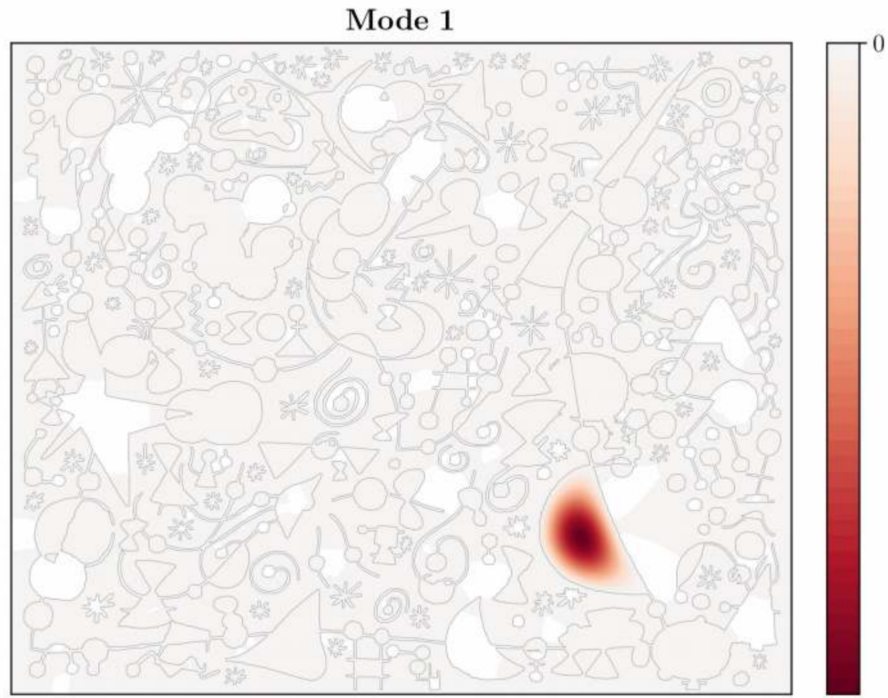

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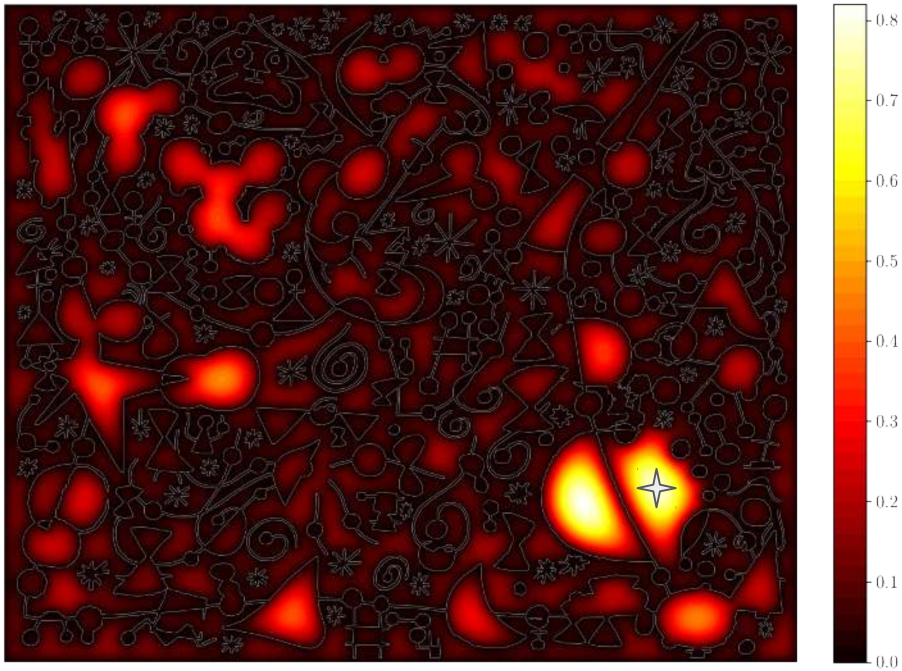

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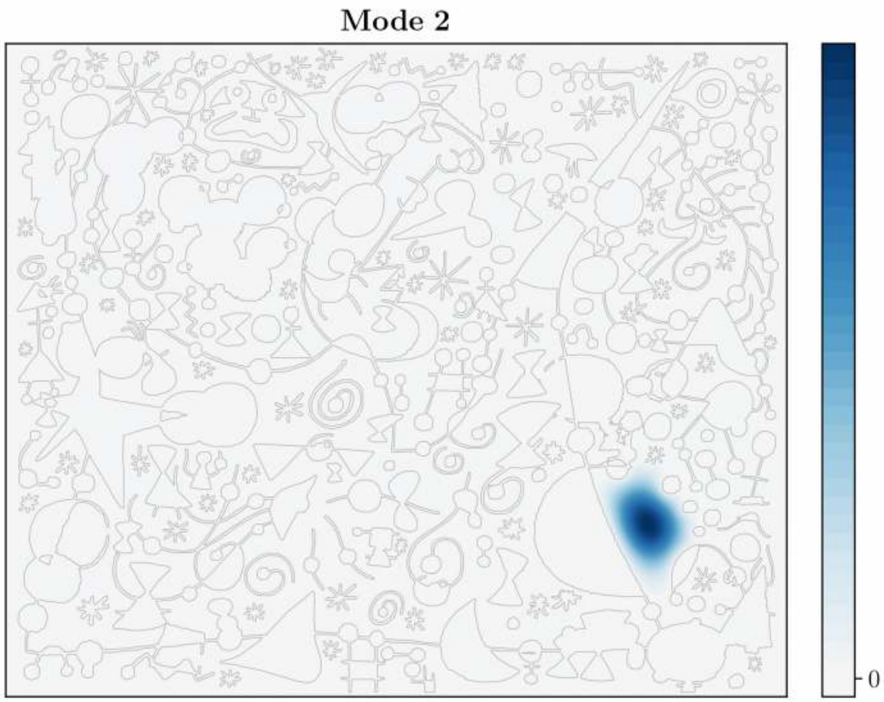

