

# A MATHEMATICAL WELCOME to CoLab

Jonathan M  
Borwein **FRSC**



Canada Research  
Chair & Director



Canada Research  
Chairs

Chaires de recherche  
du Canada

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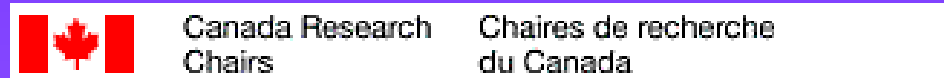
♠ I shall touch on three **'mathematical-ish' threads**<sup>1</sup>

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- ★ **Conceptualizing** – mathematical modelling and real-time distributed visualization/decision making

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- ★ **Conceptualizing** – mathematical modelling and real-time distributed visualization/decision making
- ★ **Computing** – parallelization and gridification
- ★ **Communicating and Collaborating** – ACEs (Advanced Collaborative Environments) and Caves

<sup>1</sup> **Tom Lehrer** locally, with permission

# PROMISES & PITFALLS

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- ★ . . . and a link to **CoLab** photo plus some **prototypical demos**

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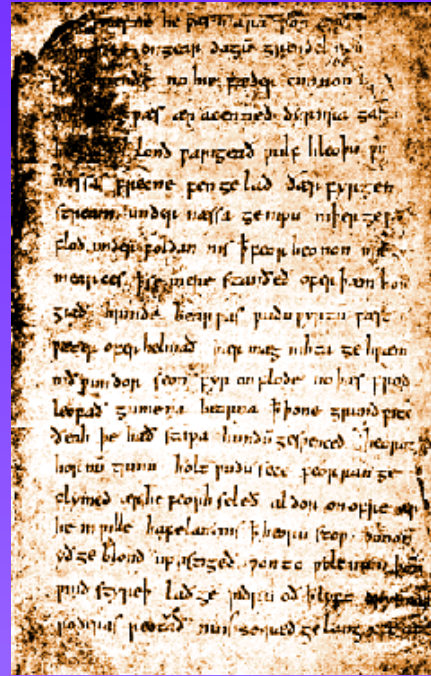
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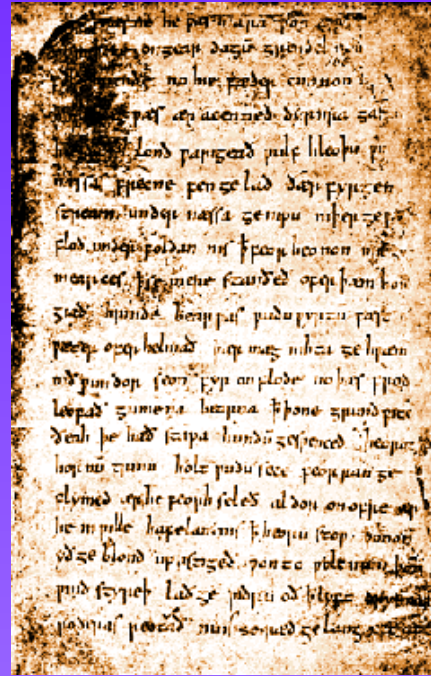
- ★ ... and a link to **CoLab** photo plus some **prototypical demos**
- **What will a large linear (nonlinear) system be in three years?**

# THE BEOWULF SAGA



The digital future *must*  
recapture the past (digitally)

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The digital future *must*  
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- And it helps to understand the present!

## MODERN COMPUTING



SFU's new **Top500** 'hot' 192cpu **Beowulf** cluster was home built for under **\$250K US**

