Publication Culture in Mathematics in the age of Open Access
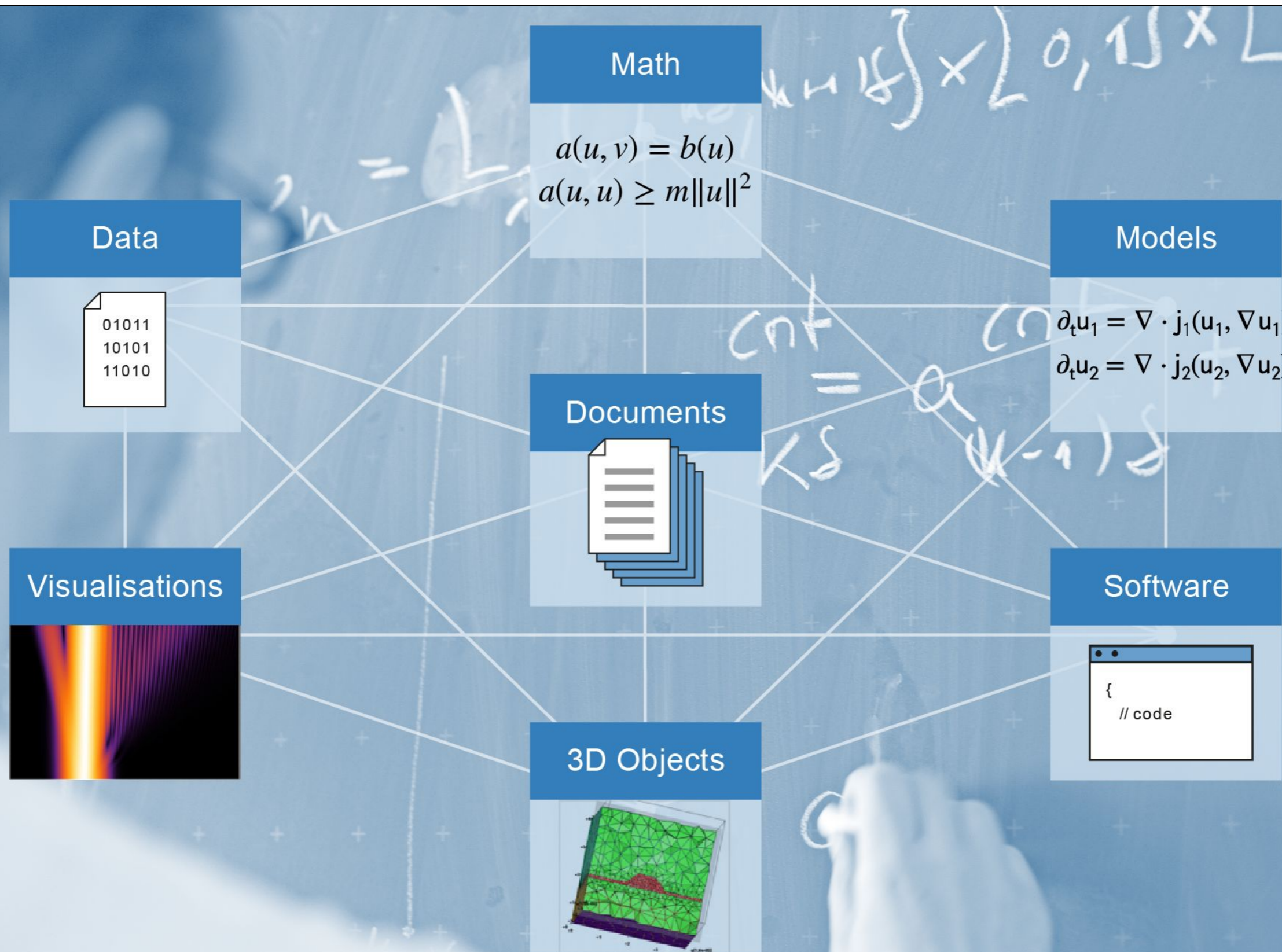
Daniel Mietchen, FIZ Karlsruhe & MaRDI: The Mathematical Research Data Initiative
Wissenschaftliche Publikationskulturen im Zeitalter von Open Access @ ThULB Jena
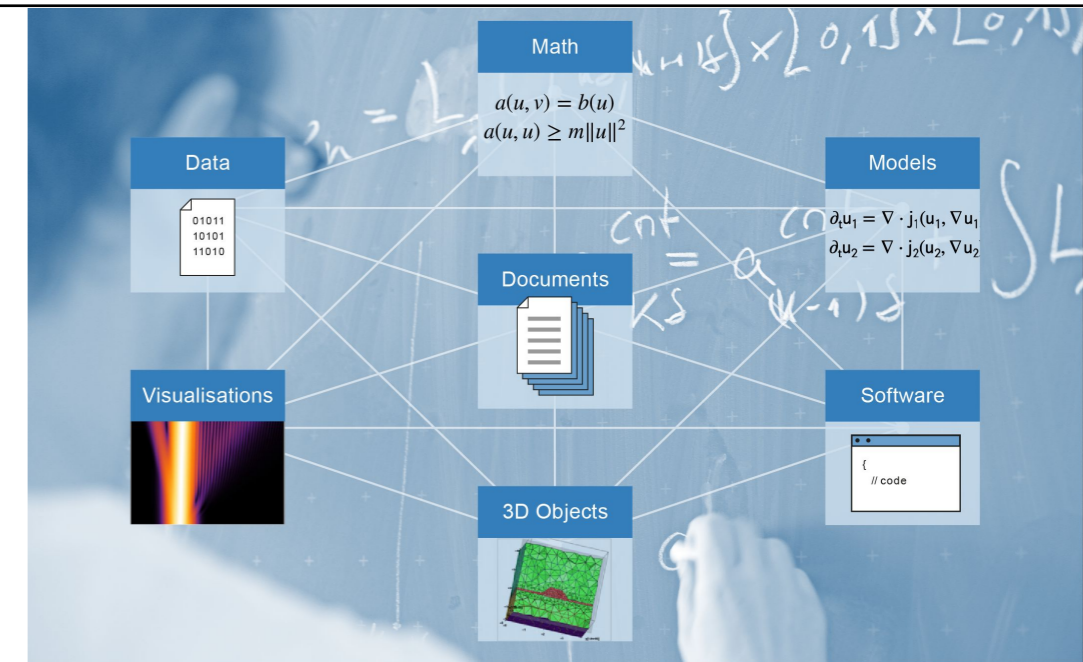30 November 2023 - DOI: 10.5281/zenodo.10225500