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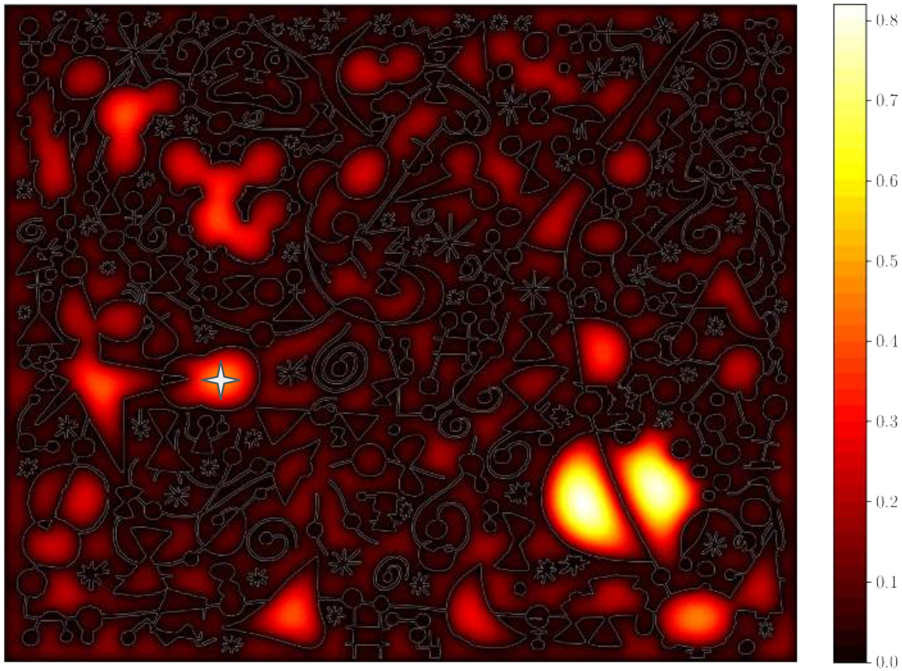

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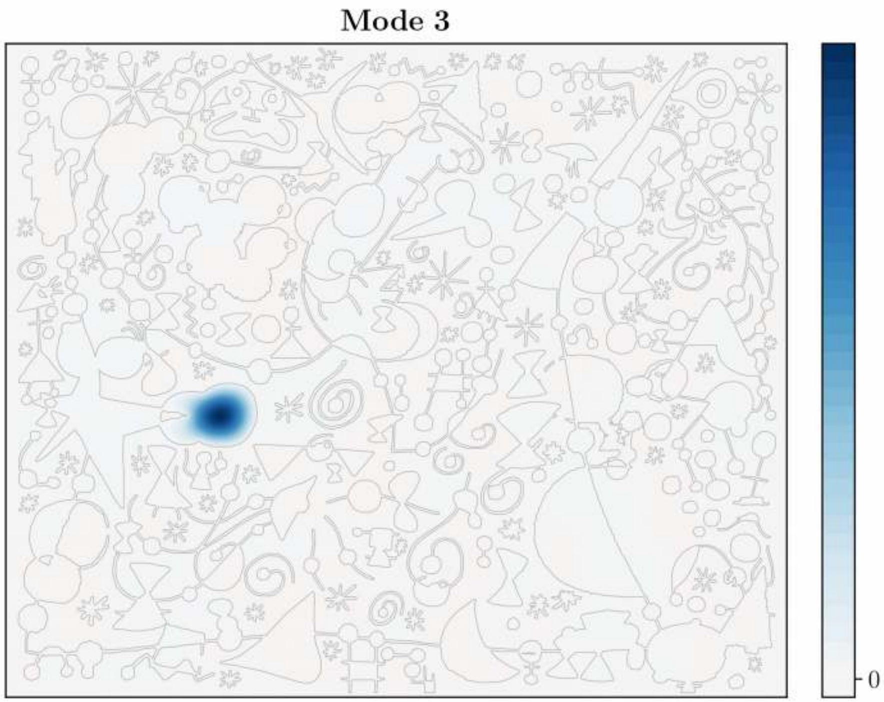

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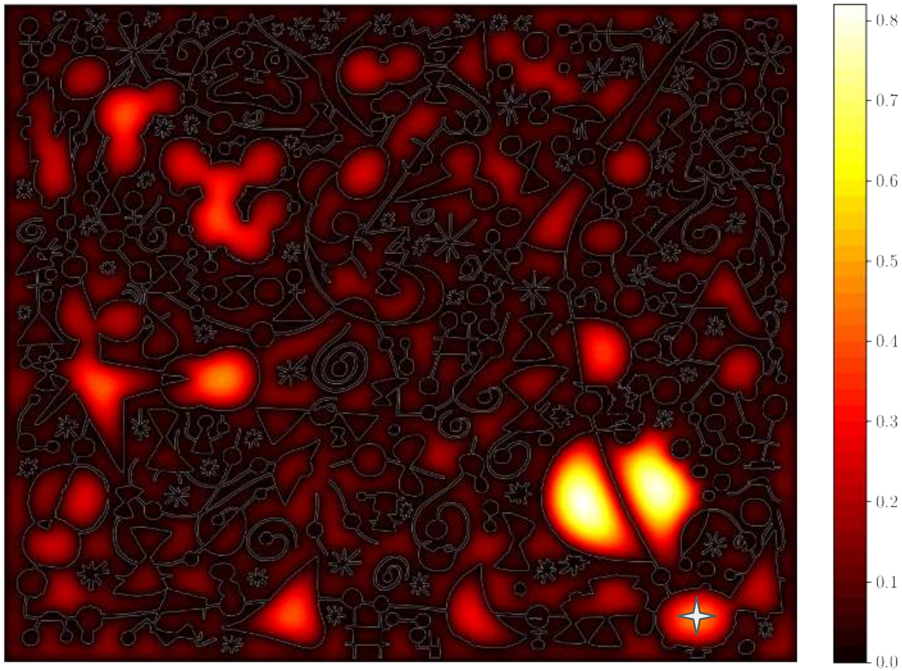