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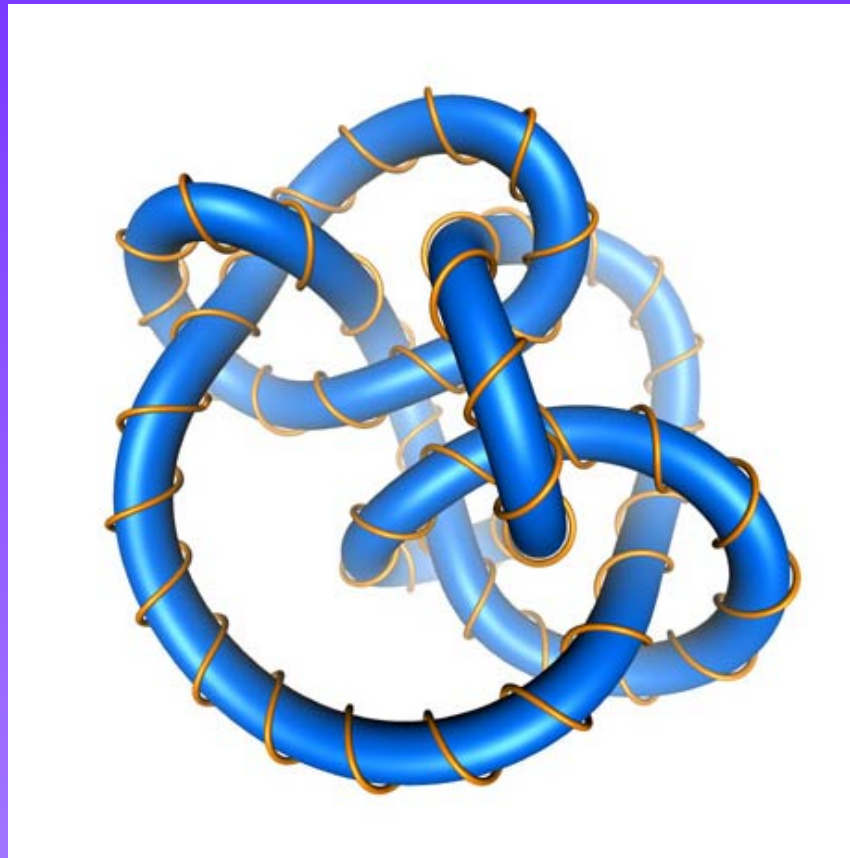
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- How to access these at **reasonable (human and dollar) costs?**

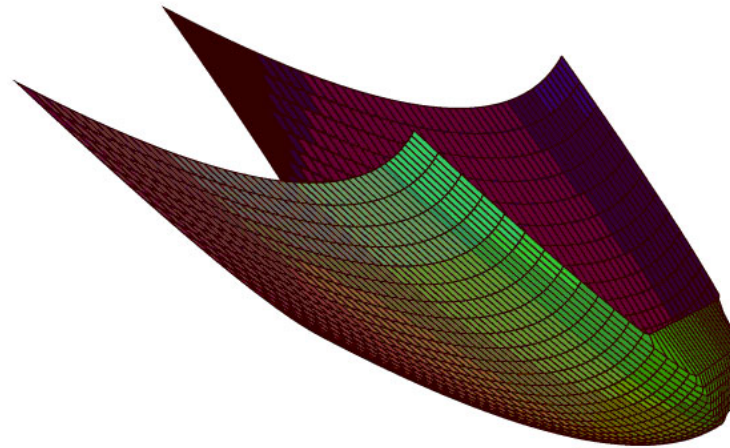
# THREE DIMENSIONAL SPATIAL KNOTS



In the NewMIC 'Cave'

# AND PALPABLE STRUCTURES

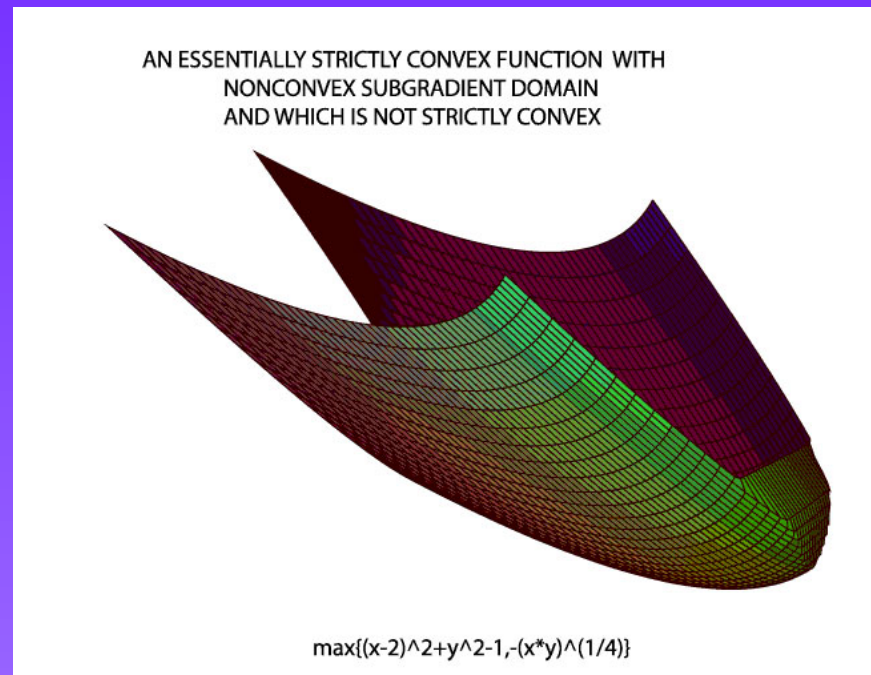
AN ESSENTIALLY STRICTLY CONVEX FUNCTION WITH  
NONCONVEX SUBGRADIENT DOMAIN  
AND WHICH IS NOT STRICTLY CONVEX



