Akiva Yaglom, the man and the probabilist

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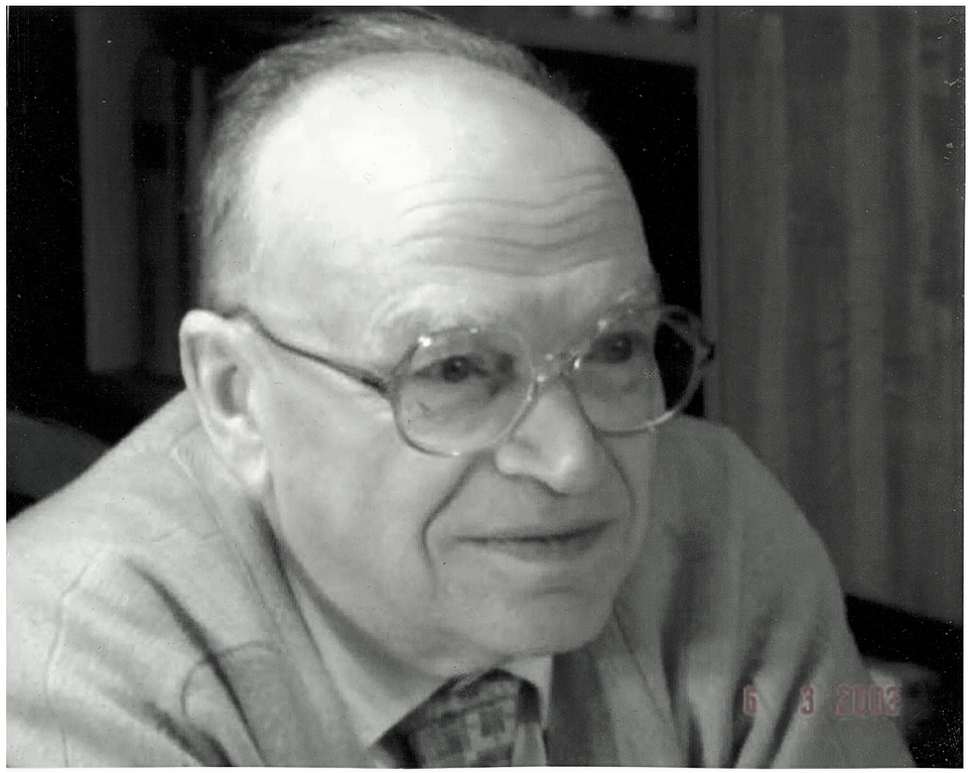

A few things I know about Akiva (AMY)

(see also the obituary by Peter Bradshaw in Flow Turbulence Combust. (2008) 80: 287-289)

- Born 6 March 1921 (Kharkov) ⇒ 5 March 1953 ! ... ⇒ October 1985 Abuladze's *Repentance*
- A very close associate of A.N. Kolmogorov since early war years (Sverdlovsk/Ekaterinburg)
- Returns to Moscow (where he lived since 1926) in 1943. No to work on nuclear bombs.
- Early 50's: starts working at Institute of Atmospheric Physics. Late 50's: position at Moscow U.
- Close association with I.M. Gel'fand and with A.S. Monin (more later)
- Deeply involved in helping people who suffered from oppression
- Enlarged English edition of Monin-Yaglom published by MIT with the help of John Lumley
- 1992 moves to USA (MIT). Also supported by CTR, Stanford and by John Padushka
- Author of 6 books (including "the Bible of turbulence") and 120 scientific papers

The probabilist

Probability theory underwent deep changes in the 20th century, because of the need to work with fields, both in quantum field theory and in the classical theory of random fields, e.g. random temperature or dissipation fields.

AMY was a natural bridge between great mathematicians such as A.N. Kolmogorov and I.M. Gel'fand and those involved constantly in concrete problems of geophysics and fluid dynamics. He developed the theory of random scalar and vector fields in great details and made it accessible to very large scientific audiences, in the best of the Russian tradition.

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Integration in Functional Spaces and its Applications in Quantum Physics*†‡

I. M. GEL'FAND AND A. M. YAGLOM

(Received December 7, 1959)

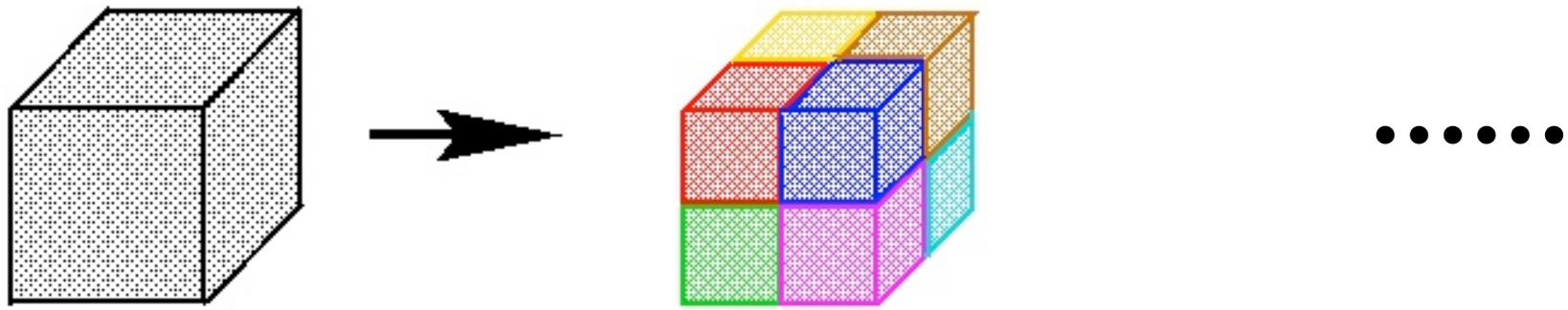
This translation of the survey article by I. M. Gel'fand and A. M. Yaglom on the theory and applications of integration in functional spaces in problems of quantum physics was prepared because it was felt that such a review would be of interest and of use to mathematical physicists working in several different fields.