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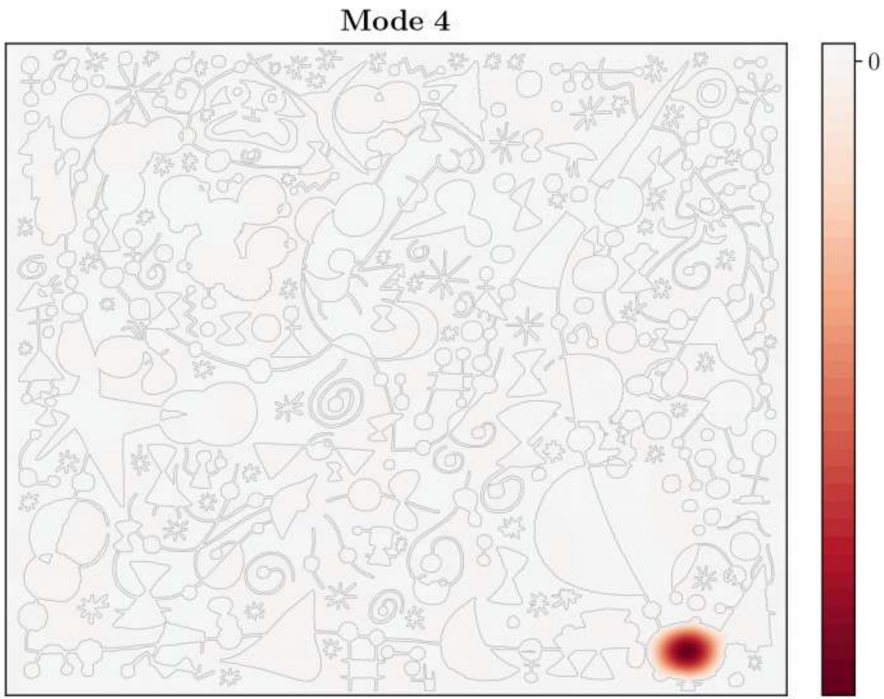

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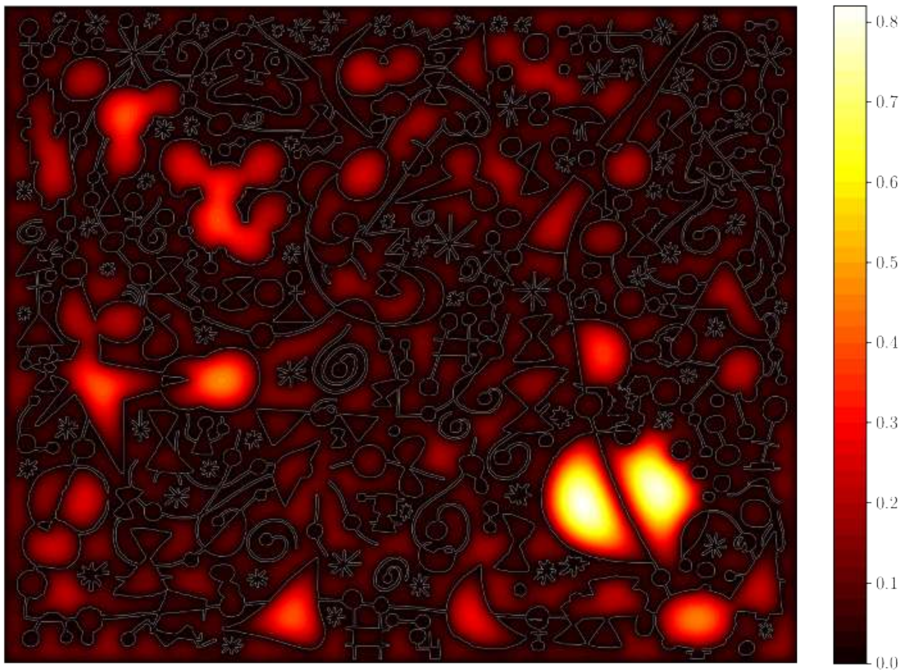

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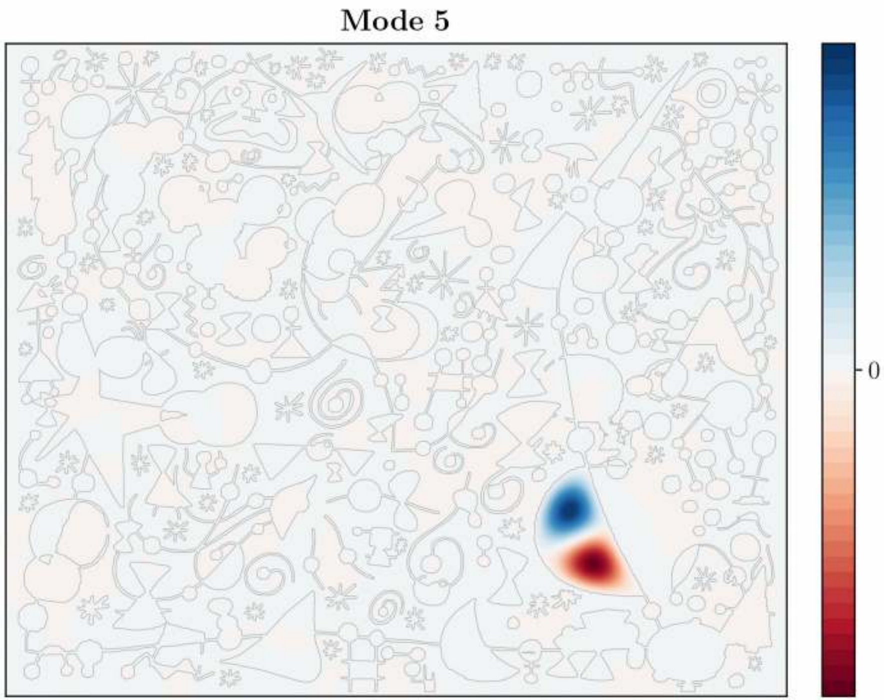