$$\max\{(x-2)^2+y^2-1, -(x*y)^{1/4}\}$$

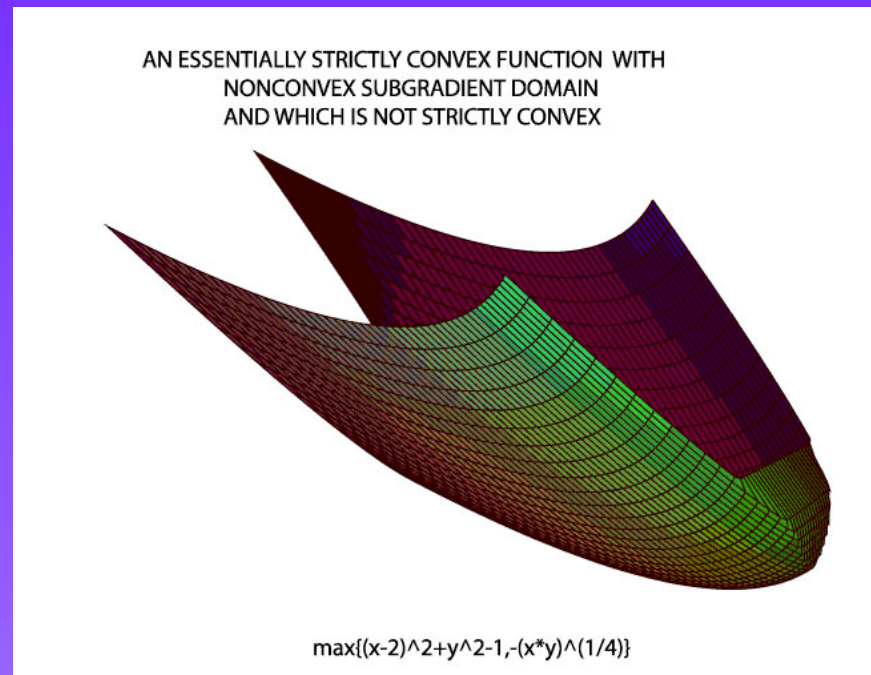


# AND PALPABLE STRUCTURES



$$f(x, y) := ((x - 2)^2 + y^2 - 1) \vee -\sqrt[4]{xy}$$

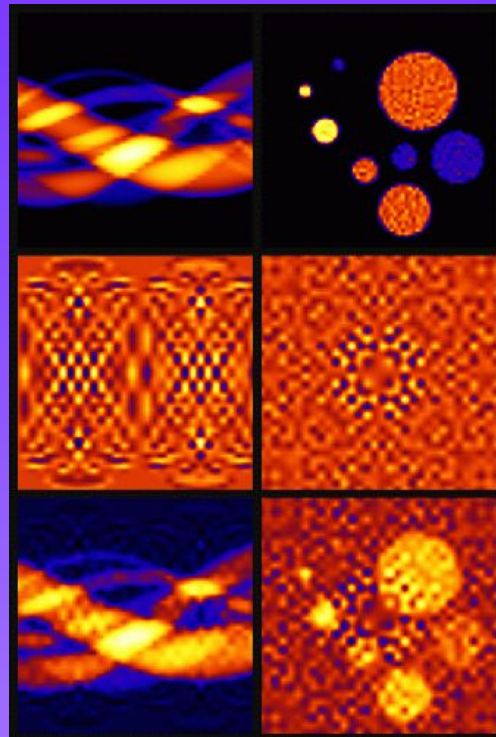
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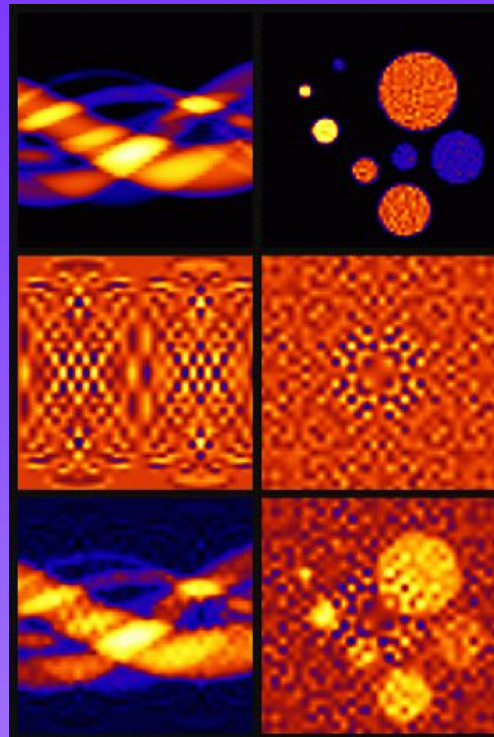
