http://origami.science
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https://github.com/neyrinck/

Mark C. Neyrinck

Resumé

Ikerbasque Fellow
Univ of the Basque Country,
Bilbao, Spain

Born in Colorado; Citizen of USA

Principal Achievements, Expertise and Media

- Discovered Voronoi/Delaunay computational geometry similarities linking the network of the cosmic web (the cellular spatial structure in the universe), origami, and architectural structures such as trusses, spiderwebs, and trees, as well as . Related to tessellations and segmentations of spatial images and spatial **graph theory**.
  - Appeared and worked on visuals and script for the NOVA program "The Origami Revolution", https://rmpbs.pbslearningmedia.org/resource/buac17-912-sci-ess-nvtorcosmicfold/wgbh-nova-the-origami-revolution-cosmic-folding/
  - The Cosmic Spiderweb on All Dark-Matter-Haloes' Eve, *The Huffington Post*
  - The Geometry of the Cosmic Web and the Flow of Primordial Information through It, Santa Fe Institute seminar, Jan 2018
  - "How to Make an Origami Universe," Battersby, Stephen, *New Scientist*
  - "The Origami Cosmic Web of Galaxies," invited blog post, *The Huffington Post*
- Creative visualization, sonification and tactilization (e.g. 3D printing and modeling)
- Pioneered several methods for point-set and **image analysis** (feature detection, segmentation and classification, related to the large-scale arrangement of matter and galaxies)
- Developed novel **statistical uncertainty quantification techniques,** e.g. demonstrating why Gaussianization, the image-analysis technique, works so well to make images more informative and comprehensible

Education

Ph.D., M.S., Astrophysical and Planetary Sciences, University of Colorado at Boulder
Ph.D. Thesis: "Illuminating the Tips of Dark-Matter Icebergs" **(Thomas Award)**
B.A. Physics, w/spec. in Astro, **University of Chicago (Honors; Lewis Prize)**
Mathematics, Part IB, Pembroke College, **Cambridge University**

Software expertise

- Developed several software packages: publicly available cosmological halo-finders VOBOZ and ORIGAMI; the CosmicEmuLog emulator; CosmoPy, Python toolkit for cosmology; "Fold Your Own Universe" cosmology NASA SpaceApp; "sectional-tess" computational geometry package for cosmology, architecture, origami, and network science
- Developer in Python on a daily basis; Proficient in C, Mathematica, SQL; Experienced in Java, Perl, Lisp, SQL, C++, Inform, R

Selected Symposia, Awards, Grants, and Professional Service

- Invited participant, Science Foo Camp, Google HQ *June 2018*
- NASA proposal review panels *2011-2015*
- **PI, Templeton New Frontiers in Astronomy and Cosmology Award, $200,000**
  "Information Flowing and Folding into Complexity" *2012-2014*
- **Richard N. Thomas Award**, annual award for outstanding research by a graduating CU-Boulder Astrophysics PhD student
- **Lewis Prize**, "**best graduating senior in physics," University of Chicago**

Employment

Ikerbasque Fellowship, Univ of the Basque Country, Bilbao, Spain *Spring 2018-*
Postdoctoral Fellow, Institute for Computational Cosmology,
Durham University, UK *Summer 2016-Fall 2017*
Associate Research Scientist, Johns Hopkins University Physics and Astronomy Dept
Institute for Data-Intensive Engineering and Science (IDIES) *Fall 2014-Summer 2016*
Course Instructor, "Origami Mathematics and Cosmology", JHU *Winter 2015*
Assistant Research Scientist, Johns Hopkins University *Summer 2011-Fall 2014*
W. M. Keck Fellow, Johns Hopkins University *Fall 2008-Summer 2011*
Postdoctoral Researcher, Institute for Astronomy, U. of Hawaii *Fall 2005-Summer 2008*
Course Instructor, "Black Holes", Astrophysics Dept., U. of Colorado *Summer 2005*

Leadership, Collaboration, Communication

- Frequently supervised PhD and undergraduate students, in group meetings and individually
- Lead and contributed to small and large collaborations of both local and international teams, on dozens of papers
- Participated in collaborations of hundreds of scientists
- Founded, then led a weekly cosmology discussion group at Johns Hopkins for several years
- Collaboratively evaluated proposals on several NASA proposal review panels
- Over 100 presentations, seminars, and classes; instructor at Johns Hopkins and CU Boulder

Selected Academic Papers **(Google Scholar: over 80 entries, over 3280 citations, h-index 25. Links in blue)**
Computational geometry/Feature-detection/image analysis algorithms:

Neyrinck et al. 2018,
The cosmic spiderweb: equivalence of cosmic, architectural and origami tessellations
Libeskind, … Neyrinck et al. 2018, Tracing the cosmic web (cosmic web classifier/feature detection comparison project)
Ivkin, … Neyrinck et al 2018, Scalable Streaming Tools for Analyzing N-body Simulations: Finding Halos and Investigating Excursion Sets in One Pass
Neyrinck, Falck & Szalay 2015, ORIGAMI: Delineating Cosmic Structures with Phase-Space Folds
Falck, Neyrinck & Szalay 2012, ORIGAMI: Delineating Halos Using Phase-space Folds
Neyrinck 2008, ZOBOV: a parameter-free void-finding algorithm

Understanding through improved statistics:

Neyrinck et al 2009,
Rejuvenating the Matter Power Spectrum: Restoring Information with a Logarithmic Density Mapping-
Discovery paper of the Gaussianization approach in large-scale structure statistics, essentially explaining why altering the "histogram" in an image works so well in improving information content