

Finding structure in chaos

Yuval Wigderson

Inaugural lecture

October 5, 2026

Confusion heard his voice, and wild uproar
Stood ruled, stood vast infinitude confined;
Till at his second bidding Darkness fled,
Light shone, and [order from disorder sprung](#).

John Milton, *Paradise Lost* III.710-714

Introduction

Overview

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The universe looks chaotic...

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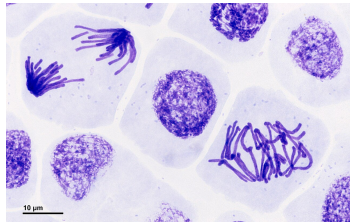
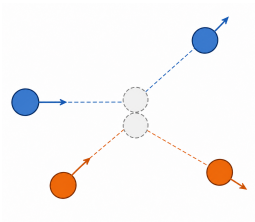
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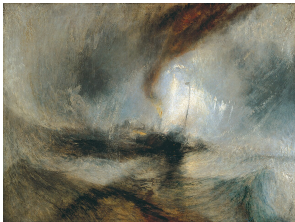


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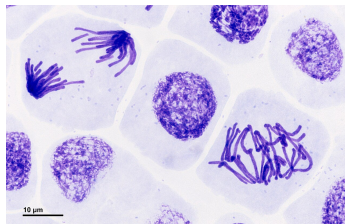
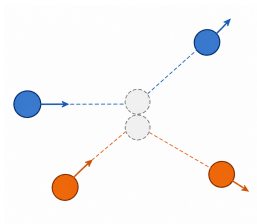


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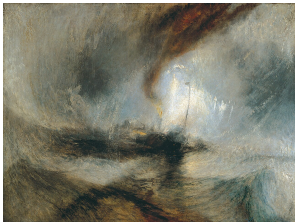
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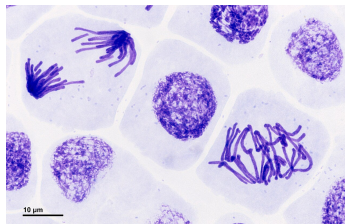
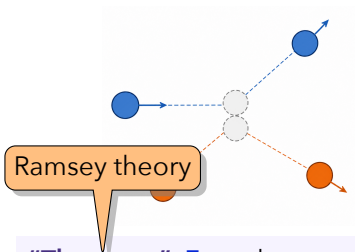
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Astronomy

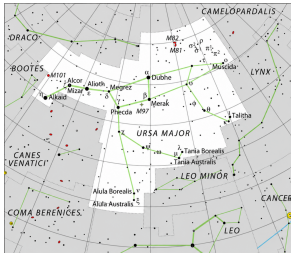
Constellations

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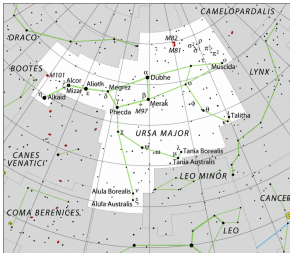
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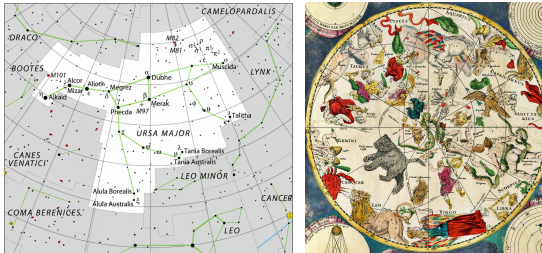
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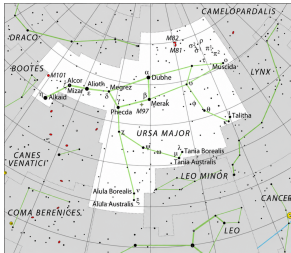
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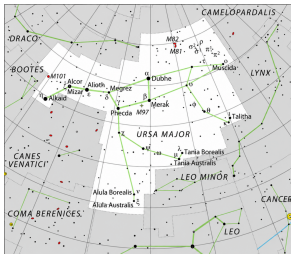
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[Furstenburg-Katznelson 1978]

You can find any shape you want in the stars.