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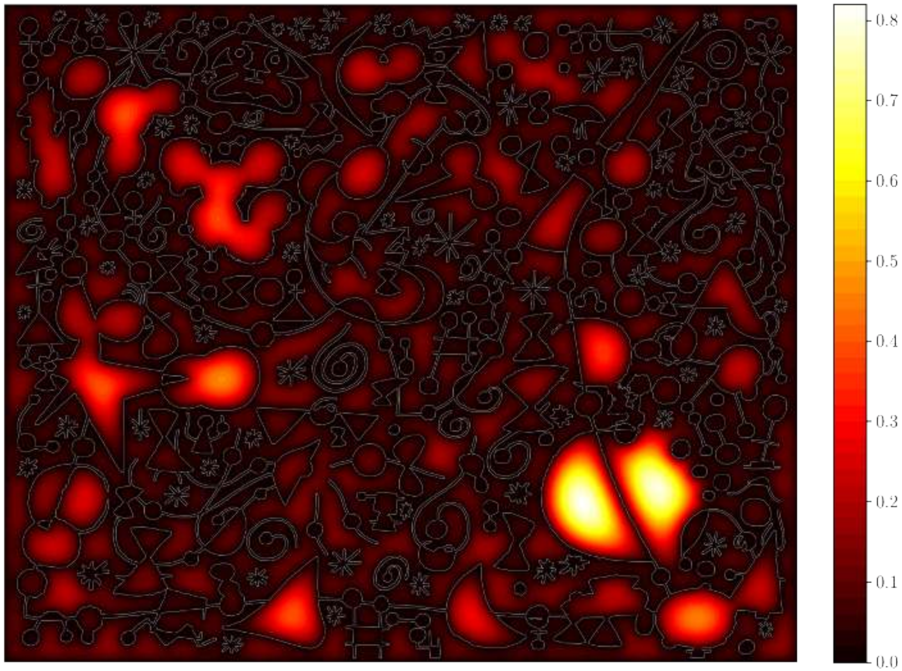

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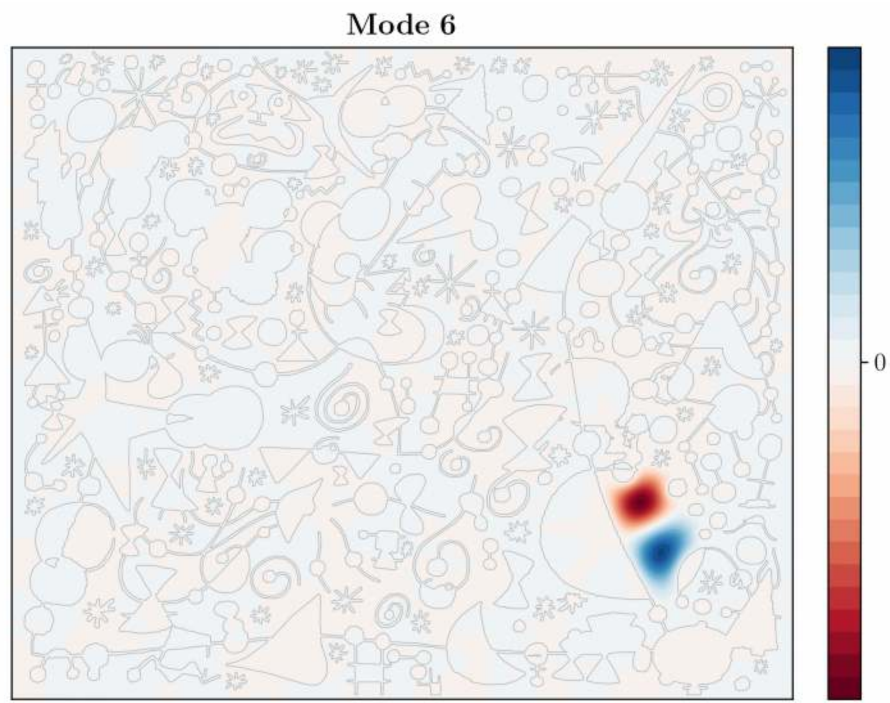

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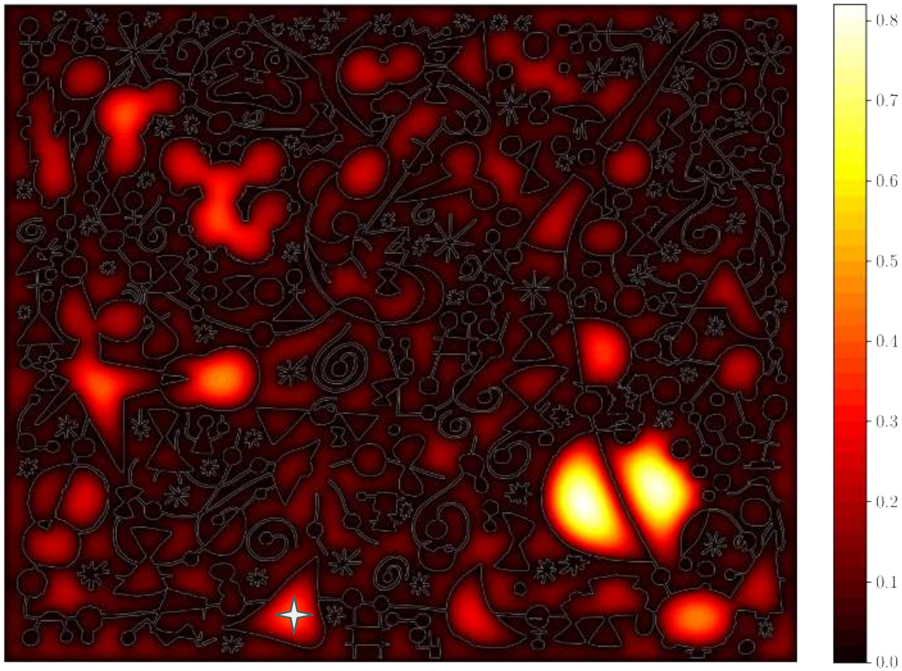

