*Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, technical proofs (TP), and all past articles are available online at **billiards.colostate.edu**. Reference numbers used in the articles help you locate the resources on the website.*

Recently, I was invited to be the featured guest on a podcast with the famous astrophysicist Neil deGrasse Tyson (see **Image 1**). Neil's podcast series, called StarTalk Sports Edition, deals with the science of sports, and the topic of this episode was billiards physics. The podcast was co-hosted by Tyson, comedian Chuck Nice, and past pro soccer player Gary O'Reilly.

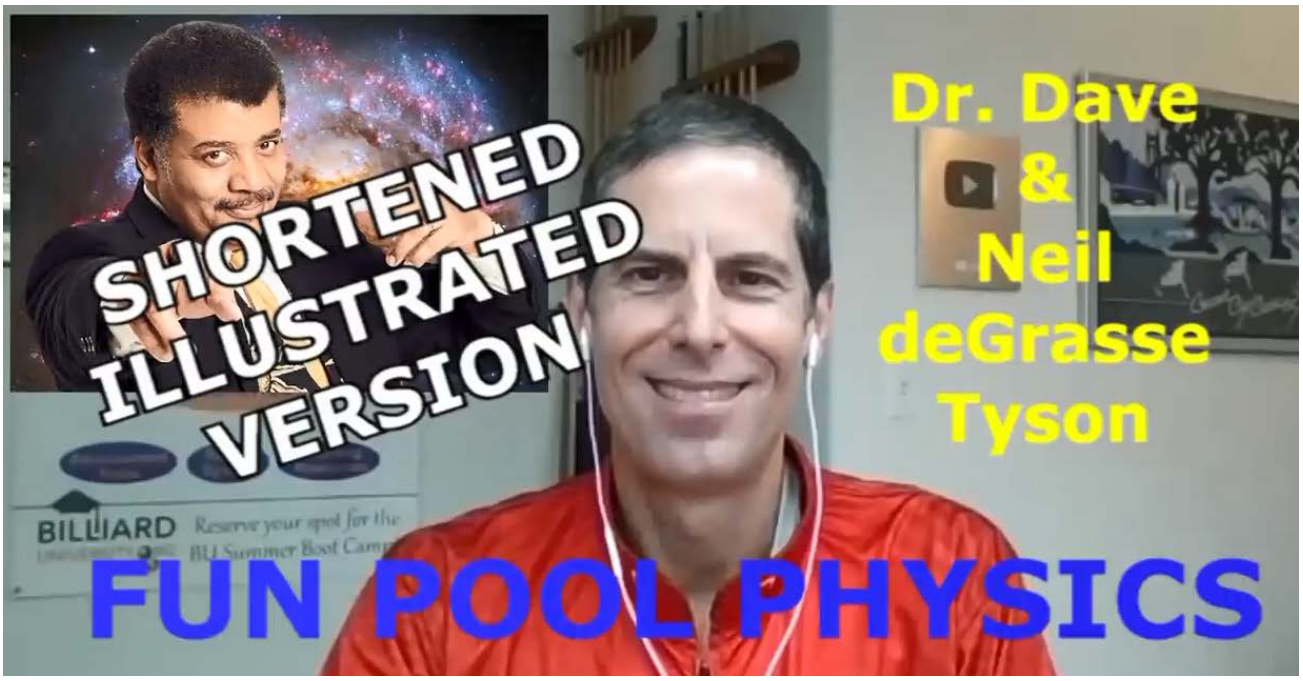

Image 1 Shortened/illustrated podcast video title screen

We discussed a wide range of billiards topics in the podcast, including:

- **the history of pocket billiards**
  The game evolved from 15th century French and British aristocrats moving croquet indoors and eventually onto tables.

- **origination of the term "pool"**
  The term originated from horse track betting "pools" where pocket billiards tables were introduced into betting rooms to give gamblers something to do between races, and to give them something else to bet on.

- **origination of the term "English" (AKA sidespin)**
  The term came from visits by British ("English") players doing exhibitions in America in the early 1800s, where they demonstrated fancy sidespin shots ("English" shots) made possible by the then-recent invention of the leather tip in Europe.