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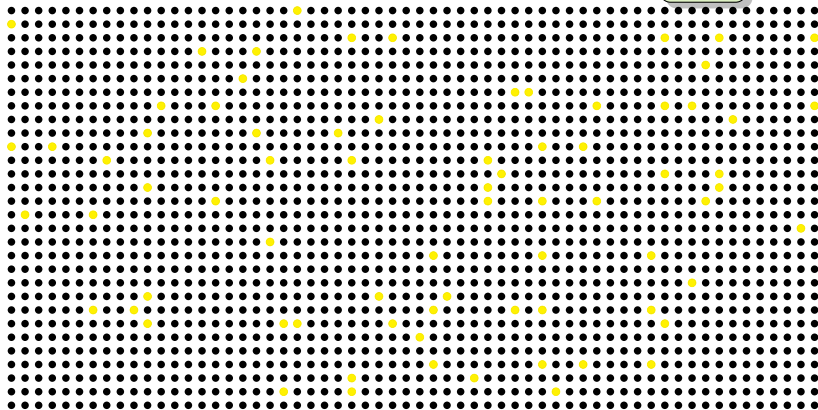
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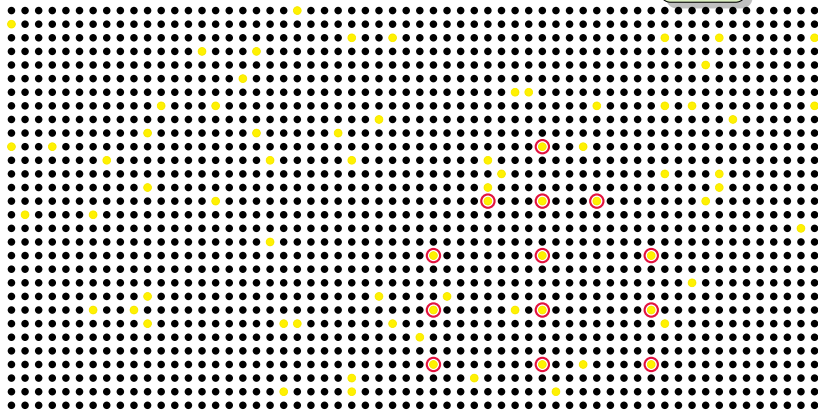
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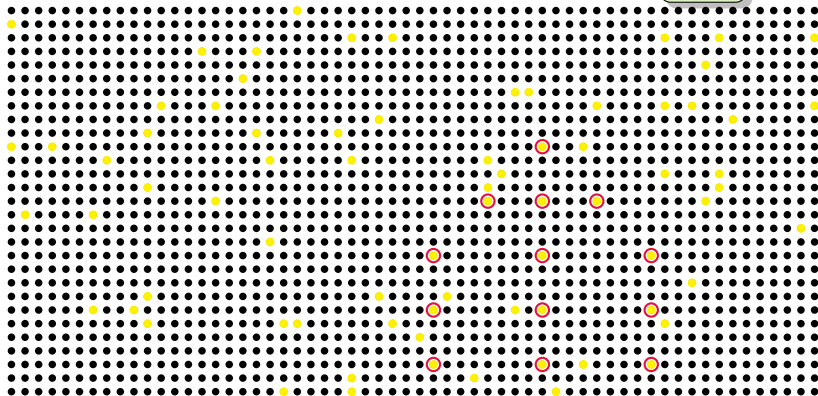
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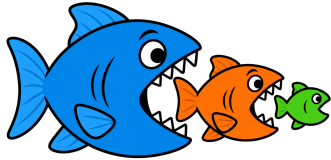


For any star density and shape, a sufficiently large sky contains it.

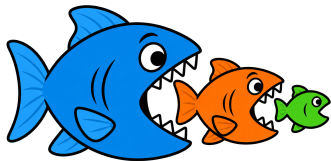
Biology

Rock-paper-scissors

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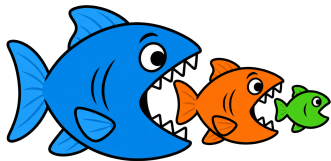