Structure of the talk

- Outputs of mathematical research
- Publication landscape in mathematics
- Dimensions of openness in mathematics
- A transition example: zbMATH Open
- Discussion invited throughout
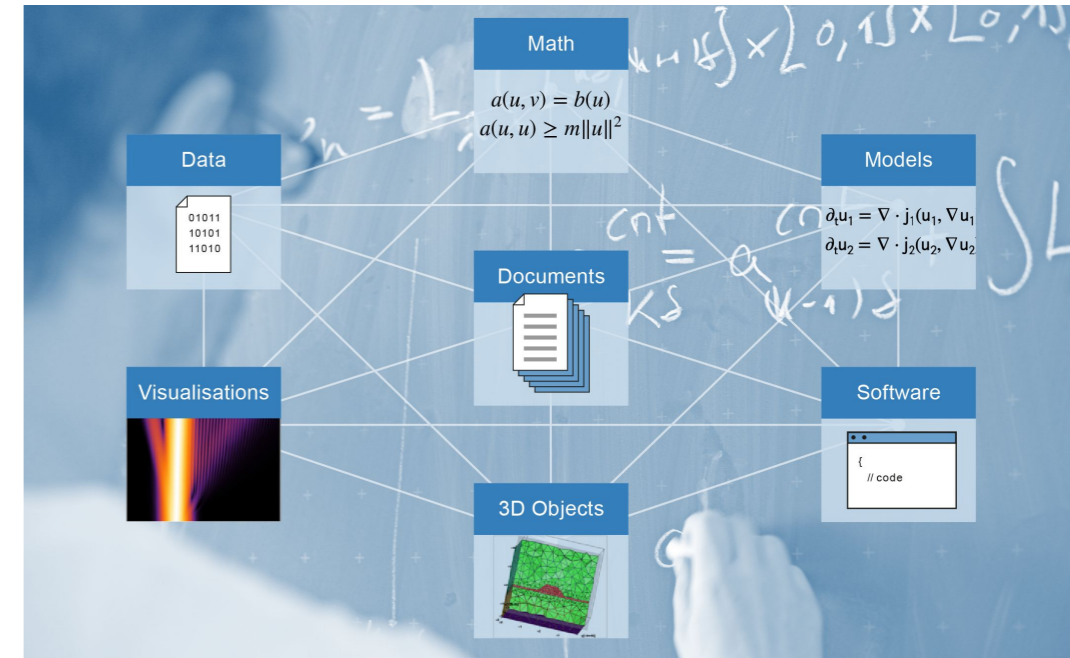
Outputs of mathematical research

