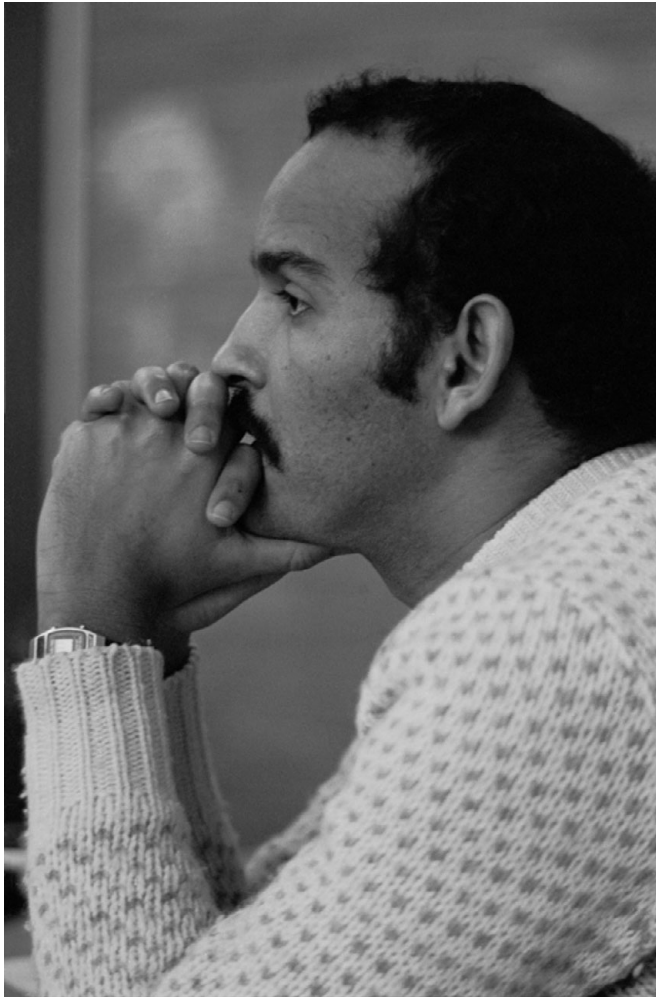# YAHYA OULD HAMIDOUNE
the Mauritanian mathematician
1948 – 11 March 2011

Yahya, Université Pierre et Marie Curie, 1982, © J. A. Bondy.

Yahya ould Hamidoune passed away in Paris on 11 March 2011 after a brief illness, leaving insufficient time for his friends and colleagues to express their indebtedness to him for his kindness and generosity, both in mathematics and in everyday life. Yahya was a discreet individual, always looking for the essential rather than the superficial, and certainly did not receive the recognition he deserved. May this modest testimony render justice to this singular man.

Yahya ould Hamidoune was born in Atar, Mauritania, officially in October 1947. In fact, as Yahya's brother explained to me, it was rather a year later, probably in the beginning of November 1948. During the 1950s, their father declared a false birthdate in order to allow Yahya to enter school a year earlier. His family belonged to the highly literate tribe of Owlad Daymân and his father was a famous encyclopædist, writing among other things the most celebrated book on Mauritania, an encyclopædia in 42 volumes entitled *La Vie Mauritanienne*.

At fifteen, Yahya went to Cairo, where he studied mathematics up to graduate level. In 1970, he returned to Nouakchott (the capital of Mauritania) and began teaching at the Lycée National, the most famous high school in Mauritania; at that time, there was no university in Nouakchott. But Yahya needed challenges, and loved playing games. He became the national champion of Mauritanian draughts. He also attained a high level in chess (as I recall, his Elo rating was about 2200), tarot, bridge and backgammon. At that time, Yahya was also involved in several revolutionary and anti-neocolonialist movements which shook Mauritanian society, and indeed the whole world, in the 1970s. He would pay the price for his involvement, spending several months in jail.

In 1975, Yahya sought a fresh intellectual challenge. He went to France and started his doctoral studies in graph theory with M. Las Vergnas at the Université Pierre et Marie Curie (Paris 6). Yahya's first publication, 'Sur les atomes d'un graphe orienté', appeared in the *Comptes Rendus de l'Académie des sciences* in 1977. He soon became an expert on graph connectivity and obtained his PhD ('Quelques problèmes de connexité dans les graphes orientés') in February 1978. He was admitted to the CNRS (Centre National de la Recherche Scientifique) as a full-time researcher in 1979, and joined C. Berge's group at Paris 6.