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- When appropriately **educated**, **seeing** is believing

# QUALITY OF RECONSTRUCTIONS

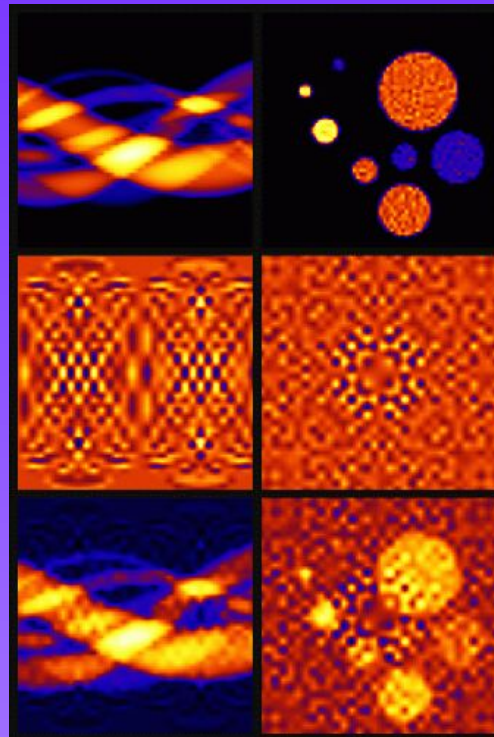


# QUALITY OF RECONSTRUCTIONS



Ideal Information      Sinogram Information

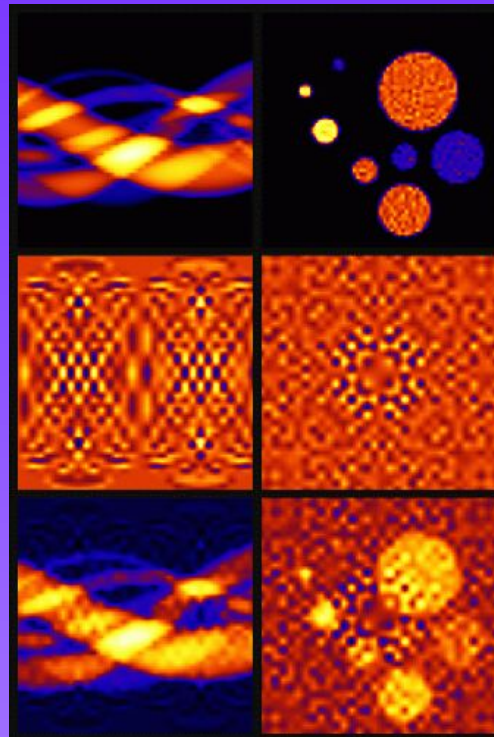
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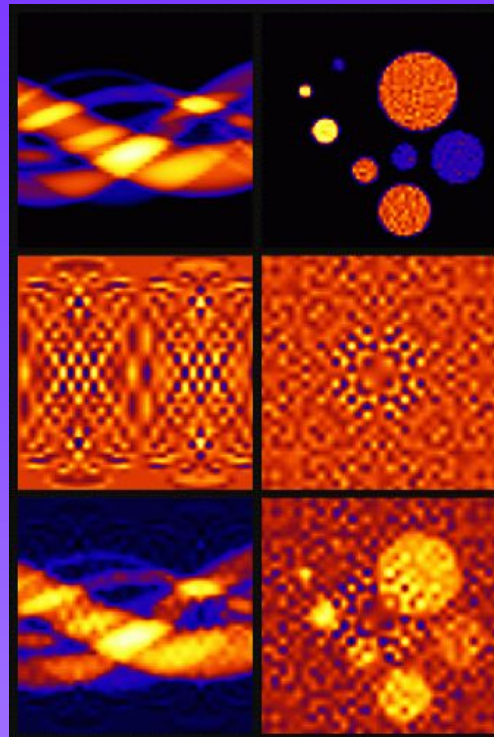