Math

- Mathematical expressions
  - Equations
  - Inequations
- Definitions
- Theorems
- Conjectures
- Lemmas
- Proofs
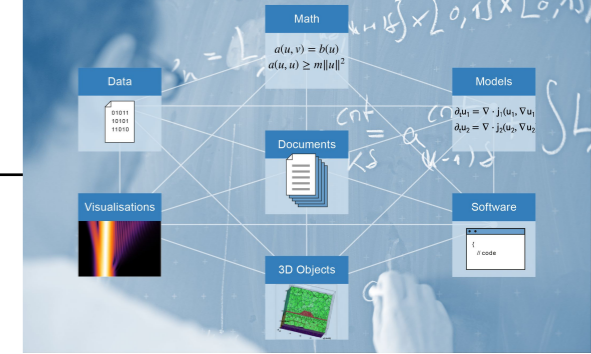- Structures
- Algorithms
- Models
- ...

Models

- Sets of mathematical statements connected via some shared variables
- Types
  - mathematical models
    - statistical model
    - logical model
    - …
  - computational models
  - disciplinary adaptations
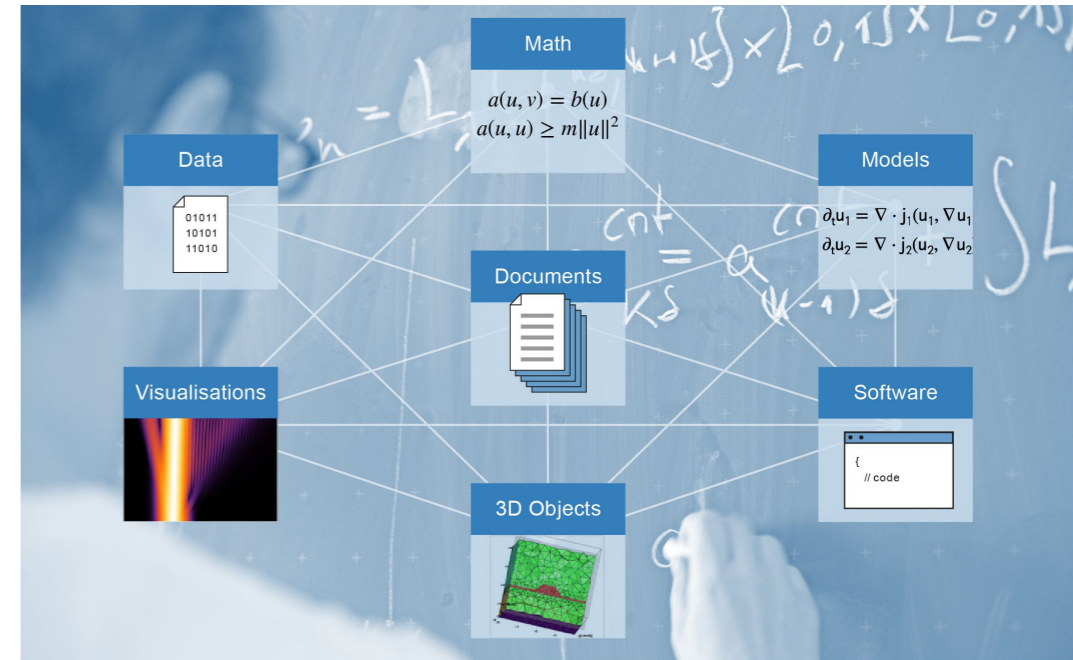   - climate model
    - economic model
    - …

