Publication List – Davide Michieletto

School of Physics and Astronomy, University of Edinburgh, UK
davide.michieletto@ed.ac.uk | www2.ph.ed.ac.uk/∼dmichiel

Summary: 27 published papers, 260 citations, h-index 10.
△ Publication highlights and for which I clarify their importance and my contribution.
[n] Denotes number of citations as reported by Google Scholar.

[0] **D. Michieletto**, N. Gilbert *Role of nuclear RNA in regulating chromatin structure and transcription*, **Current Opinion in Cell Biology**, **58** 120 (2019)
△ [0] E. Orlandini, D. Marenduzzo, **D. Michieletto***, *Synergy of topoisomerase and structural-maintenance-of-chromosomes proteins creates a universal pathway to simplify genome topology*, **Proc. Natl. Acad. Sci. USA**, 10.1073/pnas.1815394116 (2019) ***Corresponding Author** Maintaining the genome unknotted and unlinked is crucial for the life of the cell. In spite of its importance, no model can explain how this is achieved in vivo. In this paper we show that one possible mechanism is the synergy of SMC and TopoII enzymes. I conceived the model, performed the simulations, led the analysis and wrote the paper. Orlandini performed simulations, analysed the results and helped in the writing. Marenduzzo contributed to the discussion and commented the paper.
△ [0] **D. Michieletto***, M. Lusic, D. Marenduzzo, E. Orlandini, *Physical Principles of Retroviral Integration in the Human Genome*, **Nature Comm.**, **10** (575), (2019) ***Corresponding Author** In this work we draw an unprecedented connection between the process of retroviral integration and polymer physics. I conceived the project, designed the polymer model for HIV integration, performed the simulations, analysed the results and wrote the paper. Orlandini performed simulations and analysed the data. Marenduzzo contributed to the discussion and helped writing the paper. Lusic contributed to the discussion and commented the paper.
△ [1] R. Fitzpatrick, **D. Michieletto**, C. Hauer, C. Kyrillos, B. J. Gurmessa, R. M. Robertson-Anderson, *Synergistic interactions between DNA and actin trigger emergent viscoelastic behavior*, **Phys. Rev. Lett.**, **121** 257801 (2018) Using a combination of experiments and simulations, we describe the rheology and viscoelastic properties of blends of DNA and actin. I have fully designed the computational models, performed and analysed large-scale simulations. Fitzpatrick performed the experiments, Robertson-Anderson conceived the project and wrote most of the paper. We jointly interpreted the results.
△ [6] **D. Michieletto***, M. Chiang, D. Colì, A. Papantonis, E. Orlandini, P. R. Cook, D. Marenduzzo, *Shaping Epigenetic Memory via Genomic Bookmarking*, **Nucleic Acids Res.**, **46**, 1(2018) ***Corresponding Author** We extend a model established in Michieletto et al PRX 2016 to explain how genomic bookmarks can regulate the interplay of epigenetics and genome folding. I conceived the idea of using bookmarks, designed the model, led the project and data interpretation and wrote the paper. Chiang and Coli performed the simulations. Orlandini, Marenduzzo, Papantonis and Cook contributed to the discussion and helped writing the paper.

[12] C.A. Brackley, J. Johnson, **D. Michieletto**, A. Morozov, M. Nicodemi, P.R. Cook, D. Marenduzzo, *Extrusion without a motor: a new take on the loop extrusion model for genome organisation*, **Nucleus**, **9**, 1(2018)

[1] S. Iubini, E. Orlandini, **D. Michieletto**, M Baiesi, *Topological Sieving of Rings According to Their Rigidity*, **ACS Macro Lett.**, **7**, 12 (2018)
△ [9] **D. Michieletto***, N. Nahali, A. Rosa*, *Glassiness and Heterogeneous Dynamics in Dense Solutions of Ring Polymers*, **Phys. Rev. Lett.**, **119**, 197801(2017) ***Joint Corresponding Author** Extended the ideas of Michieletto and Turner, PNAS 2016 in the case of systems of rings at different concentrations. A. Rosa and I conceived the idea and designed the simulations. We all performed simulations and analysed the data. A Rosa and I wrote the paper.

[7] **D. Michieletto***, E. Orlandini, D. Marenduzzo, *Epigenetic Transitions and Knotted Solitons in Stretched Chromatin*, **Scientific Reports**, **7**, 14642(2017) ***Corresponding Author**
△ [3] Y. A. Fosado, **D. Michieletto**, D. Marenduzzo, *Dynamical Scaling and Phase Coexistence in Topologically-Constrained DNA Melting*, **Phys. Rev. Lett.**, **119**, 118002(2017) ***Joint First Author** We theoretically and computationally explored a new model to explain the phase transition observed in denatured DNA. Marenduzzo conceived the project. Fosado performed the simulations. I did the theoretical and numerical solution of the dynamical equations and the numerical calculation of the phase diagram.