Until the mid-1980s, Yahya worked almost exclusively on connectivity problems. He developed a theory for directed graphs parallel to W. Mader's theory of fragments and atoms in graphs. Among other achievements, he gave in 1978 a proof of the Behzad–Chartrand–Wall conjecture in the case of vertex-transitive graphs. At that time, Yahya was also interested in combinatorial games and matroids, and published a good number of papers on these topics.

After reading H. B. Mann's book *Addition Theorems*, dealing with the theory of sumsets

$$\mathcal{A} + \mathcal{B} = \{a + b, \ a \in \mathcal{A}, \ b \in \mathcal{B}\},$$

for $\mathcal{A}$ and $\mathcal{B}$ two subsets of a group, Yahya realized that certain results of his on graph connectivity generalize, in a disguised form, some classical combinatorial results of additive number theory (at that time, this body of work was not yet called *additive combinatorics*). The *isoperimetric method* was born. Yahya proceeded to investigate, in a systematic way, the classical results of the theory, due to Cauchy and Davenport, Chowla, Olson, Mann, Shepherdson, Shatrowsky, Vosper, Kneser, Kemperman and others. He found new proofs, improvements, generalizations, and many applications of these theorems.

Yahya particularly appreciated challenges, which explains why he loved studying questions posed by others. His most famous result is surely his 1991 proof with J. A. Dias da Silva of a conjecture due to P. Erdős and H. A. Heilbronn on restricted addition of sets modulo a prime. The paper appears in the *Bulletin of the London Mathematical*

Society (1994) under the slightly cryptic title 'Cyclic spaces for Grassmann derivatives and additive theory'. Erdős and Heilbronn had asked whether, if $\mathcal{A}$ is a subset of the cyclic group of order p (a prime), then the set of sums of two distinct elements from $\mathcal{A}$, namely

$$\{a + b, \ a \in \mathcal{A}, \ b \in \mathcal{A}, a \neq b\},$$

must have size at least $\min(2|\mathcal{A}| - 3, p)$. This is what Dias da Silva and Hamidoune proved. They also generalized this to the case of more than two summands.
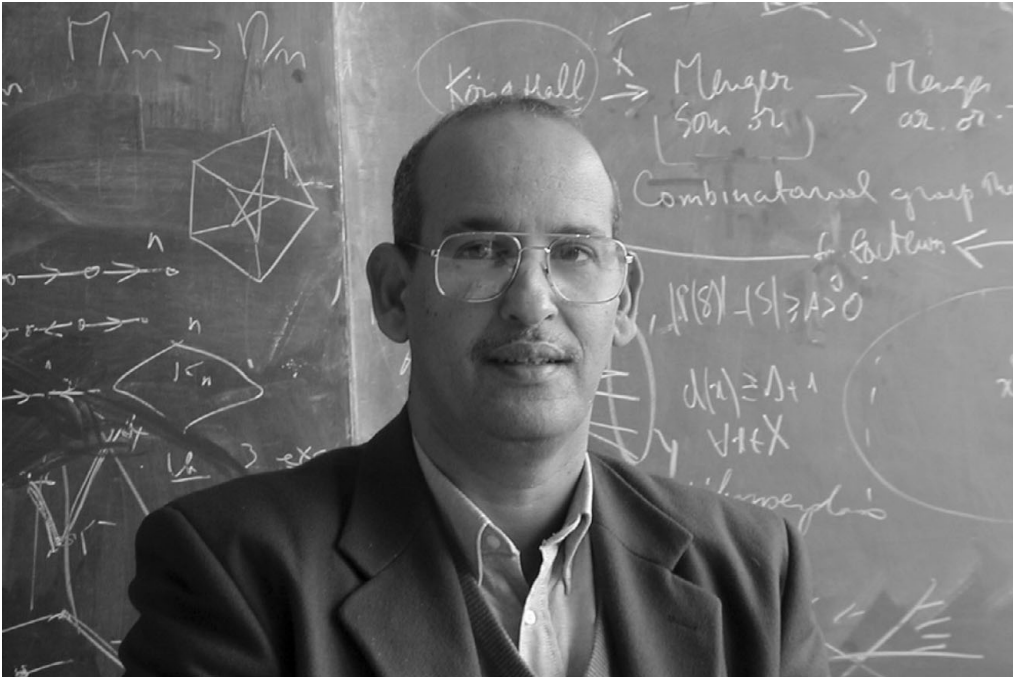
Yahya in his office, 1999, © M. Las Vergnas.