- **Gustave Coriolis**
  The famous mathematician and physics Coriolis wrote an amazing book in the early 1800s dealing with billiards physics. He also discovered the Coriolis Effect which explains how hurricanes and

galaxies form (but not why toilets flush in the direction they do, despite the common myth). Among many other things, Coriolis discovered how to predict and control curving cue ball (CB) paths on a pool table. **Image 2** illustrates the Coriolis aiming system that can be used to aim massé shots. The line of action of the cue results in contact on the CB at point "B." Extending this line down onto the table defines aim point "A" on the cloth. Finally, point "R" is the resting point of the CB on the cloth. Coriolis discovered that the final direction of the CB, after curving, should theoretically be parallel to the line through points "R" and "A." I sometimes call the Coriolis aiming system the "BAR" method because contact point "B" on the ball results in aim point "A" on the cloth, and the line from resting point "R" predicts the final CB direction.

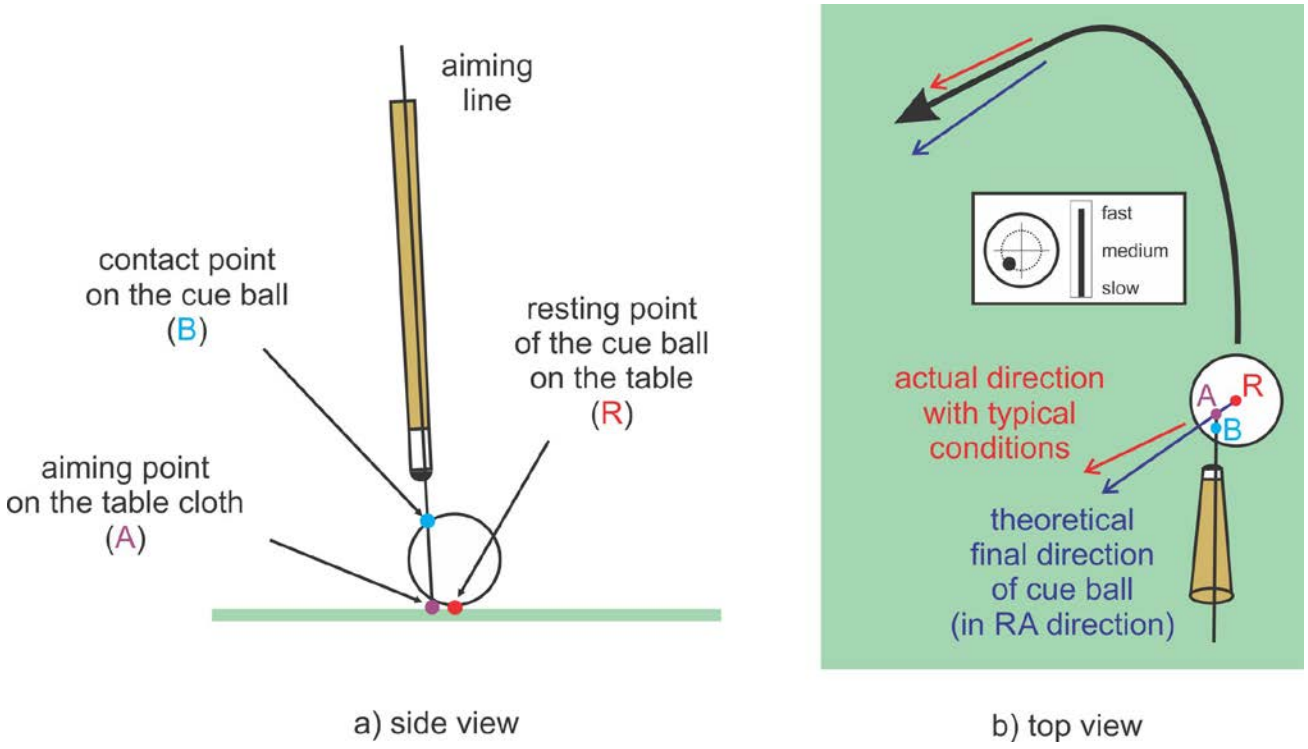

Image 2 Coiolis or "BAR" aiming system

- **the evolution of pool equipment**
  Not much has changed in hundreds of years. We still use leather tips on mostly wooden cues; although, carbon fiber has recently been introduced (and is becoming quite popular) as a replacement to maple. Fortunately, balls are no longer made of ivory. In the shameful past of the sport, countless elephants were slaughtered since a single tusk typically yielded only three balls! Today's synthetic phenolic resin balls are a much better and more sustainable alternative. However, engineers have still not been able to improve upon nature's slate, used for the bed of the table under the cloth, or leather used for cue tips. When discussing the carbon fiber revolution, I explained the physics behind CB deflection (AKA "squirt"). As shown in **Image 3**, when you hit the CB on the right side, the CB starts to rotate counterclockwise, pushing the tip to the right during contact. Because the end of the shaft has mass, the tip pushes back on the CB which causes squirt to the left a little. Because carbon fiber shafts can be made lighter, especially at the tip end, they don't create as much CB deflection.