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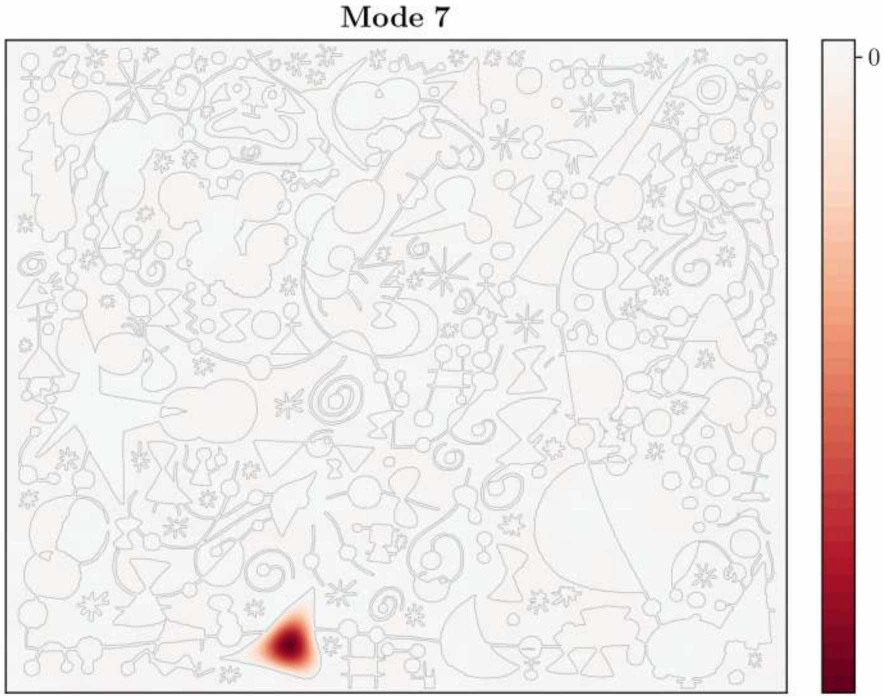

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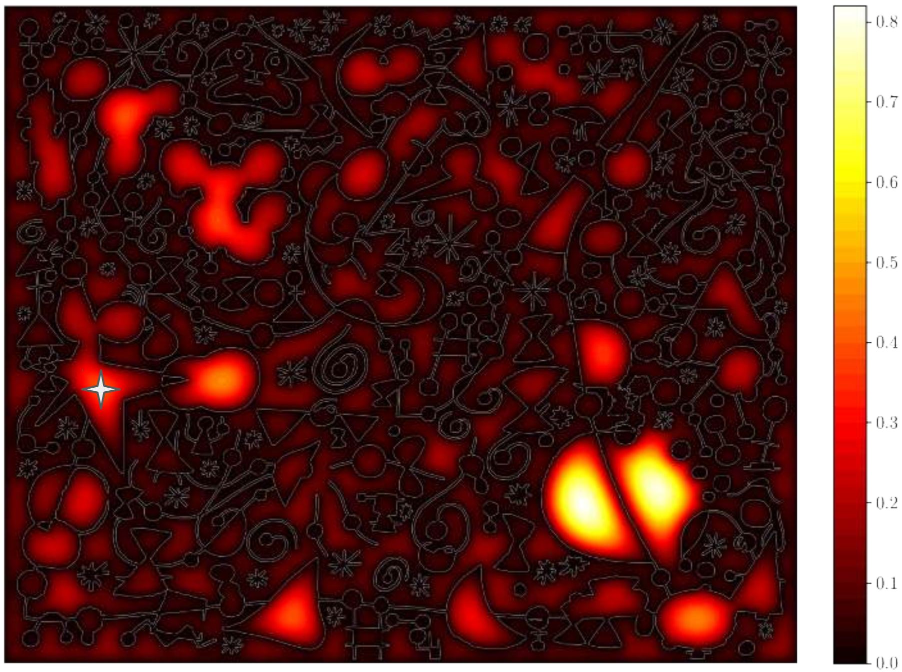

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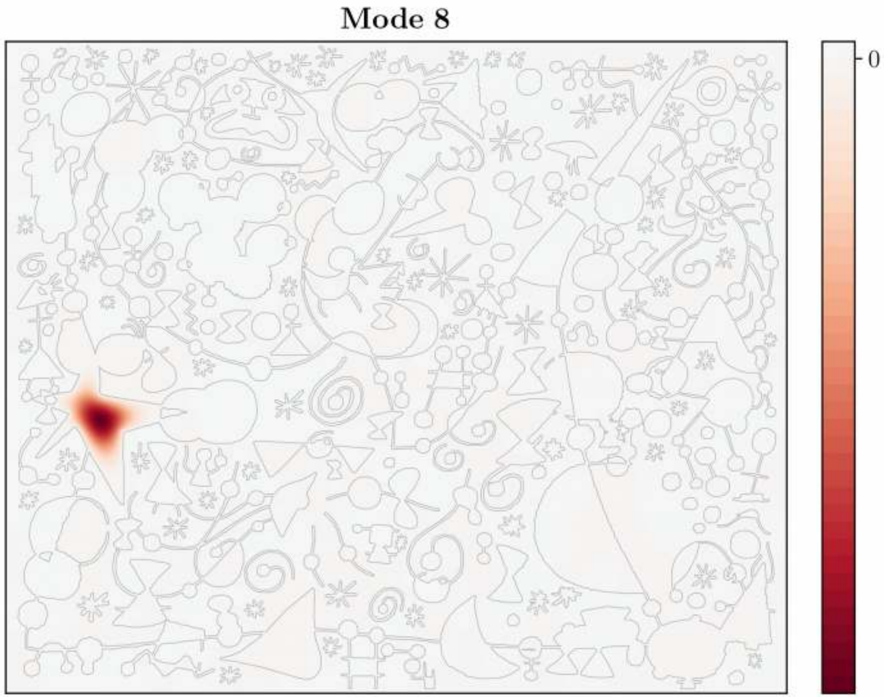

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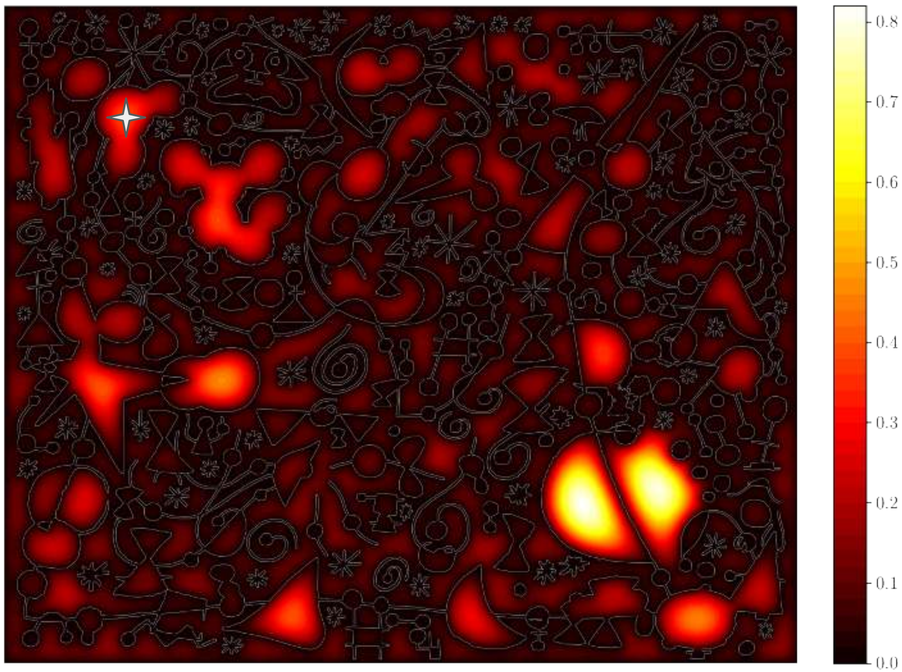

