and original views on the essential aspects, importance and role of statistical laws in physics and in other disciplines such as the social sciences. ■

About the author

Rosario Nunzio Mantegna is a professor of Applied Physics and chairman of the PhD school in Applied Physics of Palermo University. Mantegna's research is focused on the application of methods of statistical physics to physical, biological and economic complex systems. He is currently coordinating the research group Observatory of Complex Systems of Dipartimento di Fisica e Tecnologie Relative of Palermo University (http://lagash.dft.unipa.it). Mantegna is managing editor of the International Journal of Theoretical & Applied Finance and member of the editorial board of Quantitative Finance. He has co-authored with H.E. Stanley the book An Introduction to Econophysics, CUP, Cambridge 2000.

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Physics in daily life: cycling really fast

L.J.F. (Jo) Hermans,
Leiden University • The Netherlands

We remember that the cyclist on a horizontal road has to beat two forces. One is the rolling resistance, proportional to the total weight ($C_r mg$). The other one is air drag, proportional to the frontal area, the air density and the velocity squared ($C_D.A.\ 1/2\rho v^2$). The two are equal at roughly 15 km/h for a normal bicycle. In view of the v^2 dependence, drag is by far dominant at record-breaking speeds: If you want to go fast, get rid of the drag.

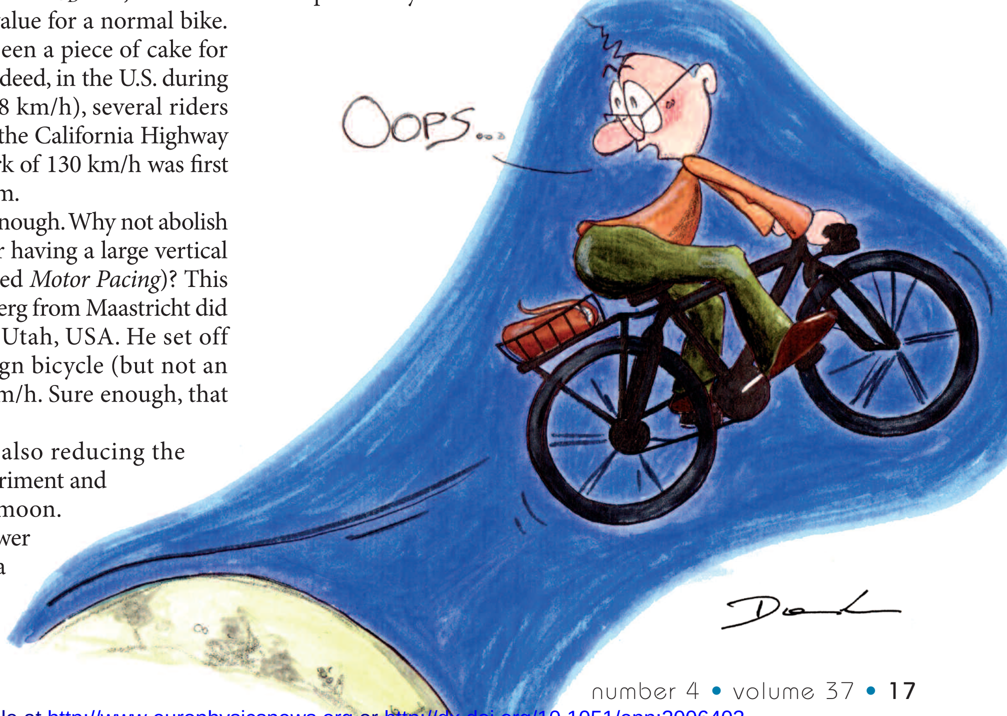
One way to minimize drag is to use super-streamlined, recumbent bikes: HPV's, for Human Powered Vehicles. Their main advantage is a reduction of the drag coefficient C_D to 0,1 which is an order of magnitude smaller than the value for a normal bike. As a result, speeds above 90 km/h have been a piece of cake for experienced riders ever since the 1980s. Indeed, in the U.S. during the nationwide speed limit of 55 mph (88 km/h), several riders earned an honorary speeding ticket from the California Highway Patrol. More recently, in 1998, the landmark of 130 km/h was first reached by the Canadian Sam Whittingham.

For the real speed devil that's not good enough. Why not abolish drag altogether, by riding behind a fast car having a large vertical board at its rear end (a technique also called *Motor Pacing*)? This is precisely what Dutchman Fred Rompelberg from Maastricht did in 1995, on the Bonneville Salt Flats in Utah, USA. He set off behind a powerful car on a special-design bicycle (but not an HPV) and reached a breathtaking 268 km/h. Sure enough, that made him the fastest man-on-a-bike ever.

Now let us take this a bit further, by also reducing the rolling resistance. Let us do a though-experiment and calculate how fast we could ride on the moon. Reasonable input data would be a peak power of 750 watt for the rider (which is what a trained cyclist briefly reaches on earth), a mass m = 100 kg (including the space suit), $C_r = 0.0045$ (a typical value for bicycles) and $g = 1.62\ m/s^2$. Since the rolling resistance is the only force to be overcome, all we have to do is solve the equation $C_r mgv = 750$ W.

The resulting speed v turns out to be some 3700 km/h. That is really fast: over Mach 3 in terms of the terrestrial speed of sound at ambient temperature. But for lack of an atmosphere, we do not have to worry about sonic booms on the moon.

Much faster than that, however, may become a problem: 3700 km/h, that is about half the escape velocity… ■



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