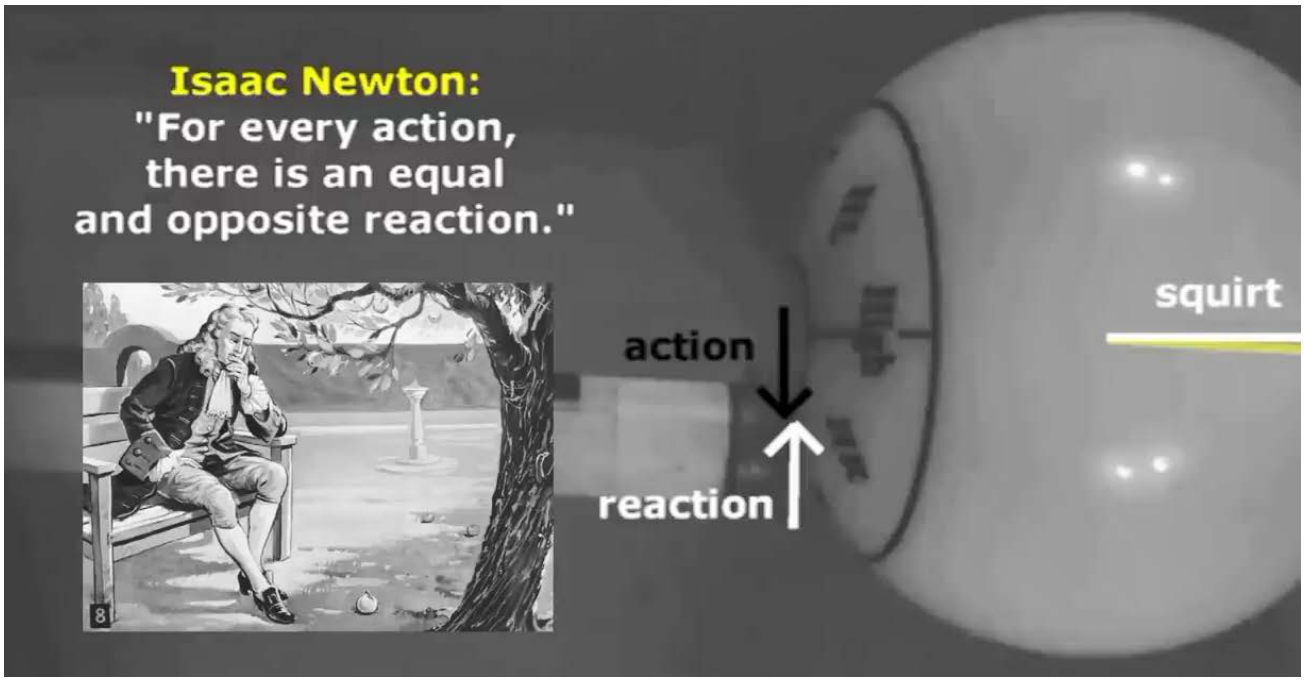

Image 3 Squirt physics

- **trick shots**
  Fancy shots like jump shots and massé shots, where you curve the CB around or over an obstacle, involve lots of interesting physics and require well-practiced skill.

- **sidespin physics**
  Squirt, swerve, and throw, the physics effects that come with using sidespin must be understood and judged accurately to play at a high level.

- **strategy**
  Pool is a fun and challenging game party due to the chess-like strategy and planning required to play at a high level. Pool is also great because even somebody who has never played before can immediately enjoy the challenge and excitement of occasionally pocketing balls. When discussing 9-ball, I ribbed Neil about his reputation for helping to declassify Pluto as an official solar-system planet. I always thought it would be cool to have a ball set where each of the 9 balls looked like one of the nine planets (see **Image 4**), but Neil ruined that removing Pluto from the official list.