Data

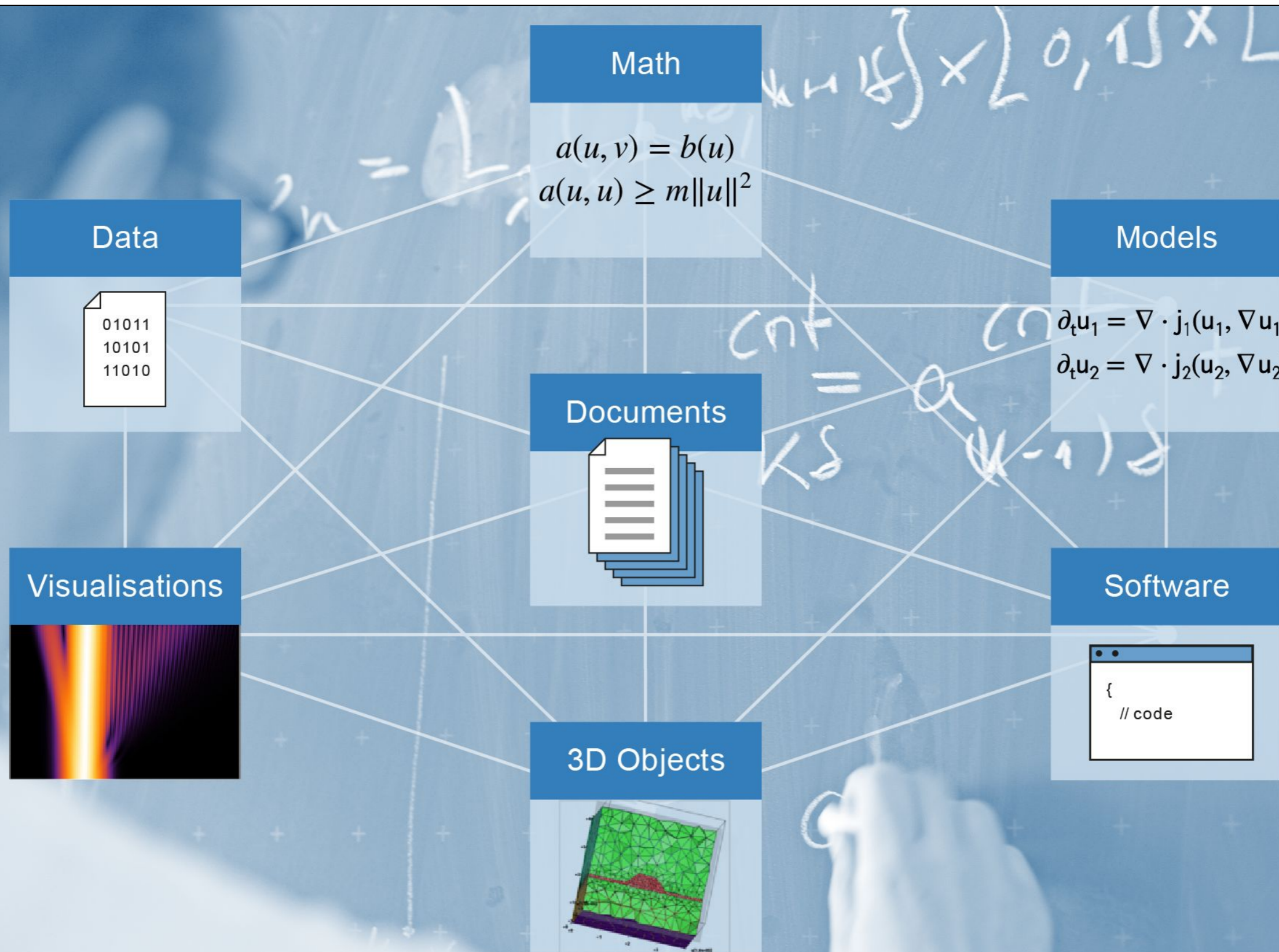| Category	Types	Description
Symbolic data	Formulae, Theorems, Proofs, Functions	Mathematical expressions, theorems, proofs, and functions represented using symbolic notation.
Numeric data	(Integer) number sequences, Matrices, Tensors, Finite lattices	Numerical values, matrices, lattices used in mathematical modeling and analysis.
Geometric data	Curves, Surfaces, High-dimensional objects, Polytopes	Objects and structures used in geometry and related fields, such as curves, surfaces, and high-dimensional objects, e.g. manifolds.
Models	Math models, BioModels	Abstractions of real-world phenomena used to make predictions and test hypotheses.
Observational data	Simulations, Experiments, Observations	Empirical data collected through experiments, simulations, and observations of natural phenomena.
Text data	arXiv.org, EuDML, Encyclopedia of Math	Written and digital sources of mathematical research, including papers, books, and online resources.