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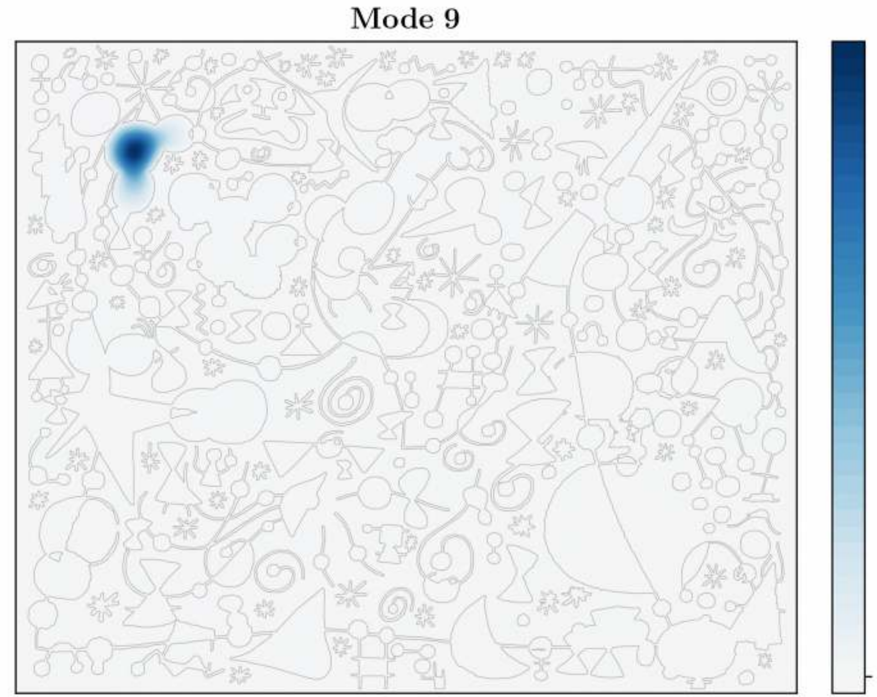

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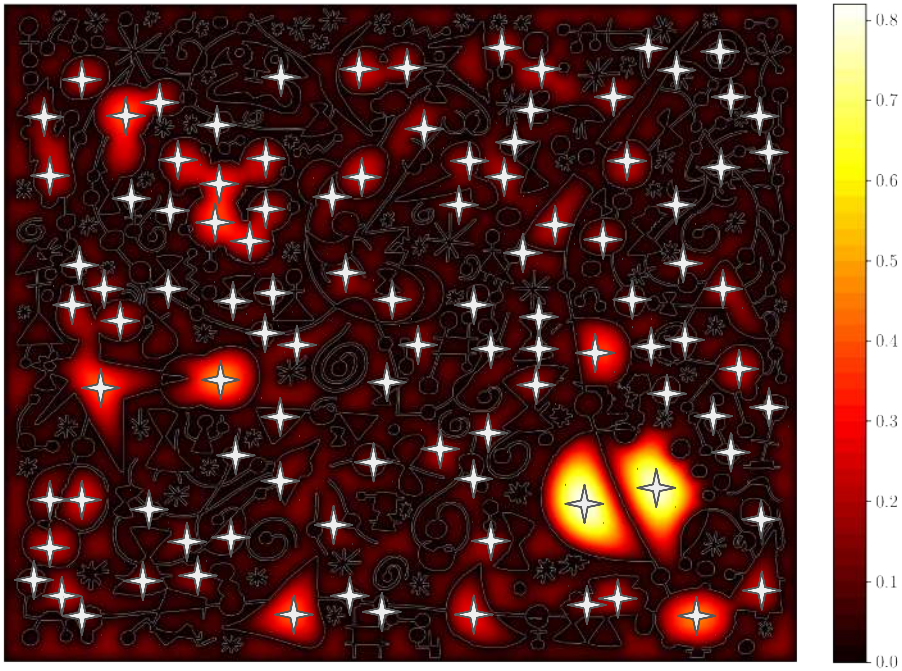

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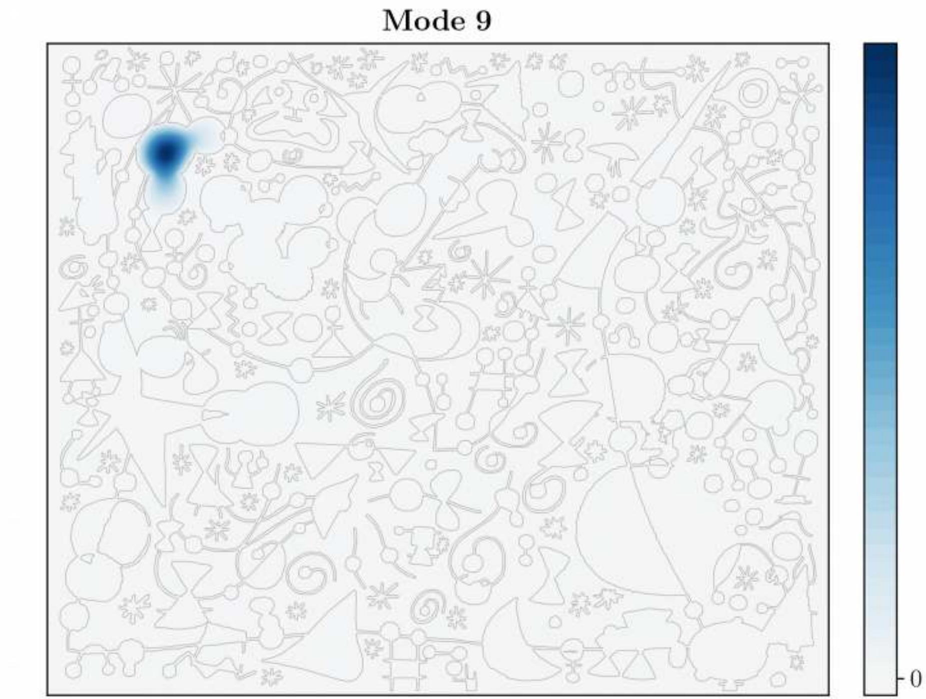