The article begins with a discussion of Wiener measure, after which the extension is made to the complex measure introduced by Feynman in his formulation of quantum mechanics, and examples are given of the use of these methods in quantum mechanics, quantum field theory, and quantum statistical physics. A comprehensive bibliography of works devoted to the theory and applications of functional integration methods is included.

From eddy breakdown to fractals and multifractals

- In the early 60's, stimulated by experimental results obtained at the Institute of Atmospheric Physics, Obukhov and then Kolmogorov developed the lognormal model of intermittency which accounts for increasing fluctuations of the energy dissipation when focussing on smaller and smaller scales.

- Novikov and Stewart (1964) then developed a concrete eddy breakdown hierarchical probabilistic model, which was then generalized considerably by Yaglom (1964) to become what is now called the *random multiplicative model* of turbulence



$$\varepsilon_\ell = \varepsilon W_1 W_2 \ldots W_n$$

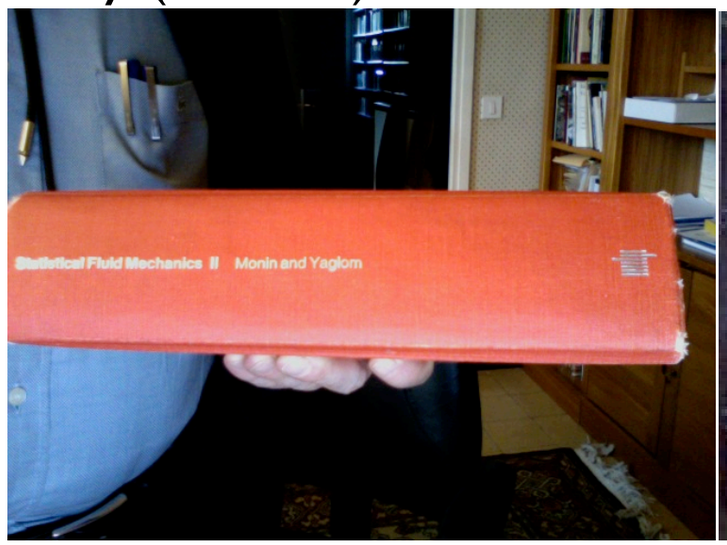
- Mandelbrot (1968, 1974) found that the resulting intermittency could be characterized as *fractal* : the dissipation has generally a non-integer Hausdorff dimension.

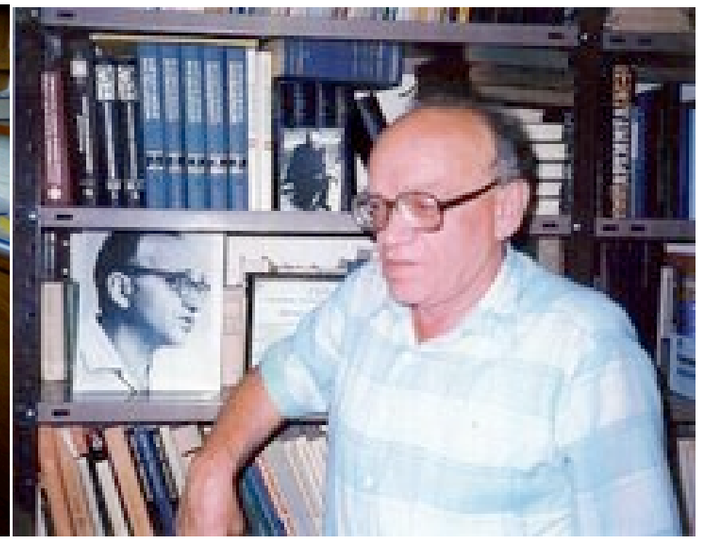
- Parisi and UF (1985) found that Yaglom's model is actually *multifractal* : there is a spectrum of singularities. There has been much later developments ranging from experimental (Sreenivasan and coll.) to pure mathematical (Kahane, Jaffard). Many geophysical applications have been reported at EGS/EGU nonlinear sessions over the years.

Statistical Fluid Mechanics

- In 1965 Nauka Press, Moscow published *Statisticheskaya gidromekhanika - Mekhanika Turbulenosti* by Andrey S. Monin and Akiva M. Yaglom (MY)

- In 1971 MIT Press, Cambridge published *Statistical Fluid Mechanics* vol. I (782 pages, blue cover) and in 1975 vol. II (896 pages, red cover), a much edited translation with considerable help from John Lumley (Cornell)





- *"If ever a book on turbulence could be called definitive,"* declared Science, *"it is this book by two of Russia's most eminent and productive scientists in turbulence, oceanography, and atmospheric physics."*

- Indeed, the Monin and Yaglom has become the Bible of turbulence, where you can find (if patient enough) everything known in turbulence up to the early seventies.

- Much of the work of Kolmogorov and his school had been ignored in the West until MY became available. For example the four-fifth law and its extension to temperature fields:

$$\langle \{ [\mathbf{v}(\mathbf{x}+\mathbf{r}) - \mathbf{v}(\mathbf{x})] \cdot \frac{\mathbf{r}}{r} \}^3 \rangle = -\frac{4}{5}\varepsilon r$$ (ANK 1941c) and a similar temperature identity of AMY.