Conrad et al. (2023). Making Mathematical Research Data FAIR: A Technology Overview. DOI: 10.48550/arXiv.2309.11829

Documents

- Journal articles
- Preprints
- Conference papers
- Books
- Book chapters
- White papers
- Software descriptions
- Data descriptions
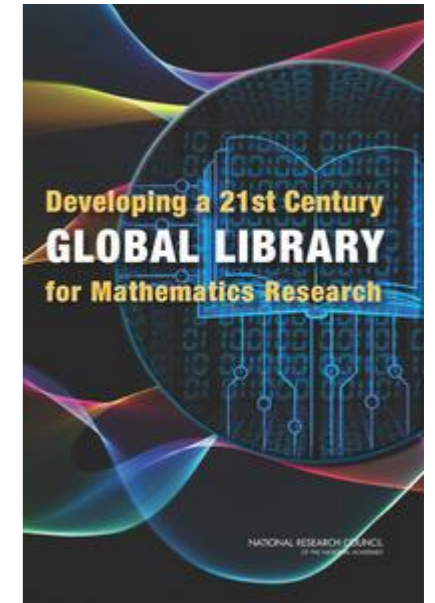- Computational notebooks
- Grant proposals
- ...

Publication landscape in mathematics
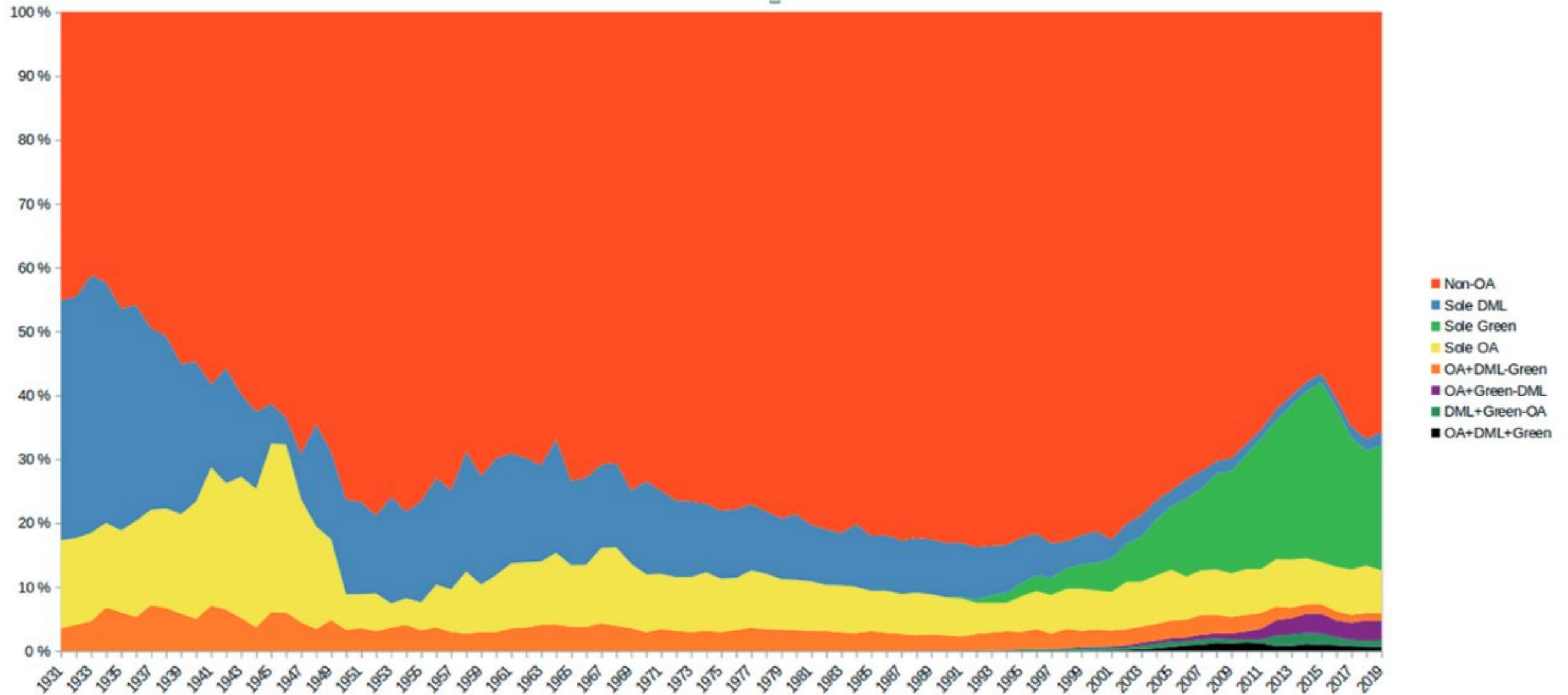
Publication landscape in mathematics