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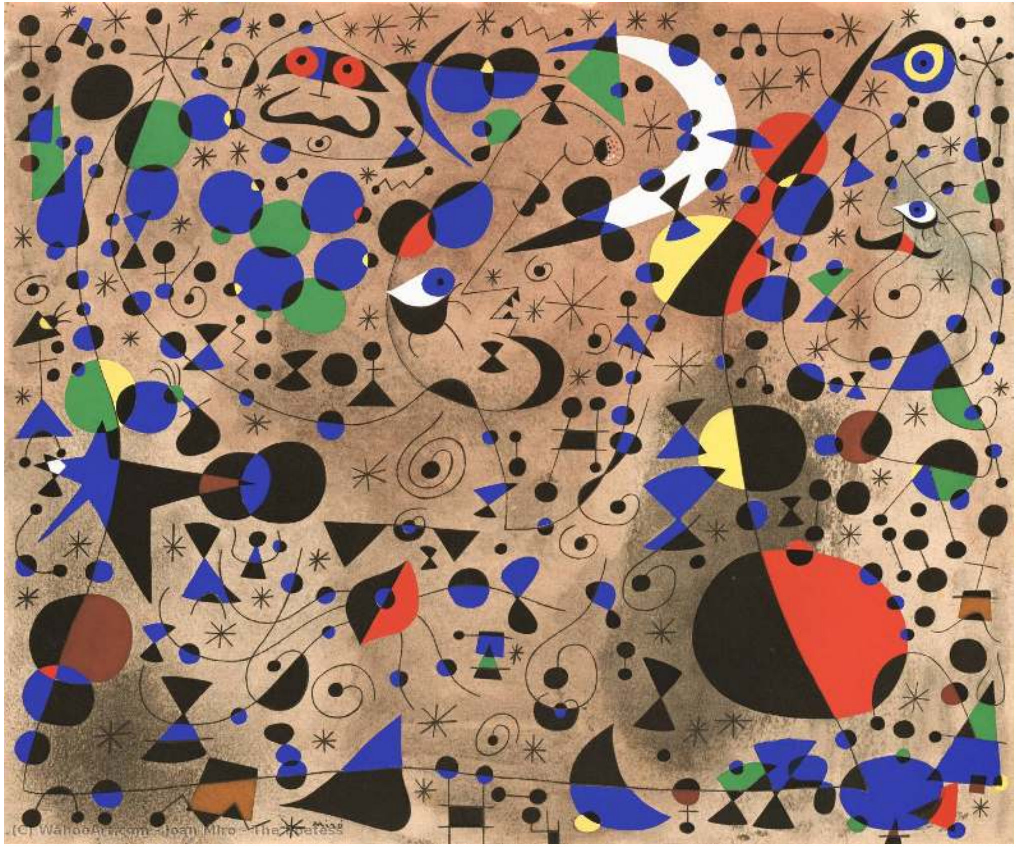
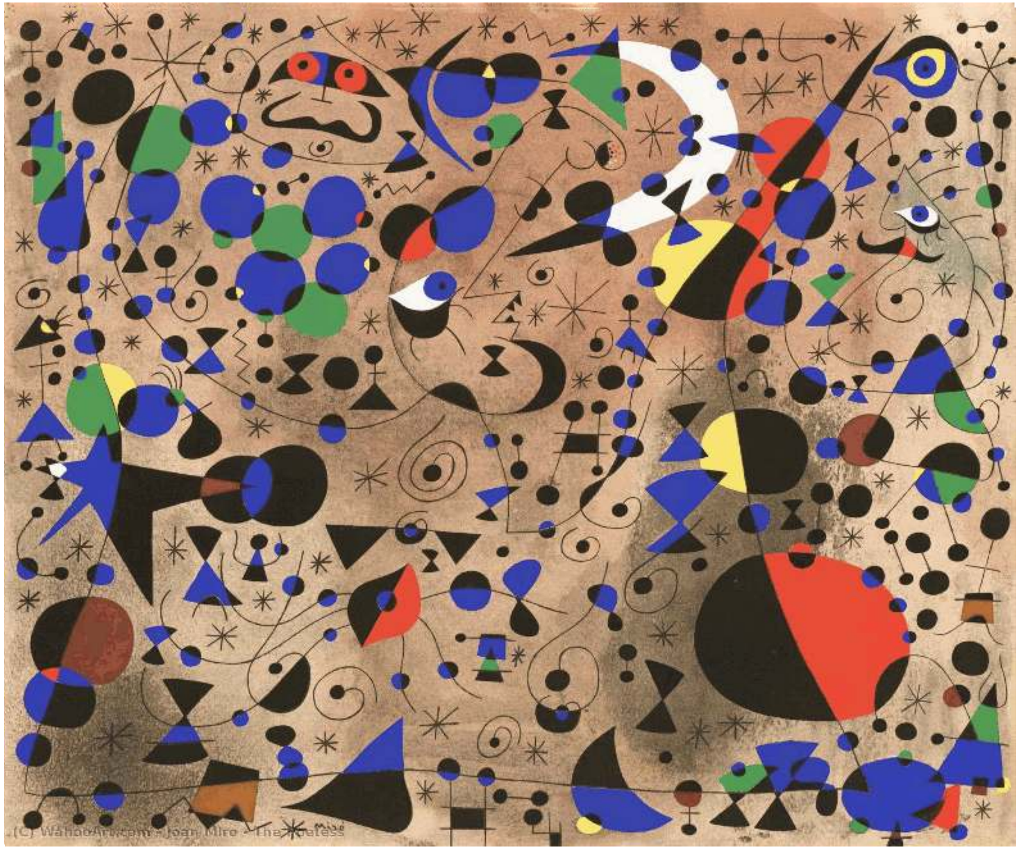
Does the landscape predicts radiation?