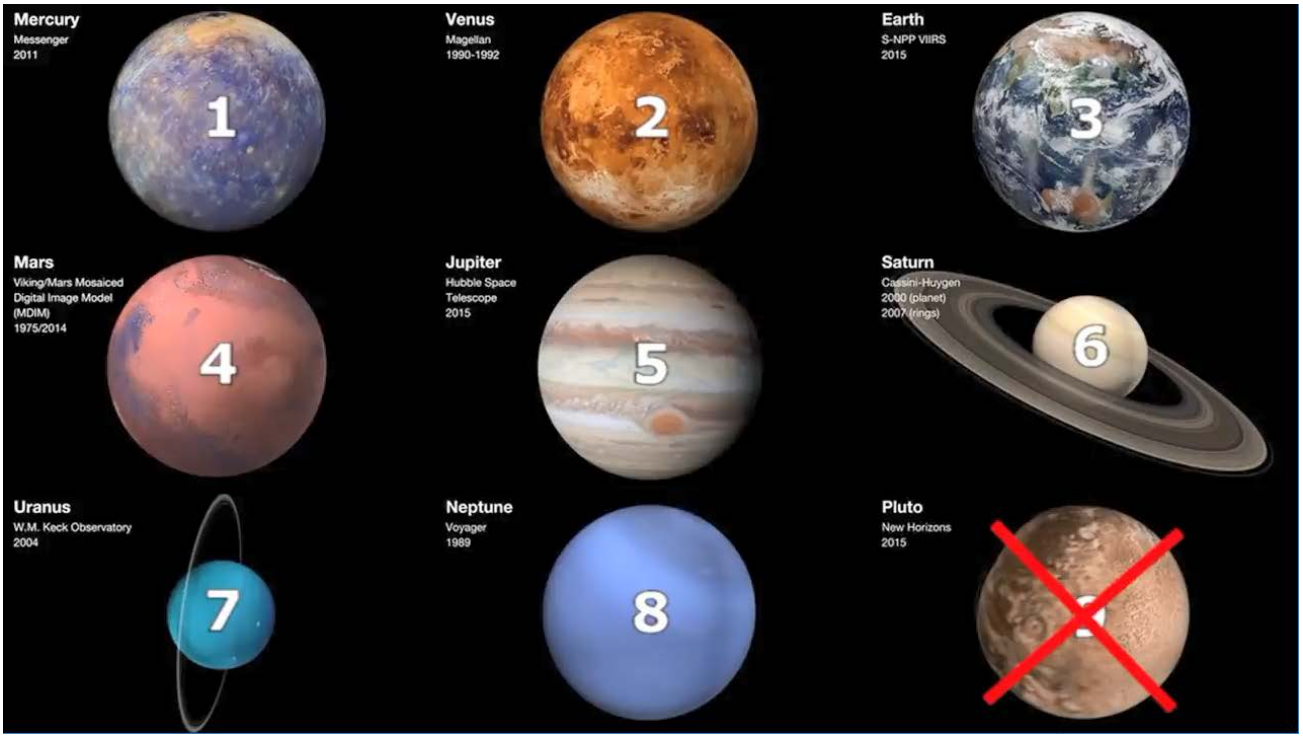

Image 4 9-planet ball-set inspiration

If you want to watch or listen to the podcast, it is available in online video **NV J.97**, which a shortened (13:57) and illustrated video version with shot examples. The video includes images, illustrations, animations, and video demonstrations of many of the concepts being discussed. The full (52:15) unedited version of the video podcast is available at:

https://youtu.be/ZfxtXmnheDgi

and an edited audio-only podcast version (37:33) is available at

https://www.startalkradio.net/show/pool-table-physics-with-dr-dave-alciatore/.

As Dr. Neil says at the end of the podcast, no one will walk by a pool table the same way again after watching or listening to the podcast. Enjoy!

Good luck with your game,
Dr. Dave


normal video

NV J.97 – Dr. Dave Schools Neil deGrasse Tyson in Billiards Physics

PS:

- I know other authors and I tend to use lots of terminology, and I know not all readers are totally familiar with these terms. If you ever come across a word or phrase you do not fully understand, please refer to the online glossary at ***billiards.colostate.edu***.

Dr. Dave is a PBIA Advanced Instructor, Dean of the Billiard University, and author of the book: The Illustrated Principles of Pool and Billiards and numerous instructional DVD series, all available at: ***DrDaveBilliards.com****.*