- Similar to other disciplines, except for
  - preprints often standing alone
  - preprints often with LaTeX source code
  - new business models
    - arXiv consortium of user institutions
    - subscribe to open
      - European Mathematical Society journals
- Databases dedicated to mathematical objects
  - Digital Library of Mathematical Functions
  - Online Encyclopedia of Integer Sequences
  - Archive of Formal Proofs
  - Database of Ring Theory
  - Encyclopedia of Graphs
  - zbMATH/ swMATH

Developing a 21st Century
GLOBAL LIBRARY
for Mathematics Research

NATIONAL RESEARCH COUNCIL

Dimensions of openness in mathematics

- Open Access to publications
  - free to read
    - common, especially via preprints
    - Elsevier boycott
    - for machines (LaTeX/ MathML / formula search)
  - openly licensed
    - still rare but increasing
- Open data
  - common in some areas, rare in others
- Open-source software
  - increasingly common
- Open process
  - still rare, but examples like Polymath projects
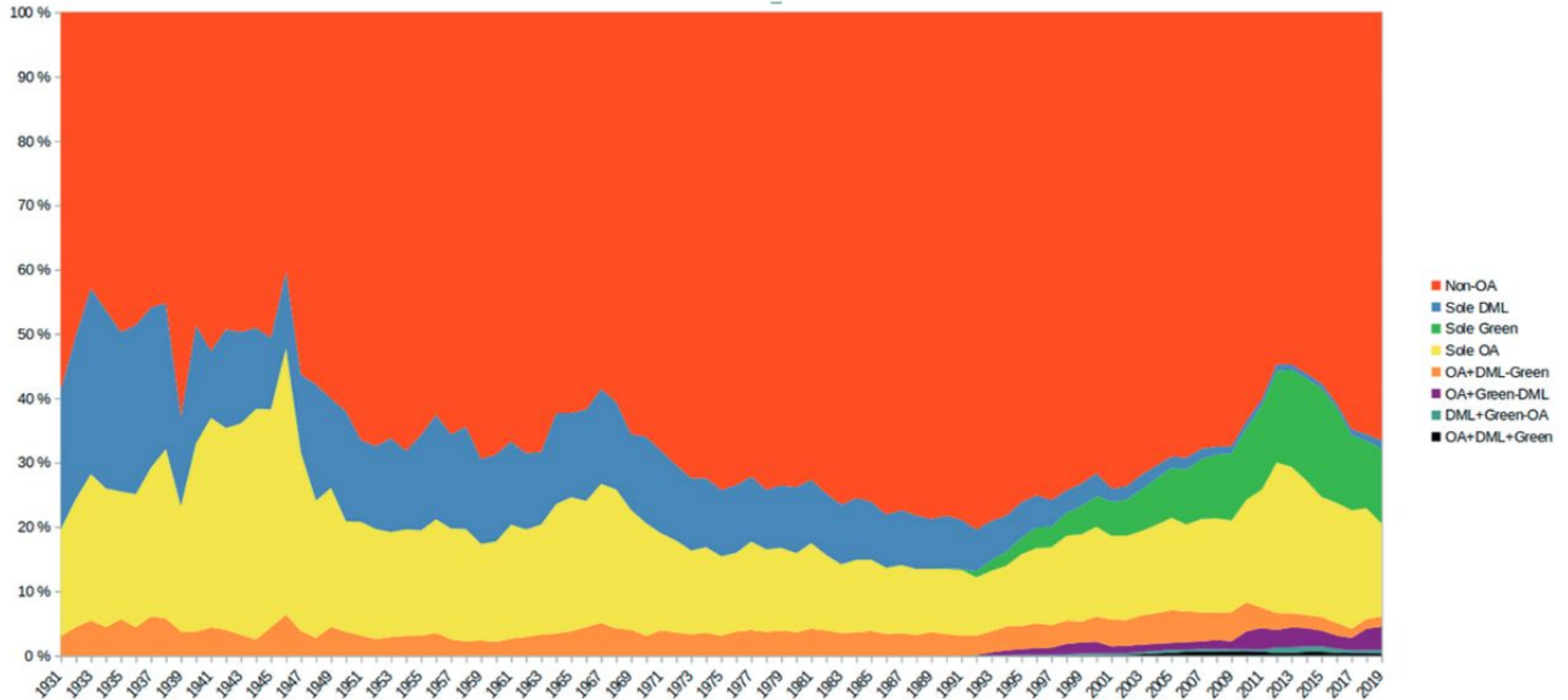
Open Access in math journals over time