Ideal Sinogram  
Information

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when Combined

# QUALITY OF RECONSTRUCTIONS



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- **Space and Speed** allow for **Quality** to come to the fore

# CINDERELLA'S DYNAMIC PROOFS

♠ Mathematics is changing

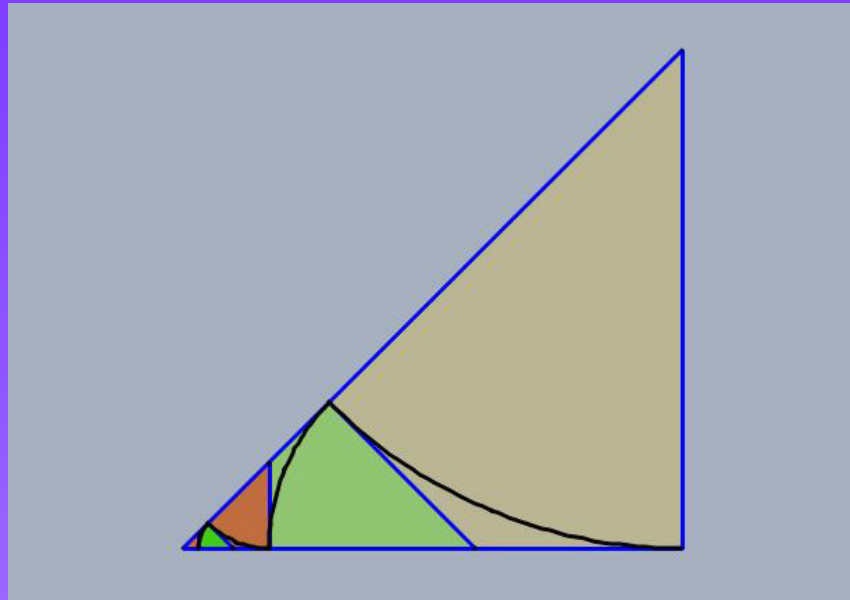


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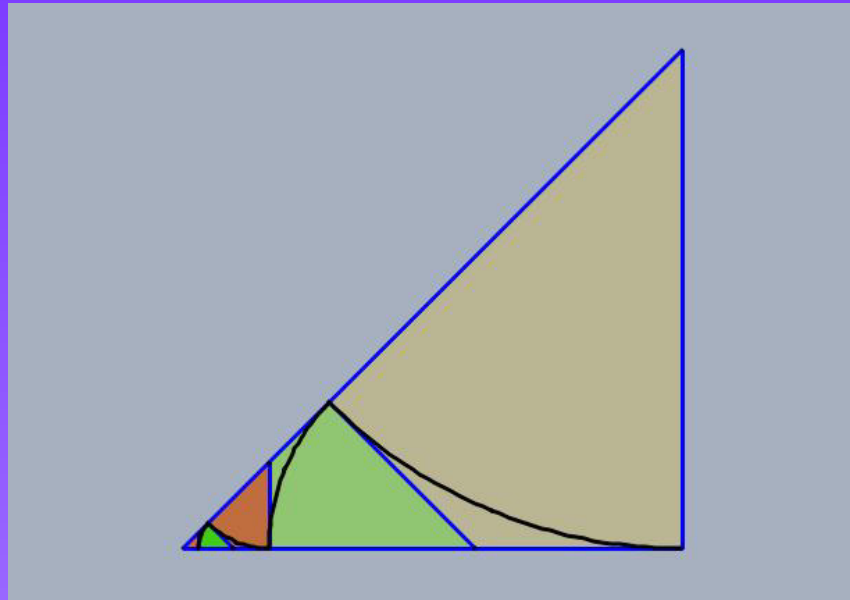
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A proof that  $\sqrt{2}$  is irrational