- Describe the radiation from the landscape with



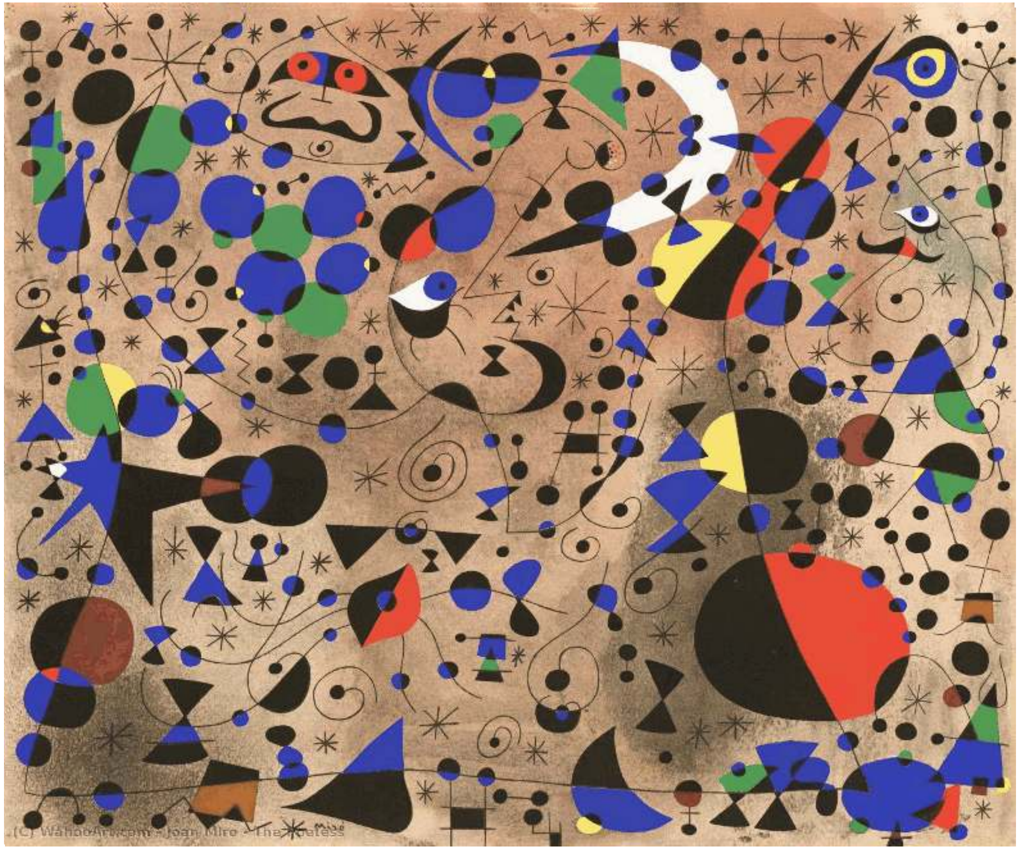
Does the landscape predicts radiation?

- Describe the radiation from the landscape with
  - Acoustic power



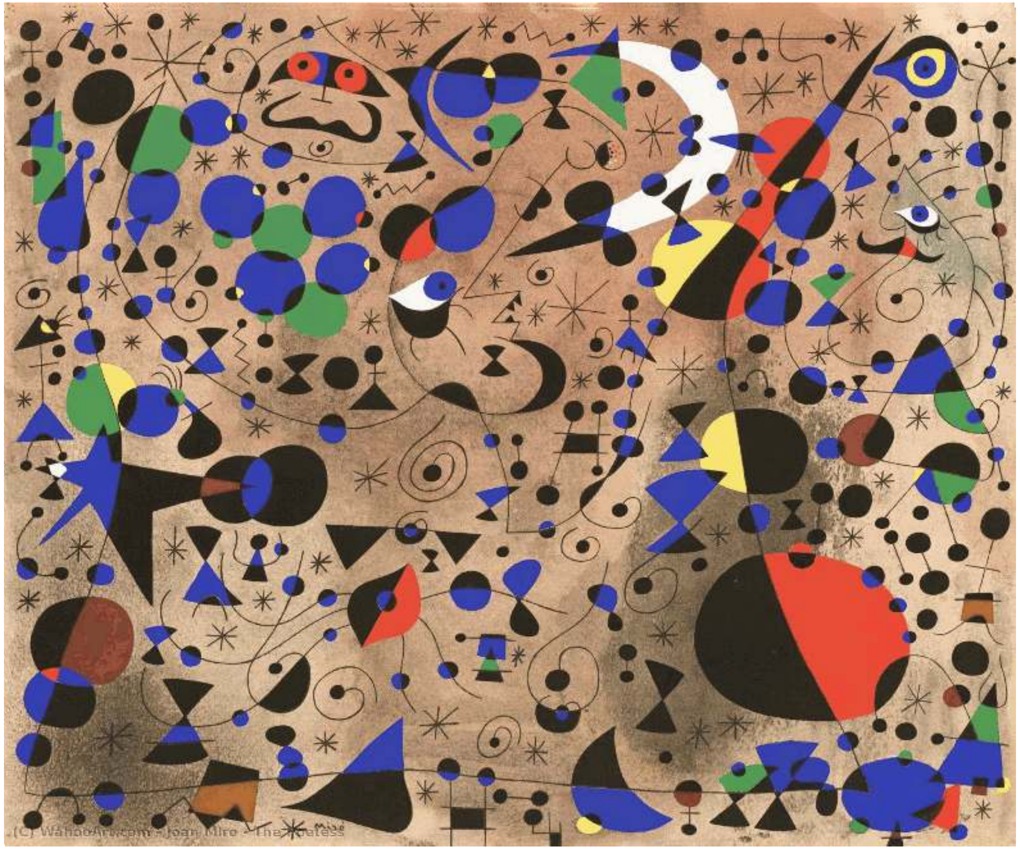
Does the landscape predicts radiation?

- Describe the radiation from the landscape with
  - Acoustic power
  - Mean squared velocity



Does the landscape predicts radiation?

- Describe the radiation from the landscape with
  - Acoustic power
  - Mean squared velocity
  - Radiation efficiency



merci !