

# Carlos '97 free kick no fluke, say French physicists

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Roberto Carlos' free kick goal against France in 1997's Tournoi de France is thought by many to have been the most skilful free kick goal - from 35m with a powerful curling banana trajectory - ever scored; but by others to have been an incredible fluke.

Taken in 1997, a year before the French won the World Cup, Brazilian Carlos's [goal](#) held France to a frustrating draw but, now, a group of French physicists - perhaps with a nostalgic eye to a happier time for French football - have computed the [trajectory](#) and shown that Carlos' goal was no fluke.

The research published today, Thursday 2 September, in [New Journal of Physics](#) (co-owned by the Institute of Physics and German Physical Society), explains why French [goalkeeper](#) Fabien Barthez made no move for the [ball](#) (but why a ball-boy ten metres from the goal did duck to safety) as the ball made a last moment sweep left and landed in the back of the net.

Using tiny plastic (polypropylene and polyacetal) balls and a slingshot, the French research team from the École Polytechnique in Palaiseau varied the velocity and spin of balls travelling through water to trace different trajectories.

While their research quickly confirmed the long-known Magnus effect, which gives a spinning ball a curved trajectory, their research revealed fresh insight for spinning balls that are shot over a distance equivalent to

Roberto Carlos' free kick.

The friction exerted on a ball by its surrounding atmosphere slows it down enough for the spin to take on a greater role in directing the ball's trajectory, thereby allowing the last moment change in direction, which in the case of Carlos' kick left Barthez defenceless.

The researchers refer to their discovery as the 'spinning ball spiral', comparing the spiraling effects of Roberto Carlos's kick with the shorter-distance (20-25m) 'circular' free kicks shot by the likes of Beckham and Platini.

As Christophe Clanet and David Quéré, researchers from École Polytechnique, write, "When shot from a large enough distance, and with enough power to keep an appreciable velocity as approaching the goal, the ball can have an unexpected trajectory. Carlos' kick started with a classical circular trajectory but suddenly bent in a spectacular way and came back to the goal, although it looked out of the target a small moment earlier.

"People often noticed that Carlos' free kick had been shot from a remarkably long distance; we show in our paper that this is not a coincidence, but a necessary condition for generating a spiral trajectory."

**More information:** Paper online:  
[iopscience.iop.org/1367-2630/12/9/093001](https://iopscience.iop.org/1367-2630/12/9/093001)

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