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- **Inter-disciplinarity** is much more possible (e.g., **pseudo spectra**)

## A DISCLAIMER

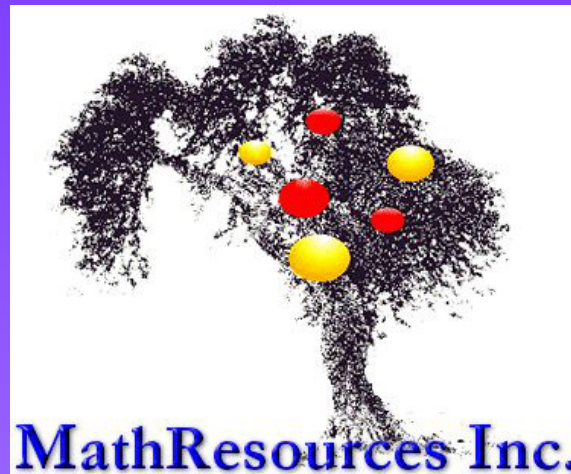
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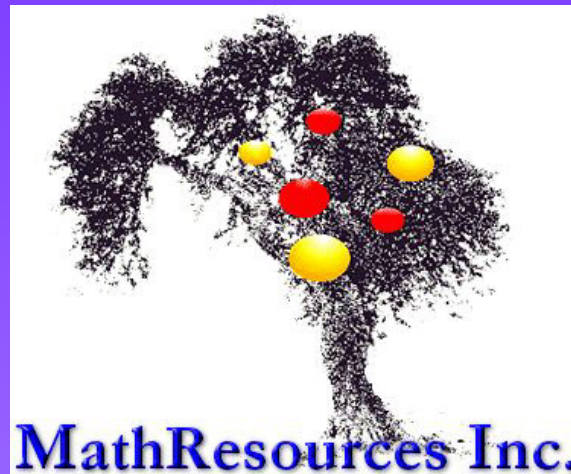
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## THOMAS JEFFERSON

**“If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called an idea, which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of everyone, and the receiver cannot dispossess himself of it.**



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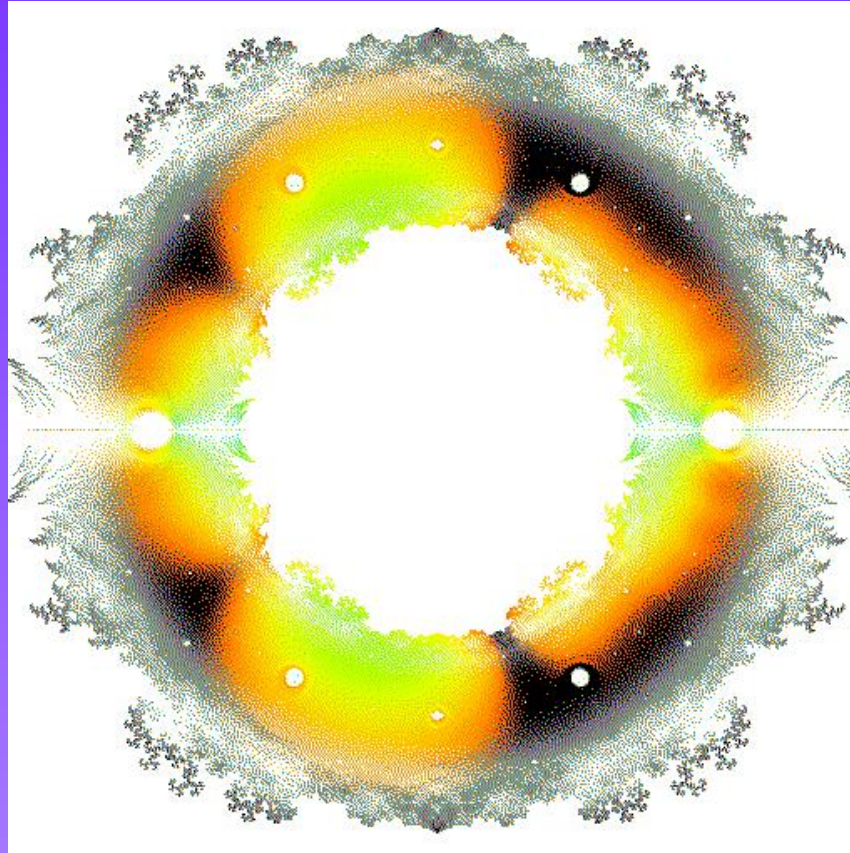
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Its peculiar character, too, is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me, receives instruction himself without lessening mine; as he who lites his taper at mine, receives light without darkening me.<sup>2</sup>