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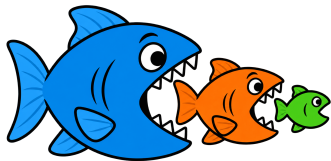
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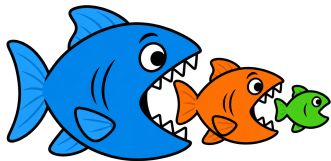
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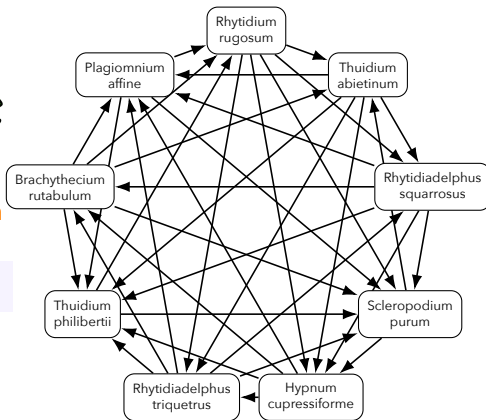
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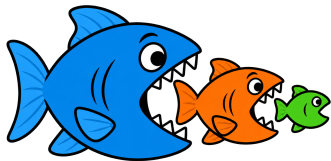
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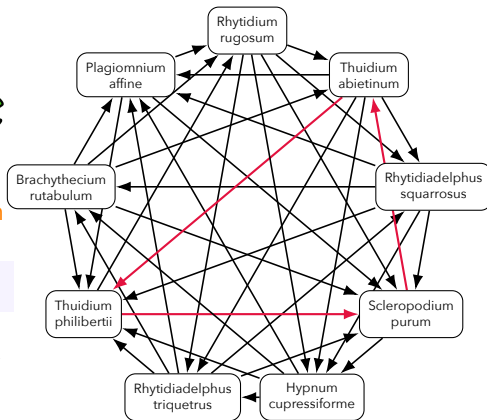
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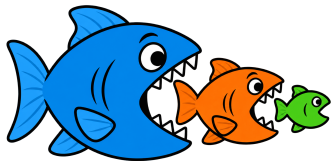
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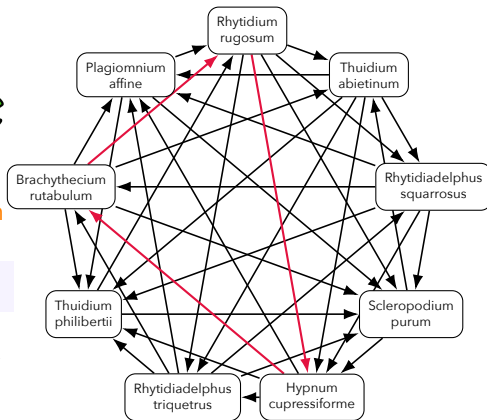
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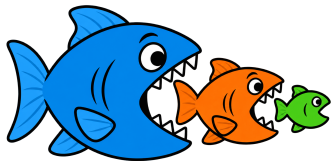
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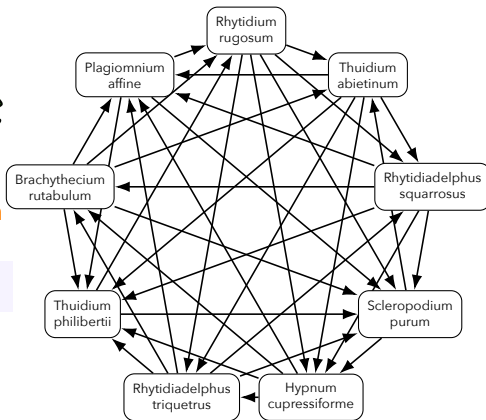
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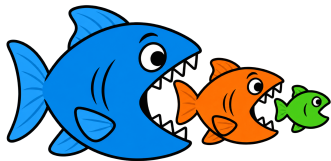


Theorem

[Rédei 1934]

One can **always** sort the species so A beats B beats C ...

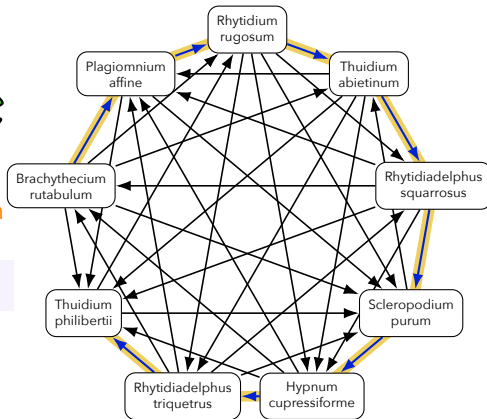
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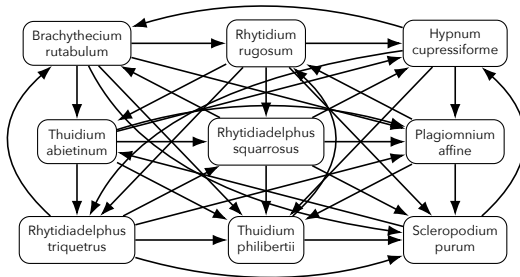
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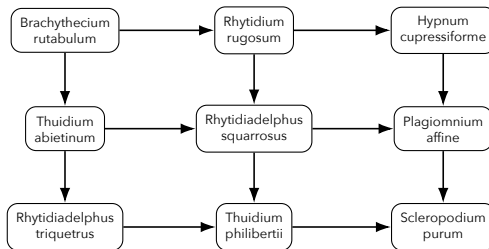
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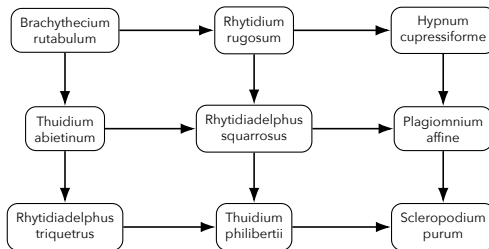
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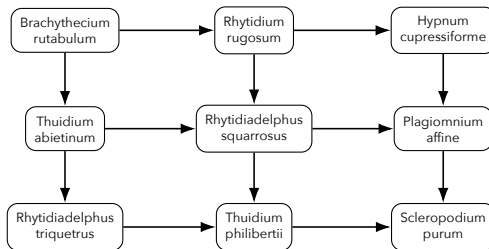