Here is another, partly more recent, example of Yahya's achievements. If G is an abelian group, the *critical number* of G is the smallest integer k such that any subset $\mathcal{S}$ of G of cardinality at least k satisfies the property that any element of G can be expressed as the sum of the elements of a subset of $\mathcal{S}$. In a paper co-authored with W. Gao in 1999, Yahya proved the full (that is, for any abelian group) Diderrich conjecture (1975) on the values of these constants. Later (2008), with A. Lladó and O. Serra – Yahya's principal co-authors – he even answered an analogous but more complicated question of V. Vu dealing with the special case where $\mathcal{S}$ is a set of invertible elements of a cyclic group.

Very recently, Yahya answered in a brilliant way a question of T. Tao dealing with a non-commutative version of Kneser's theorem [1]. Indeed, as I can certify, Yahya was able to answer the question very rapidly after reading it. It is likely that this or similar results already existed in his mind before the question was asked. He simply needed an opportunity to write it down!

In 2001, Yahya was awarded the Chinguitt Prize (from the hands of the President of Mauritania) for his lifetime achievements in science. This is the highest scientific prize in Mauritania, and he was the first-ever recipient. Having obtained this award, Yahya used it to promote scientific research and teaching in Mauritania. Yahya was very involved in the development of the sciences in his country. He proposed several improvements in the teaching system, in particular for the organization of high-level teaching within the country. Very recently, Yahya proposed that I accompany him to Mauritania in order to promote the international entrance examinations to the École polytechnique among the best Mauritanian students, *for the love of humanity*, as he loved to say.

Yahya was not only a mathematician, especially in Mauritania, where he travelled two or three times a year. There, he was a personality, known to – and loved by – a large part of the population. When his remains arrived in Nouakchott in the middle of the night, about five thousand people were waiting for him at the airport. In fact, Yahya was well known in Mauritania as a militant for democracy and ecology. He was a deeply honest citizen who was not afraid to fight against corruption, a fight which occasionally provoked death threats. One of his main battles was protecting the Parc National du Banc d'Arguin – a huge Mauritanian bird sanctuary protected by UNESCO – notably in 2005 against a petroleum company. In fact, Yahya was the main character in a documentary, *Between the Oil and the Deep Blue Sea* [2], which shed light on this fight.

I will treasure memories of Yahya ould Hamidoune. As a mathematician, that is evident! But there are not many who can say, as he did, that *mathematics is done to enhance friendship*, without appearing ridiculous. Yahya was an independent spirit with high human qualities and high ethical standards.

A number of tributes to Yahya have taken place recently, including a one-day event at the Université Pierre et Marie Curie on 29 March 2011 [3]. Several websites contain interesting information about him, as well as photographs [4, 5]. During a UNESCO conference on mathematics in Africa in mid-April 2011, C. Villani evoked Yahya's character as an example for the African mathematical community. A *Yahya ould Hamidoune Prize* will be created to reward brilliant young Mauritanian students. And a special issue of the *European Journal of Combinatorics* will be dedicated to Yahya's memory. Last, but not least, an international conference in additive combinatorics will be organized at the Institut Henri Poincaré in Paris from 9 July to 13 July 2012 [6].

The interested reader will find a more complete account of Yahya's life and achievements in [7].

ALAIN PLAGNE, Centre de Mathématiques Laurent Schwartz,
École polytechnique, Palaiseau, France

References

[1] terrytao.wordpress.com/2011/03/12/hamidounes-freiman-kneser-theorem-for-nonabelian-groups

[2] www.roninfilms.com.au/feature/764.html

[3] people.math.jussieu.fr/~balandraud/YoH/YoH.html

[4] www.math.jussieu.fr/~mlv/YOH/YOH.html

[5] www.math.polytechnique.fr/~plagne/hamidoune.html

[6] www.caparis2012.wordpress.com/

[7] Plagne, A. (2011) Yahya ould Hamidoune, grand Mauritanien, homme singulier, mathématicien d'exception. *Gaz. Math.* **129** 123–129.