## The IAMP Early Career Award for 2015

Prof. Hugo Duminil-Copin (University of Geneva)

Citation: *For his fundamental contributions in the rigorous analysis of critical phenomena,*
in particular for establishing the critical point in the two-dimensional random cluster model and for the proof of continuity of the magnetization at the critical temperature in the ferromagnetic Ising model.
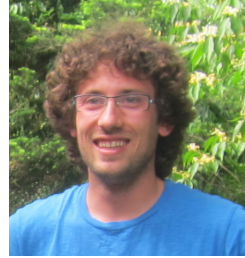
The prize was established by the IAMP in 2006, to be awarded at the ICMP congresses, in recognition of a single achievement in Mathematical Physics. It is reserved for scientists of age 35 years or less, on July 31 of the year of the Congress. Its previous laureates were:

2009 Mihalis Dafermos
2012 Artur Avila

The 2015 Prize Committee consisted of:
Laszlo Erdős (Chair), Giovanni Felder, Vojkan Jaksic, Jens Marklof, Gunther Uhlmann

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Laudatio

delivered by Michael Aizenman (Princeton Univ.)
at the ICMP 2015, Santiago de Chile, 27 July 2015.

It is a pleasure and honor to speak in praise of Professor Hugo Duminil - Copin and to congratulate him in the name of our association on his accomplishments so far.

Hugo received his professional education in Paris and Geneva:
  2003-2005 Lycée Louis-Le-Grand (preparatory classes),
  2006-2008 École Normale Supérieure (MA Univ. Paris XI)
  2008 - 2012 PhD studies at Univ. Geneva (with S. Smirnov).
Since then he has been in University of Geneva, advancing in two years to the rank of Full Professor (2014).

His research concerns topics in mathematical physics which interface with probability, complex analysis and combinatorics. His contributions have already been recognized in international prizes: 2012 Rollo Davidson Prize (joint with V. Beffara) and 2013 Oberwolfach Prize, and he was invited to give a plenary talk at the 36th SPA conf., the 2015 Collège de France Cours Peccot, and a plenary talk at this ICMP 2015.

In his earlier mathematical works Hugo focused on the nature of phase transitions in 2D lattice models in particular models with stochastic geometric content, such as Bernoulli percolation, self-avoiding walks, Ising, Potts and O(n)-models.

He has also worked on random walks in random environment, internal diffusion limited aggregation, and bootstrap percolation.

Techniques which he has applied and advanced include probabilistic methods for the study of geometric representations of these models (random cluster methods, random currents, Russo Seymour Welsh analysis), and also discrete holomorphic observables.

The key results derived in these works include:

- full derivation of the honeycomb lattice connectivity constant ($\sqrt{2 + \sqrt{2}}$),

- "sharpness of the phase transition" in general 2D Fortuin-Kasteleyn models (previously proven only for independent percolation and Ising models),

- divergence of the correlation length as $T \searrow T_c$ for the $Q \leq 4$ Potts models (in 2D),

- conformal invariance in certain critical systems,

- threshold phenomena (e.g. in bootstrap percolation).

More recently, Hugo turned to critical behavior beyond planar models, including the more elusive 3D for which one of the cited results was obtained:

- Continuity of the spontaneous magnetization at T_c ($\lim_{T \nearrow T_c} M(T) = 0$) for the three dimensional Ising model.

This is not the place for a full presentation of Hugo's mathematical works. More can be learned from his plenary lecture, and can also be found in the review articles which he has penned. To list some of his publications (over 40 at the moment):

1. (with S. Smirnov) The connective constant of the honeycomb lattice equals $\sqrt{2 + \sqrt{2}}$. Ann. Math., **175**, 1653-1665 (2012).

2. Divergence of the correlation length for critical planar FK percolation with $1 \leq q \leq 4$ via parafermionic observables. J. Phys. A: Math. Theor., **45**, (2012).

3. (with A. C. D. van Enter) Sharp metastability threshold for an anisotropic bootstrap percolation model, Ann. Prob., **41**, 1218-1242 (2013).

4. (with C. Lucas, A. Yadin and A. Yehudayoff) Containing Internal Diffusion Limited Aggregation. Electr. Comm. Prob., **18**, 1-8 (2013).

5. (with I. Manolescu) The phase transitions of the planar random-cluster and Potts models with $q \geq 1$ are sharp. Prob. Th. Rel. Fields. (Online First 2015).

6. (with C. Garban and G. Pete) The near-critical planar FK-Ising model. Comm. Math. Phys., **326**, 1-35 (2014).

7. (with M. Aizenman and V. Sidoravicius) Random Currents and Continuity of Ising Model's Spontaneous Magnetization. Comm. Math. Phys., **334**, 719-742 (2015).

8. (with V. Sidoravicius and V. Tassion) Continuity of the phase transition for planar Potts models with $1 \leq q \leq 4$. (arxiv.org/pdf/1505.04159; 60 pages).

In August 2015 Hugo will celebrate his 30'th birthday. Were his collaborators to join, among the attendants would be:

D. Ahlberg, M. Aizenman,
T. Alberts, J. Balogh,
R. Bauerschmidt, N. Beaton,
V. Beffara, I. Benjamini,
S. Benoist, B. Bollobás,
M. Bousquet-Mélou, D. Chelkak,
D. Cimasoni, L. Coquille,
A. van Enter, C. Garban,
J. de Gier, A. Glazman,
J. Goodman, T. Guttmann,
    and

A. Hammond, A. Holroyd, C. Hongler, D. Ioffe, A. Kemppainen, G. Kozma, C.Lucas, I. Manolescu, R. Morris, P. Nolin, R. Peled, G. Pete, W. Samotij, V. Sidoravicius, G. Slade, S. Smirnov, P. Smith, Y. Spinka, V. Tassion, Y. Velenik, A. Yadin, A. Yehudayoff.

Such a gathering could yield a rather good math-phys & probability meeting!

We wish Hugo Duminil-Copin a further productive career,

in the course of which he may continue enriching our field,

combining rigor with vigor - as is his hallmark.