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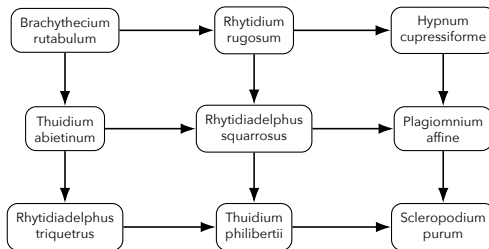


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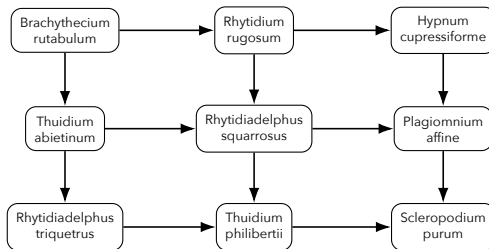
[Bradač–Morawski–Sudakov–W. 2025]

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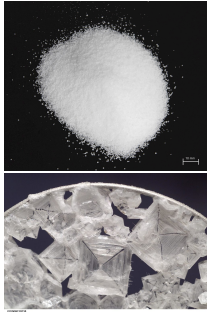
Chemistry

Crystals

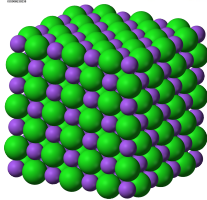
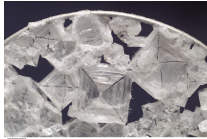
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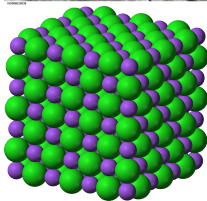
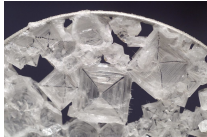
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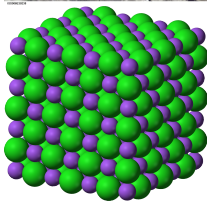
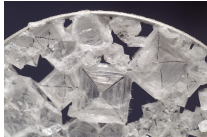


Crystals



Crystal family	Lattice system	Point group (Hermann-Mauguin)	14 Bravais lattices (Pearson symbol)			
			Primitive	Base-centered	Body-centered	Face-centered
Triclinic		$\bar{1}$				
Monoclinic		$2/m$				
Orthorhombic		mmm				
Tetragonal		$4/mmm$				
Hexagonal	Rhombohedral	$\bar{3}m$				
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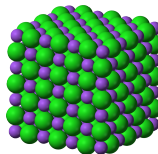
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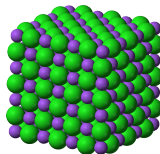


NaCl

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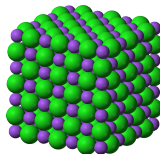


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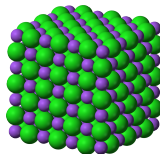


NaF NaCl NaBr

A pattern

It is difficult to **predict** the crystal structure of a given compound...
but clear patterns emerge.

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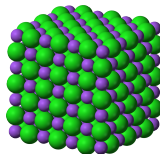


LiCl
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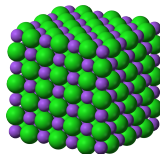


LiF LiCl LiBr LiI
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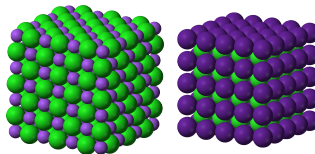


LiF LiCl LiBr Lil
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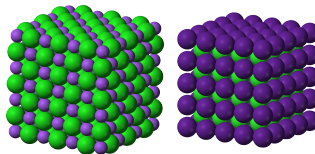


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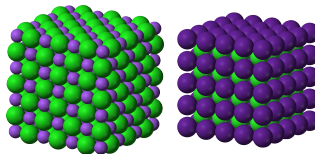
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Theorem

[Kővári-Sós-Turán 1954, Erdős-Rado 1956]

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Ramsey numbers

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We don't really care about the exact values.

We care about the remarkable phenomenon that patterns are always guaranteed to exist.

Conclusion

Astronomy, again

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