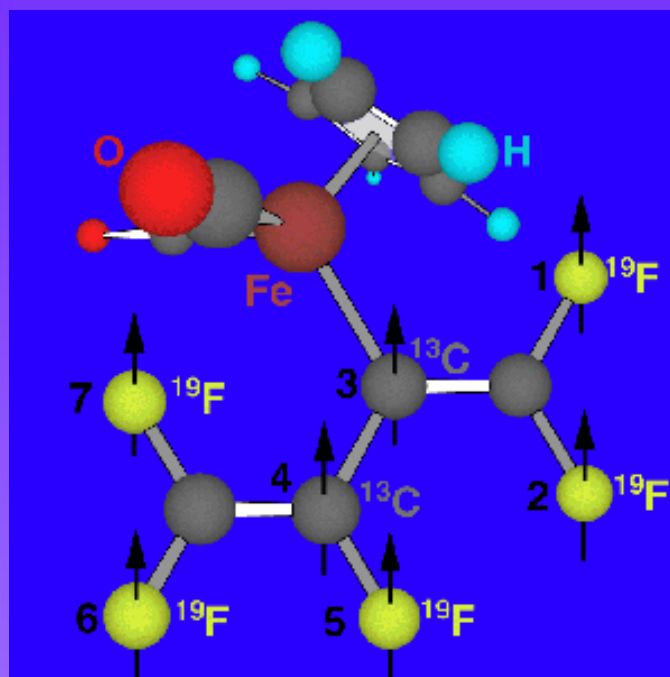
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<sup>2</sup> See my [Quotations page](#)

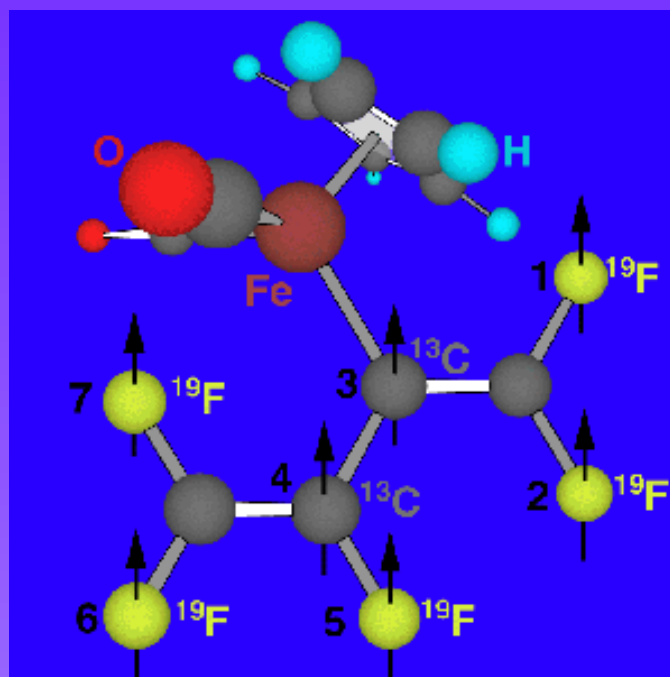
# CHAOS IN ROOTS



# THAT'S IT, EXCEPT IF ...



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- Quantum computing goes macro!<sup>3</sup>

<sup>3</sup> The 2001 factorization of 15 using  $10^{20}$  molecules at IBM

# REPTILIAN PARALLELISM



**Two heads are not always better than one!**

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- **Thank you to all who have helped build CoLab.**