Share of different OA resources for digitally available core math journal articles
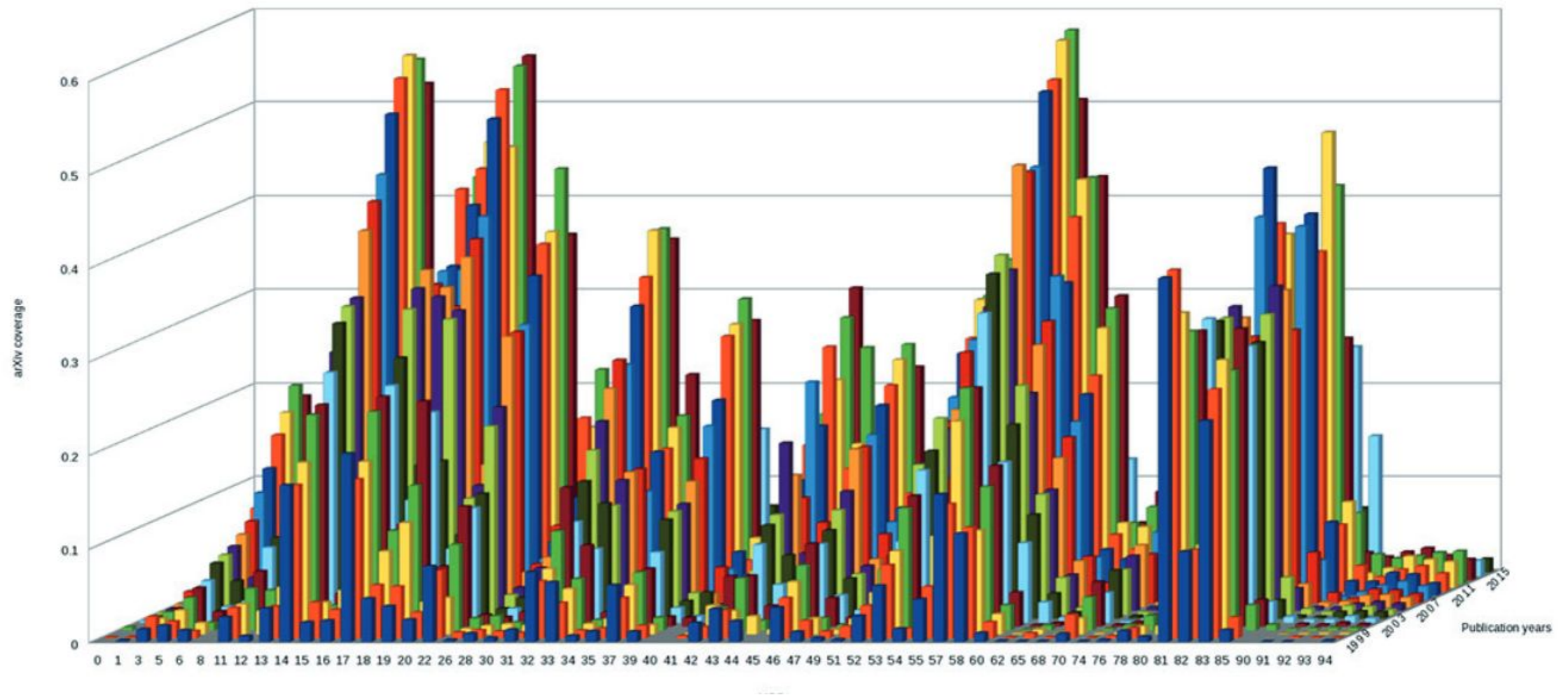
A transition example: zbMATH Open

