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**How Cristiano Ronaldo performs his knuckleball?** CAROLINE COHEN, BAPTISTE DARBOIS TEXIER, LadHyX, DAVID QUERE, PMMH, ESPCI, CHRISTOPHE CLANET, LadHyX — A soccer ball kicked at very low spin can exhibit a zigzag trajectory. Along its straight path, the ball deviates laterally from about 0.2 m, that is to say one ball diameter. One zig zag happens as the ball travelled about 15 m. As the deviation direction seems unpredictable, this effect is highly annoying for goalkeepers. That why Cristiano Ronaldo and many soccer players are looking for this phenomenon. Those trajectories called knuckleballs are also observed on volleyball and baseball. We study experimentally indoor knuckleballs for different balls varying from soccer balls to smooth spheres. We show that knuckle effect doesn't derive from ball deformations at foot impact or ball seams. Actually, aerodynamic lift forces on a smooth sphere are fluctuating and are responsible for knuckleballs. From this study, we deduce side force intensity exerted on smooth spheres and sport balls for typical game Reynolds number ( $Re \sim 10^4 - 10^6$ ). Finally we discuss required conditions to observe a knuckleball on the sport field.

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