[22] C. A. Brackley, J. Johnson, **D. Michieletto**, A. Morozov, M. Nicodemi, P. Cook, D. Marenduzzo, *Non-equilibrium chromosome looping via molecular slip-links*, **Phys. Rev. Lett.**, **119**, 138101(2017)

[4] **D. Michieletto***, E. Orlandini, D. Marenduzzo, M. S. Turner, *Ring Polymers: Threadings, Knot Electrophoresis and Topological Glasses*, **Polymers**, **9**, 349(2017) ***Corresponding Author**

[16] C. Brackley, B. Liebchen, **D. Michieletto**, F. Mouvet, P. Cook, and D. Marenduzzo, *Ephemeral protein binding to DNA shapes stable nuclear bodies and chromatin domains*, **Biophys. J.**, **112**, 1085(2017)
△ [26] **D. Michieletto*** and M. S. Turner, *A Topologically Driven Glass in Ring Polymers*, **Proc. Natl. Acad. Sci. USA**, **113**(19), 5195(2016) ***Joint Corresponding Author** Threadings between ring polymers

in dense solutions have been conjectured to hinder their dynamics but no one could unambiguously detect this effect in simulations and experiments. I conceived the idea of borrowing a protocol used for studying colloidal glasses called "random pinning perturbations" to quantify topology-driven glassiness in solutions of rings and performed the simulations. Turner and I interpreted and analysed the data and wrote the paper.

△ [27] **D. Michieletto***, E. Orlandini and D. Marenduzzo, *Polymer model with epigenetic recolouring reveals a pathway for the* de novo *establishment and 3D organization of chromatin domains*, **Phys. Rev. X**, **6**, 041047(2016) ***Corresponding Author** Epigenetic modifications are mobile biochemical marks that affect how the genome is organised in cell. The interplay between epigenetic marks and genome folding is one of the most important and poorly understood phenomena in biology. Here I have conceived a way to describe this system as an extension of the 1D Ising model living on freely fluctuating polymers. This idea was inspired by earlier work on "magnetic polymers" done by Orlandini. I designed the computer code, run the simulation, performed the analysis. Marenduzzo, Orlandini and I interpreted the results and wrote the paper.

△ [12] **D. Michieletto**, *On the Tree-Like Structure of Rings in Dense Solutions*, **Soft Matter**, **12**, 9485(2016) Ring polymers do not follow the same universal scaling of linear polymers in dense solutions. To understand the difference in structure, in this paper I have generalised the equation for the writhe of a curve in space to detect branched and tree-like substructures in the conformations of ring polymers in solution.

[9] Y. A. G. Fosado, **D. Michieletto**, J. Allan, C. A. Brackley, O. Henrich, and D. Marenduzzo, *A Single Nucleotide Resolution Model for Large-Scale Simulations of Double Stranded DNA*, **Soft Matter**, **12**, 9458(2016)

△ [8] **D. Michieletto**, D. Marenduzzo, E. Orlandini, *Topological Patterns in Two-Dimensional Gel Electrophoresis of DNA Knots*, **Proc. Natl. Acad. Sci. USA**, **112**(40), E5471(2015) ***Corresponding Author** How DNA knots diffuse within a gel is of central importance for ubiquitous techniques such as gel electrophoresis. In spite of its importance, no model could predict the patterns observed in gels. Here we show that these can be explained accounting for entrapments due to dangling ends. I formulated the hypothesis, designed and run the simulations, designed the simplified random walk model. Orlandini, Marenduzzo and I interpreted the data and wrote the paper.

△ [13] **D. Michieletto***, D. Marenduzzo, E. Orlandini, *Is the Kinetoplast DNA a Percolating Network of Linked Rings at its Critical Point?*, **Phys. Biol.**, **12**, 036001(2015) ***Corresponding Author** The kinetoplast DNA is the mitochondrial genome of a parasite that is unique in nature. I autonomously conceived the idea of understanding its topology using a model for linked rings under confinement. I designed and performed simulations and analysed the data. Marenduzzo, Orlandini and I interpreted the results and wrote the paper.

[10] **D. Michieletto**, M. Baiesi, E. Orlandini, M. S. Turner, *Rings in Random Environments: Sensing Disorder Through Topology*, **Soft Matter**, **11**, 1100(2015)

[35] **D. Michieletto**, D. Marenduzzo, E. Orlandini, G. P. Alexander, M. S. Turner, *Threading Dynamics of Ring Polymers in a Gel*, **ACS Macro Lett. 3**, 255(2014)

[17] **D. Michieletto**, D. Marenduzzo, E. Orlandini, G. P. Alexander, M. S. Turner, *Dynamics of Self-Threading Polymers in a Gel*, **Soft Matter**, **10**, 5936(2014)

[6] Y. Timofeeva, S. Coombes, **D. Michieletto** *Gap junctions, dendrites and resonances: a recipe for tuning network dynamics*, **The Journal of Mathematical Neuroscience 3**, 15(2013)

Books & Outreach

D. Michieletto and M.S. Turner, A Taste for Anelloni, **Physics World**, December 2014

D. Michieletto, Topological Interactions in Ring Polymers, *Outstanding Theses*, **Springer**, 2016