- started 1931 as "Zentralblatt für Mathematik und ihre Grenzgebiete"
- electronic since 1980, print discontinued in 2013
- back issues until about 1820
- 2021: zbMATH ⇒ zbMATH Open
- metadata about
  - mathematical publications
    - their authors
    - associated software (swMATH)
- started out as subscription database
- recently converted to free-to-read
- conversion to open licensing is ongoing
- centrally curated but open to community contributions

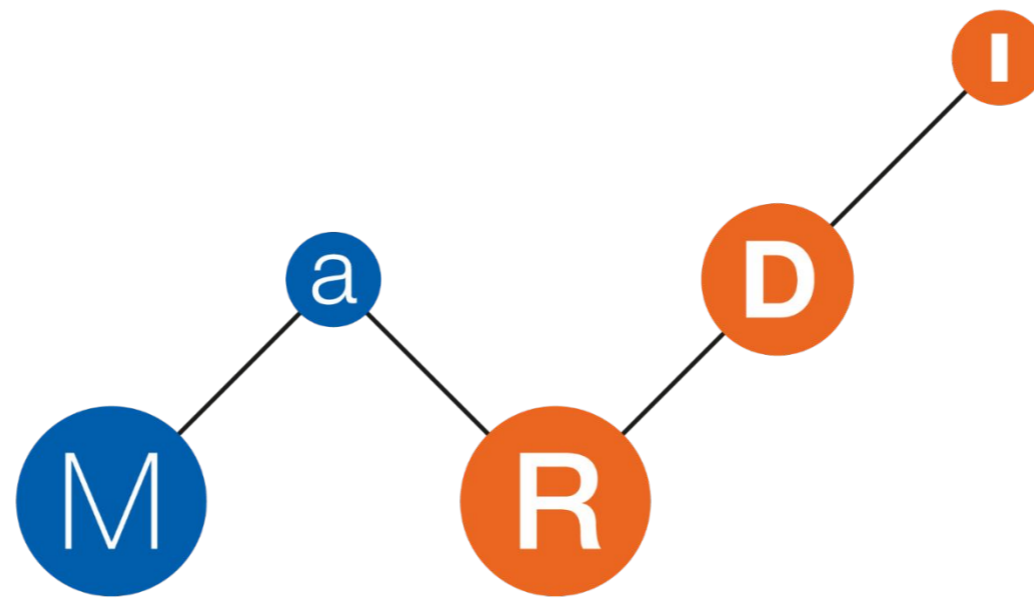# Open Access in zbMATH over time

Share of different OA resources for digitally available journal articles indexed in zbMATH

Overlap between arXiv and zbMATH

Percentage of arXiv papers covered in zbMATH, by main Mathematical Subject Classification classes for publication years 1999–2017

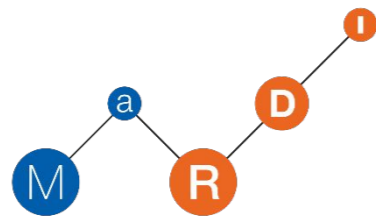# MaRDI: The Mathematical Research Data Initiative

https://mardi4nfdi.de/
https://portal.mardi4nfdi.de/

Thank you!

contact:

daniel.mietchen@fiz-karlsruhe.de

https://mastodon.social/@EvoMRI